CITY OF GRANDVIEW

WASTEWATER TREATMENT PLANT IMPROVEMENTS — PHASE 1

HLA PROJECT NO. 23030

Construction Specifications & Bid Documents

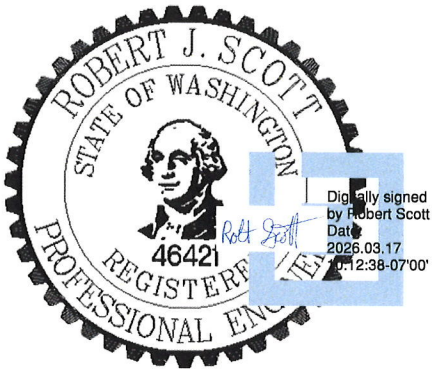
MARCH 2026

CITY OF GRANDVIEW, WASHINGTON

CONTRACT DOCUMENTS

FOR

WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1





HLA PROJECT NO. 23030

CONTRACTING AGENCY:

City of Grandview
207 W. Second Street
Grandview, WA 98930

ENGINEER:

HLA Engineering and Land Surveying, Inc. (HLA)
2803 River Road
Yakima, WA 98902

MARCH 2026

CITY OF GRANDVIEW
YAKIMA COUNTY, WASHINGTON

CONTRACT DOCUMENTS
FOR

WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1

HLA PROJECT NO. 23030

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SECTION 1 - ADVERTISEMENT FOR BIDS

ADVERTISEMENT FOR BIDS

City of Grandview
207 W. Second Street
Grandview, WA 98930

The City of Grandview invites separate sealed BIDS for the construction of the Wastewater Treatment Plant Improvements - Phase 1, HLA Project No. 23030, including the following approximate major quantities of work:

> Construction of a new 500,000 gallon sludge holding tank and modification of the existing sludge holding tank; modification and demolition of the existing sludge dewatering facility to include removal of two (2) belt presses and installation of three (3) new screw presses with associated polymer feed equipment, conveyors, and electrical improvements; construction of a new mechanical plant influent lift station and drainage lift station; construction of a new 2,000 SF metal-framed storage building; and replacement of the existing ultraviolet disinfection system including modification of the existing concrete channels.

This contract has two hundred sixty (260) working days to complete the work.

Bids will be received by the City Clerk at City Hall, 207 W. Second Street, Grandview, WA 98930, until 1:30 p.m., April 16, 2026, and then shortly thereafter will be publicly opened and read aloud at the City Council Chambers located at 207 W. Second Street.

CONTRACT DOCUMENTS may be obtained at the following website: https://www.hlacivil.com/bid/. Planholder list and addenda will be available on the website. Bidders are encouraged to register as planholders on the website, whom will be added to the Planholder list and will receive automatic addenda notification. All questions should be directed to Robert J. Scott, PE, and Jakob W. Michael, PE, at 509-966-7000 or rscott@hlacivil.com and jmichael@hlacivil.com.

A pre-bid conference will be held at the project site, 875 Bridgeview Road Grandview WA 98930 at 10:00 a.m., April 2, 2026. Prospective bidders are encouraged to attend the pre-bid conference, but bids may be submitted without attending the meeting.

Each bid or proposal must be accompanied by bond or a certified check, payable to the order of the Treasurer of the City of Grandview for the sum of not less than 5% of said bid or proposal and none will be considered unless accompanied by such deposit, to be forfeited to the City of Grandview in the event the successful bidder shall fail or refuse to enter into a Contract with the City for the making and construction of the aforesaid improvement. All bids or proposals must be in writing on the form bound in the Specifications, sealed and filed with the Clerk on or before the day and hour above mentioned.

The City of, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Contract Documents must be paid on this project, and that the Contractor must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex, or national origin.

The City of Grandview, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

The City of Grandview reserves the right to reject any and all bids and to waive technicalities or irregularities, and after careful consideration of all bids and factors involved, make the award to best serve the interests of the City of Grandview.

Anita Palacios, MMC
City Clerk

Publish: March 18, 2026
March 25, 2026

SECTION 2 - INFORMATION FOR BIDDERS

INFORMATION FOR BIDDERS

BIDS will be received by the City of Grandview (herein called the "CONTRACTING AGENCY"), at City Hall, 207 W. Second Street, Grandview, WA 98930, until 1:00 p.m., April 16, 2026, and then at the City Council Chambers publicly opened and read aloud.

Each BID must be submitted in a sealed envelope, addressed to the City Clerk at 207 W. Second Street, Grandview, WA 98930. Each sealed envelope containing a BID must be plainly marked on the outside as BID for Wastewater Treatment Plant Improvements - Phase 1, and the envelope should bear on the outside the BIDDER'S NAME, address, and license number if applicable, and the name of the project for which the BID is submitted. If forwarded by mail, the sealed envelope containing the BID must be enclosed in another envelope addressed to the CONTRACTING AGENCY at City Hall, 207 W. Second Street, Grandview, WA 98930.

All BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the original BID form must be fully completed and executed when submitted. Only one copy of the BID form is required.

The CONTRACTING AGENCY may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the CONTRACTING AGENCY and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID SCHEDULE by examination of the site and a review of the Drawings and Specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the CONTRACTING AGENCY or any other person shall not affect the risks or obligations assumed by the CONTRACTOR nor relieve the CONTRACTOR from fulfilling any of the conditions of the Contract.

Each BID must be accompanied by an original BID BOND payable to the CONTRACTING AGENCY for five percent of the total amount of the BID. When the Agreement is executed, the bonds of the unsuccessful BIDDERS will be returned. The BID BOND of the successful BIDDER will be retained until the CONTRACT BOND has been executed and approved, after which it will be returned. A certified check may be used in lieu of a BID BOND.

A CONTRACT BOND in the amount of 100 percent of the CONTRACT PRICE, with a corporate Surety approved by the CONTRACTING AGENCY, will be required for the faithful performance of the Contract.

Attorneys-in-fact who sign BID BONDS or CONTRACT BONDS must file with each BOND a certified and effective dated copy of their Power of Attorney.

The party to whom the Contract is awarded will be required to execute the Agreement and obtain the CONTRACT BOND within ten (10) working days from the date when NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary Agreement and BOND forms. In case of failure of the BIDDER to execute the Agreement, the CONTRACTING AGENCY may consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of the CONTRACTING AGENCY.

The CONTRACTING AGENCY may make such investigations as deemed necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the CONTRACTING AGENCY all such information and data for this purpose as the CONTRACTING AGENCY may request. The CONTRACTING AGENCY reserves the right to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the CONTRACTING AGENCY that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

A conditional or qualified BID will not be accepted.

Award will be made to the lowest responsive, responsible BIDDER or all bids will be rejected.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the Contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to its BID.

The low BIDDER shall supply the names and addresses of major material SUPPLIERS and SUBCONTRACTORS when required to do so by the CONTRACTING AGENCY.

Contract time for this project is anticipated to begin by May 18, 2026.

The ENGINEER is HLA Engineering and Land Surveying, Inc. (HLA), represented by Robert J. Scott, PE, and Jakob W. Michael, PE. The ENGINEER'S address is 2803 River Road, Yakima, Washington 98902, PHONE: (509) 966-7000, EMAIL: rscott@hlacivil.com and jmichael@hlacivil.com.

SECTION 3 - BID PACKAGE

BIDDER'S CHECKLIST

All forms listed below must be fully executed and submitted with the Bid:

1) BID PROPOSAL
2) UNIT PRICE BID PROPOSAL
3) MAJOR EQUIPMENT ITEMS AND PRODUCTS
4) BID PROPOSAL SIGNATURE PAGE
5) BID DEPOSIT or BID BOND

   BID DEPOSIT - Sign the Bid Deposit in the space provided if the bid is accompanied by a certified check or cashier's check in the amount of not less than 5% of the total amount bid.

   OR

   BID BOND - This form is to be executed by the bidder and Surety Company. The amount of this bond shall be not less than 5% of the total amount bid and may be shown in dollars or on a percentage basis. Provide Power of Attorney for Surety's agent.

6) NON-COLLUSION AFFIDAVIT - Must be subscribed and sworn to before a Notary Public.
7) SURETY
8) SUBCONTRACTOR LIST
9) LIST OF REFERENCES
10) CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

The following form must be fully executed and submitted by 12:00 P.M. (noon) of the second business day following the bid submittal deadline.

1) SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA STATEMENT - Provide supporting documentation as required.

The following forms are to be executed and/or submitted for approval to the Engineer after the Contract is awarded:

1) CONTRACT - To be executed by the successful bidder and the City of Grandview.
2) AUTHORIZED SIGNATURES (DOT FORM 420-007)
3) CERTIFICATIONS
4) CONTRACT BOND - To be executed by the successful bidder and his Surety Company. Provide Power of Attorney.
5) SCHEDULE OF WORKING HOURS
6) CERTIFICATE OF PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE and contractually required endorsements must be provided by the successful bidder in accordance with the provisions of the Standard Specifications and Technical Specifications.

BID PROPOSAL

A Proposal of _____ (hereinafter called “BIDDER”), organized and existing under the laws of the State of Washington doing business as _____[1]. To the City of Grandview, Washington, (hereinafter called “CONTRACTING AGENCY”).

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all work for the construction of the WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1, HLA Project No. 23030, in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, in the case of a joint BID each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence work under this Contract within ten (10) calendar days after NOTICE TO PROCEED and to fully complete the PROJECT within two hundred sixty (260) working days of such NOTICE TO PROCEED.

BIDDER further agrees to pay as liquidated damages the sum specified for each working day thereafter as provided in Section 1-08.9 of the Standard Specifications.

BIDDER acknowledges receipt of the following ADDENDA:

_____

_____

_____

Addenda will be posted on the Engineer’s website: https://www.hlacivil.com/bid/. Bidders are encouraged to register as planholders on the website, whom will be added to the Planholder list and will receive automatic addenda notification.

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sum amounts:

[1] Insert "a corporation," "a partnership," or "an individual" as applicable.

UNIT PRICE BID PROPOSAL

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY		UNIT PRICE DOLLARS-CTS		AMOUNT DOLLARS-CTS
SCHEDULE A – Solids Handling							
1	Minor Change	FA	Est.	X	$50,000.00	=	$50,000.00
2	Apprenticeship Incentive/Penalty	CALC	Est.	X	$2,000.00	=	$2,000.00
3	Mobilization	LS	---	X	---	=	
4	Crushed Surfacing Base Course	TON	330	X		=	
5	Crushed Surfacing Top Course	TON	160	X		=	
6	HMA Cl. 1/2-Inch PG 64H-28	TON	180	X		=	
7	Site Piping, Fittings, Valves, and Structures, Complete	LS	---	X	---	=	
8	New Sludge Holding Tank	LS	---	X	---	=	
9	Ex. Sludge Holding Tank Modifications	LS	---	X	---	=	
10	Dewatering Building Modifications	LS	---	X	---	=	
11	Standby Generator, Complete	LS	---	X	---	=	
12	Electrical and Control System, Complete	LS	---	X	---	=	
						SCHEDULE A SUBTOTAL	
						8.2% STATE SALES TAX	
						SCHEDULE A TOTAL	

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY		UNIT PRICE DOLLARS-CTS		AMOUNT DOLLARS-CTS
SCHEDULE B – Storage Building							
13	Minor Change	FA	Est.	X	$25,000.00	=	$25,000.00
14	Mobilization	LS	---	X	---	=	
15	Crushed Surfacing Base Course	TON	500	X		=	
16	Crushed Surfacing Top Course	TON	230	X		=	
17	HMA Cl. 1/2-Inch PG 64H-28	TON	260	X		=	
18	New Storage Building	LS	---	X	---	=	
19	Site Piping, Fittings, Valves, and Structures, Complete	LS	---	X	---	=	
20	Electrical and Control System, Complete	LS	---	X	---	=	
						SCHEDULE B SUBTOTAL	
						8.2% STATE SALES TAX	
						SCHEDULE B TOTAL	

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY		UNIT PRICE DOLLARS-CTS		AMOUNT DOLLARS-CTS
SCHEDULE C – Influent Lift Station							
21	Minor Change	FA	Est.	X	$25,000.00	=	$25,000.00
22	Mobilization	LS	---	X	---	=	
23	Influent Lift Station	LS	---	X	---	=	
24	Site Piping, Fittings, Valves, and Structures, Complete	LS	---	X	---	=	
25	Standby Generator, Complete	LS	---	X	---	=	
26	Electrical and Control System, Complete	LS	---	X	---	=	
					SCHEDULE C SUBTOTAL		
					8.2% STATE SALES TAX		
					SCHEDULE C TOTAL		

ITEM NO.	ITEM DESCRIPTION	UNIT	QUANTITY		UNIT PRICE DOLLARS-CTS		AMOUNT DOLLARS-CTS
SCHEDULE D – UV Building							
27	Minor Change	FA	Est.	X	25,000.00	=	$25,000.00
28	Mobilization	LS	---	X	---	=	
29	UV Equipment and Building Modifications	LS	---	X	---	=	
30	Electrical and Control System, Complete	LS	---	X	---	=	
					SCHEDULE D SUBTOTAL		
					8.2% STATE SALES TAX		
					SCHEDULE D TOTAL		

SCHEDULES A, B, C, AND D TOTAL	

MAJOR EQUIPMENT ITEMS AND PRODUCTS

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

In connection with the major equipment items and products to be furnished and installed for this project, the Bidder expressly agrees to the provisions of Section 01 25 50 – Substitution of Major Equipment Items and Products and to the following:

1. That the TOTAL BID PRICE stated hereinbefore includes only the installed prices for major equipment items or products of manufacturers listed as “Basis of Bid” in Column 1 of Table 1.

2. That Bidders desiring to offer price quotes for substitute major equipment items or products may at their option fill in the name of one manufacturer on the line listed as “Alternate” in Column 2 of Table 1, and provide the installed price of each proposed “Alternate” major equipment item or product on an installed basis in the space provided.

3. That all installed prices stated in Both Column 1 and Column 2 of Table 1 include the preparation and submittal of detailed shop drawings showing all modifications, if any, to the Construction Plans necessary to accommodate such equipment and, furthermore, that all installed costs stated on Table 1 include a complete operating installation, and the furnishing and installing of any and all changes or additions in structures, piping, buildings, mechanical and electrical work, accessories, and controls necessary to accommodate the equipment or product.

4. That all proposed “Alternate” major equipment items or products listed in Table 1 are of equal quality and function to the identified “Basis of Bid” major equipment items and products, and that the proposed “Alternate” major equipment items or products will perform satisfactorily and continuously.

5. That the undersigned agrees to furnish and install such major equipment items or products for a contract price equal to the TOTAL BID PRICE, including tax, adjusted by the sum of the differences between the installed price as stated on Table 1 for each “Basis of Bid” major equipment item or product (Column 1) and the installed price for each “Alternate” major equipment item or product (Column 2) proposed by the Bidder and accepted as “or equal” by the Engineer.

6. That, if awarded a Contract on this project, all major equipment items or products be guaranteed by the undersigned and his Surety to meet the performance requirements of the Contract Documents.

TABLE 1 – TABULATION OF MAJOR EQUIPMENT ITEMS AND PRODUCTS

Spec Section	Description	Column 1		Column 2	
		“Basis of Bid” Manufacturer	Installed Price	“Alternate” Manufacturer	Installed Price
43 21 39	Submersible Liquid Pumps	Flygt			
46 24 16	Grinder Pump Control Panel	JWM Environmental			
46 66 23	UV Disinfection System	ETS			
46 73 26	Hyperbolic Mixers	Invent AG			
46 76 27	Sludge Dewatering	FKC CO. Ltd.			
46 76 27	Belt Conveyors	Serpentix			

NOTE: The installed prices of all “Basis of Bid” major equipment items or products must be written in the space provided. Failure to furnish the installed price for each “Basis of Bid” major equipment item or product may be cause for rejection of the bid. If the Bidder proposes to offer an “Alternate” major equipment item or product, both the manufacturer’s name and the installed price of the equipment must be written in the space provided. Where more than one “Basis of Bid” Manufacturer is listed, the Contractor shall circle the name of the manufacturer for which the installed price is submitted. The prices in Table 1 should not include state sales tax.

BID PROPOSAL SIGNATURE PAGE

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

_____ _____, 2026
BIDDER (CONTRACTOR) DATE

BY _____ _____
AUTHORIZED OFFICIAL'S SIGNATURE TITLE

_____
(Please print or type name)

Mailing Address:

_____ Phone: _____

_____

E-mail address:_____

CONTRACTOR LICENSE NUMBER _____

CONTRACTOR UEI NUMBER _____

CONTRACTOR UBI NUMBER _____

CONTRACTOR FEDERAL TAX I.D. NUMBER _____

CONTRACTOR EMPLOYMENT SECURITY DEPARTMENT NUMBER _____

CONTRACTOR INDUSTRIAL INSURANCE ACCOUNT NUMBER _____

The names of the principal officers of the corporation submitting this Proposal, or of the partnership, or of all persons interested in this Proposal as principals are as follows:

_____

_____

PROJECT MANAGER _____ CELL PHONE:_____

NOTES:

1) If the bidder is a co-partnership, so state, giving firm name under which business transacted. If the bidder is a corporation, this proposal must be executed by its duly authorized officials.

2) Bidders shall acknowledge receipt of all addenda, if any, in the space provided on the first page of this proposal.

BID DEPOSIT

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

Herewith find deposit in the form of a certified check or cashier's check in the amount of $_____, which amount is not less than five percent (5%) of our total bid for this project.

Sign Here _____

OR

BID BOND

KNOW ALL PERSONS BY THESE PRESENTS:

That we _____, as Principal, and _____, as Surety, are held and firmly bound unto the CITY OF GRANDVIEW, as Obligee, in the penal sum of _____ Dollars, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by these presents.

The condition of this obligation is such that if the Obligee shall make any award to the Principal for WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1, HLA Project No. 23030, according to the terms of the proposal or bid made by the Principal therefor, and the Principal shall duly make and enter into a Contract with the Obligee in accordance with the terms of said proposal or bid and award and shall give bond for the faithful performance thereof, with Surety or Sureties approved by the Obligee; or if the Principal shall, in case of failure so to do, pay and forfeit to the Obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise it shall be and remain in full force and effect and the Surety shall forthwith pay and forfeit to the Obligee, as penalty and liquidated damages, the amount of this bond.

SIGNED, SEALED, AND DATED THIS _____ DAY OF _____, 2026.

_____
Principal

_____
Surety

_____, 2026

NON-COLLUSION AFFIDAVIT

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

STATE OF WASHINGTON)
) ss. NON-COLLUSION AFFIDAVIT
COUNTY OF _____)

_____, being first duly sworn, on oath says that the bid above submitted is a genuine and not a sham or collusive bid, or made in the interest or on behalf of any person not therein named; and the said bidder further says that the said bidder has not directly or indirectly induced or solicited any bidder on the above work or supplies to put in a sham bid, or any other person or corporation to refrain from bidding; and that said bidder has not in any manner sought by collusion to secure to themselves an advantage over any other bidder or bidders.

_____
(Contractor's Signature)

Signed and sworn to (or affirmed) before me on _____, 2026, by

_____.
Notary Public Name

_____
Notary Public Signature

My Appointment Expires _____

SURETY

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

If the Bidder is awarded a construction Contract on this bid, the Surety who provides the Contract Bond will be

_____ whose address is:

_____

Street City State ZIP

SUBCONTRACTOR LIST

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

To be Submitted with the Bid Proposal

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.

LIST OF REFERENCES

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

List all projects of a similar nature completed by the BIDDER during the previous five (5) years. Similar projects are considered to be those projects with a contract amount of not less than 50 percent of the amount bid on this project with the type of construction, materials, and methods necessary for completion of this project. Provide name of contact person and phone number. Failure to complete this List of References may be cause for rejection of the BID.

Previous Similar Projects	Contact Person	Phone Number
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

CERTIFICATION OF COMPLIANCE WITH WAGE PAYMENT STATUTES

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

Failure to return this certification as part of the Bid Proposal package will make this Bid nonresponsive and ineligible for Award.

I hereby certify, under penalty of perjury under the laws of the State of Washington, on behalf of the firm identified below that, to the best of my knowledge and belief, this firm has NOT been determined by a final and binding citation and notice of assessment issued by the Washington State Department of Labor and Industries or through a civil judgment entered by a court of limited or general jurisdiction to have willfully violated, as defined in RCW 49.48.082, any provision of RCW chapters 49.46, 49.48, or 49.52 within three (3) years prior to the date of the Call for Bids.

OFFICIAL AUTHORIZED TO SIGN FOR BIDDER:

Bidder Name: _____
Name of Contractor/Bidder – Print full legal entity name of firm

_____ _____
Signature of Authorized Person *Date*

_____ _____
Print Name and Title *Location or Place Executed (City, State)*

SUPPLEMENTAL BIDDER RESPONSIBILITY CRITERIA STATEMENT

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

This form shall be completed in its entirety and submitted by the apparent low Bidder to the Contracting Agency by 12:00 P.M. (noon) of the second business day following the bid submittal deadline.

Bidder will be deemed not responsible if Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended, or supplemental bidder responsibility criteria listed in Section 1-02.14 of the Special Provisions, including submission of further documentation as may be requested by the Contracting Agency.

Contractor:

Name: _____

Address: _____

Phone: _____

Contact Person: _____

1. **Delinquent State Taxes:**

   Instruction to Bidders: Check the appropriate box

   ☐ The undersigned certifies that the Bidder does not owe delinquent taxes to the Washington State Department of Revenue without a payment plan approved by the Department of Revenue.

   ☐ Alternatively, the undersigned certifies that the Bidder does owe delinquent taxes to the Washington State Department of Revenue with a payment plan approved by the Department of Revenue.

   If the Bidder does owe delinquent taxes to the Washington State Department of Revenue, the Bidder must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency by the deadline listed above.

2. **Federal Debarment:** The Bidder shall not currently be debarred or suspended by the Federal government. 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).

3. **Subcontractor Responsibility:** The undersigned certifies that the Bidder’s standard subcontract form includes the subcontractor responsibility language required by RCW 39.06.020, and the Bidder has an established procedure it utilizes to validate the responsibility of each of its subcontractors.

4. **Claims Against Retainage and Bonds:**

   Instruction to Bidders: Check the appropriate box

   ☐ The undersigned certifies that the Bidder has not had claims against retainage or payment bonds for public works projects in the three (3) years prior to the bid submittal date.

   ☐ Alternatively, the undersigned certifies that the Bidder has had claims against retainage or payment bonds for public works projects in the three (3) years prior to the bid submittal date.

   If the Bidder has had claims against retainage and payment bonds for public works projects in the three (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 payment bonds and include name of Project, Owner and 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.

5. **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 five (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 five (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.

6. **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 five (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 five (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 five (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.

7. **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 five (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 lawsuits with judgments entered against the Bidder in the five (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 five (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)

SECTION 4 - CONTRACT AND RELATED MATERIALS

CONTRACT

THIS AGREEMENT, made and entered into in triplicate, this _____ day of _____, 2026, by and between the City of Grandview, hereinafter called the CONTRACTING AGENCY, and _____, hereinafter called the CONTRACTOR,

WITNESSETH:

That in consideration of the terms and conditions contained herein and attached and made a part of this Agreement, the parties hereto covenant and agree as follows:

I. The CONTRACTOR shall do all work and furnish all tools, materials, and equipment for the bid amount of $_____, for WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1, HLA Project No. 23030, in accordance with and as described in the attached Plans and Specifications, and the Standard Specifications for Road, Bridge, and Municipal Construction, which are by this reference incorporated herein and made a part hereof, and shall perform any alterations in or additions to the work provided under this Contract and every part thereof.

Contract time shall begin on the first working day following the Notice to Proceed Date and shall be completed within two hundred sixty (260) working days of the date of such Notice to Proceed (see SPECIAL PROVISIONS - Section 1-08.5).

If said work is not completed within the time specified, the CONTRACTOR agrees to pay to the CONTRACTING AGENCY for each and every working day said work remains uncompleted after expiration of the specified time, liquidated damages as determined in Section 1-08.9.

The CONTRACTOR shall provide and bear the expense of all equipment, work, and labor of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work provided for in this Contract and every part thereof, except such as are mentioned in the Specifications to be furnished by the CONTRACTING AGENCY.

II. The CONTRACTING AGENCY hereby promises and agrees with the CONTRACTOR to employ, and does employ the CONTRACTOR to provide the materials and to do and cause to be done the above described work and to complete and finish the same according to the attached Plans and Specifications and the terms and conditions herein contained; and hereby contracts to pay for the same according to the attached Specifications and the schedule of unit or itemized prices hereto attached, at the time and in the manner and upon the conditions provided for in this Contract.

III. The CONTRACTOR for himself, and for his/her heirs, executors, administrators, successors, and assigns does hereby agree to the full performance of all the covenants herein upon the part of the CONTRACTOR.

IV. It is further provided that no liability shall attach to the CONTRACTING AGENCY by reason of entering into this Contract, except as expressly provided herein.

V. CONTRACTOR is an independent contractor and not an employee of the CONTRACTING AGENCY. The CONTRACTING AGENCY has designated the Contract performance and the CONTRACTOR shall be responsible for the details of that work. The parties recognize the CONTRACTOR has unique skills not otherwise available to the CONTRACTING AGENCY to accomplish the purpose of the Contract. The CONTRACTOR shall supply all equipment and supplies necessary to accomplish the Contract. The parties recognize that the purpose of the Contract is not within the regular course of business of the CONTRACTING AGENCY. The parties state that the right of control over the activities necessary to perform the Contract are with the CONTRACTOR.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed the day and year first herein above written.

CONTRACTING AGENCY:

City of Grandview, Washington

By: _____ ATTEST:

Name: Ashley Lara

Title: Mayor

_____

Name: Anita Palacios, MMC

Title: City Clerk

CONTRACTOR:

_____
(CONTRACTOR NAME)

By: _____ (SEAL)
AUTHORIZED OFFICIAL'S SIGNATURE

Name: _____ ATTEST:
(Please Print or Type)

Address: _____

_____

Phone: _____

Email: _____ _____

Name: _____
(Please Print or Type)

Washington State Department of Transportation

Authorized Signatures

List the name and title of those individuals in your organization who are authorized to execute proposals, contracts, bonds and other documents and/or instruments on behalf of the organization. Specify if more than one signature is required.

NOTE: Signature must appear next to name

Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title
Name (Typed)	Signature	Title

The undersigned, being duly sworn, deposes and says that the foregoing is a true statement of facts concerning the individual, corpration, co-partnership or joint venture herein named, as of the date indicated:

Name of Firm - Be Exact

Sworn to before me this _____

day of _____ , _____

_____
Notary Public

Notary Seal

_____
Authorized Signature(s)

Corporate Seal(s)

CERTIFICATIONS

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

Provide the following:

_____
Name of Certified Testing Laboratory for Material Testing

Phone: _____

Email: _____

CONTRACT BOND

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

BOND TO CITY OF GRANDVIEW

KNOW ALL PERSONS BY THESE PRESENTS:

That we, the undersigned, _____,

as principal, and _____,

a corporation organized and existing under the laws of the State of _____, as a Surety corporation, and qualified under the laws of the State of Washington to become Surety upon bonds of contractors with municipal corporations, as Surety, are jointly and severally held and firmly bound to the City of Grandview in the penal sum of $ _____ for the payment of which sum we bind ourselves and our successors, heirs, administrators, or personal representatives, as the case may be.

This obligation is entered into in pursuance of the statutes of the State of Washington and the Ordinances of the City of Grandview.

Dated at _____, Washington, this _____ day of _____, 2026.

Nevertheless, the conditions of the above obligation are such that:

WHEREAS, under and pursuant to action of the City of Grandview, on _____, 2026, the Mayor of said City of Grandview, has let or is about to let to the said _____, the above bounden Principal, a certain Contract, the said Contract being numbered HLA Project No. 23030, and providing for the construction of WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1 which Contract is referred to herein and is made a part hereof as though attached hereto, and

WHEREAS, the said Principal has accepted, or is about to accept, the said Contract, and undertake to perform the work therein provided for in the manner and within the time set forth;

NOW, THEREFORE, if the said _____ shall faithfully perform all the provisions of said Contract in the manner and within the time therein set forth, or within such extensions of time as may be granted under said Contract, and shall pay all laborers, mechanics, subcontractors and material men and all industrial insurance premiums, and all persons who shall supply said principal or subcontractors with provisions and supplies for the carrying on of said work, and shall indemnify and hold the City of Grandview harmless from any damage or expense by reason of failure of performance as specified in said Contract or from defects appearing or developing in the material or workmanship provided or performed under said Contract within a period of one year after its acceptance thereof by the City of Grandview, then and in that event this obligation shall be void; but otherwise it shall be and remain in full force and effect.

SURETY:_____

By: _____
(Attorney-in-fact)

Name: _____
(Please Print or Type)

Agent: _____

Address: _____

_____

Surety Representative Name:

_____

Surety Representative Phone:

_____

Surety Representative Email:

_____

CONTRACTOR:

_____
CONTRACTOR NAME

By: _____
AUTHORIZED OFFICIAL'S SIGNATURE

Name: _____
(Please Print or Type)

SCHEDULE OF WORKING HOURS

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

In accordance with Section 1-08.0(2) Hours of Work, the normal straight time working hours for this project will be from _____ a.m. to _____ p.m., _____ days per week. It is understood that normal straight time working hours shall not exceed 40 hours per week, regardless of the number of days worked per week. All hours worked in excess of 40 hours per week shall be considered as overtime hours subject to the reimbursement provisions of Section 1-08.0(2) Hours of Work and Section 1-08.0(3) Reimbursement for Overtime Work of Contracting Agency Employees.

Overtime hours are defined as any hours in excess of or outside of the above normal straight time working hours when the Contractor and/or his subcontractors are on the project site performing work.

I hereby certify that my subcontractors have been notified of the normal straight time working hours provisions of this project and understand that Engineer/Contracting Agency costs for overtime hours will be deducted from amounts due to me for work performed on the project.

_____
Contractor

_____
Signature

_____
Date

SECTION 5 - LABOR STANDARDS AND WAGE RATE CONDITIONS

PREVAILING WAGE RATES

The prevailing rate of wages to be paid to all workmen, laborers, or mechanics employed in the performance of any part of this Contract shall be in accordance with the provisions of Chapter 39.12 RCW, as amended. The rules and regulations of the Department of Labor and Industries and the schedule of prevailing wage rates for the locality or localities where this Contract will be performed as determined by the Industrial Statistician of the Washington State Department of Labor and Industries, are by reference made a part of this Contract. A schedule of prevailing wage rates is included in these Specifications.

Inasmuch as the CONTRACTOR will be held responsible for paying this schedule of wages, it is imperative that all contractors and subcontractors familiarize themselves with the current wage rates before submitting bids based on these Specifications.

Before any payment is made by the local government body of any sums due under this Contract, the local government body must receive from the Contractor and each subcontractor a copy of the "Statement of Intent to Pay Prevailing Wages" approved by the Washington State Department of Labor and Industries. Prior to acceptance of the project, the Contracting Agency must receive from the Contractor and each subcontractor a copy of "Affidavit of Wages Paid" and, in addition, from the prime contractor a copy of "Release for the Protection of Property Owners and General Contractor," all approved by the Washington State Department of Labor and Industries. Forms may be obtained from the Department of Labor and Industries. The Contractor and each subcontractor shall pay all fees associated with and make all applications directly to the Department of Labor and Industries. These affidavits will be required before any funds retained, according to the provisions of RCW 60.28.011, are released to the Contractor. Payment by the Contractor and subcontractor of any fees shall be considered incidental to the construction and all costs shall be included in other pay items of the project.

Pursuant to RCW 39.12.120, a contractor, subcontractor, or employer shall file a copy of its certified payroll records using the Washington State Department of Labor and Industries (L&I) online system at least once per month. If the L&I online system is not used, a contractor, subcontractor, or employer shall file a copy of its certified payroll records directly with L&I in a format approved by L&I at least once per month. A contractor, subcontractor, or employer's noncompliance with this reporting constitutes a violation of RCW 39.12.050.

Submission of certified payrolls to the Engineer is not required during the project, unless specifically requested by the Engineer or Contracting Agency. Certified payrolls submitted to the Engineer or Contracting Agency without a request will not be reviewed and will be returned to the Contractor. Contractors must keep accurate payroll records for three years following the date of acceptance of the project by the Contracting Agency. Payroll records must show the name, address, Social Security number, trade or occupation, straight time rate, hourly rate of usual benefits and overtime hours worked each day and week, including agreements to work up to 10-hour days, and the actual rate of wages. Upon receiving a written request by any interested party, the Contractor must, within ten days, submit Certified Payroll records to the Contracting Agency and the Department of Labor.

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 are provided on the Benefit Code Key.

Journey Level Prevailing Wage Rates for the Effective Date: 04/16/2026

Yakima County

Trade	Job Classification	Wage	Holiday	Overtime	Note	Risk Class
Asbestos Abatement Workers	Journey Level	$55.11	**5D**	**1H**		**View**
Boilermakers	Journey Level	$77.39	**5N**	**1C**		**View**
Brick Mason	Journey Level	$61.09	**5A**	**1M**		**View**
Building Service Employees	Janitor	$17.13		**1**		**View**
Building Service Employees	Shampooer	$17.13		**1**		**View**
Building Service Employees	Waxer	$17.13		**1**		**View**
Building Service Employees	Window Cleaner	$17.13		**1**		**View**
Cabinet Makers (In Shop)	Journey Level	$17.13		**1**		**View**
Carpenters	Acoustical Worker	$83.21	**15J**	**11U**		**View**
Carpenters	Bridge Dock and Wharf Carpenter	$84.81	**15J**	**11U**	**9L**	**View**
Carpenters	Bridge, Dock & Wharf Carpenter	$80.50	**15J**	**4C**		**View**
Carpenters	Floor Layer & Floor Finisher	$83.21	**15J**	**11U**		**View**

Carpenters	General Carpenter	$83.21	**15J**	**11U**		**View**
Carpenters	Scaffold Erector	$83.21	**15J**	**11U**		**View**
Cement Masons	Journey Level	$58.03	**7B**	**1N**		**View**
Divers & Tenders	Bell/Vehicle/Submersible Operator (not under pressure)	$144.72	**15J**	**11T**	**9I**	**View**
Divers & Tenders	Dive Supervisor	$146.22	**15J**	**11T**	**9I**	**View**
Divers & Tenders	Diver	$144.72	**15J**	**11T**	**9I**	**View**
Divers & Tenders	Diver Tender	$91.05	**15J**	**11T**	**9I**	**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 0-30.00 PSI	$114.73	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 30.01-44.00 PSI	$124.28	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 44.01 - 54.00 PSI	$133.82	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 54.01 - 60.00 PSI	$143.37	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 60.01 - 64.00 PSI	$152.91	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 64.01 - 68.00 PSI	$162.46	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 68.01 - 70.00 PSI	$172.00	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 70.01 - 72.00 PSI	$181.55	**15J**	**11U**		**View**
Divers & Tenders	Hyperbaric Worker - Compressed Air Worker 72.01 - 74.00 PSI	$191.09	**15J**	**11U**		**View**
Divers & Tenders	Lead Diver (Dive Master)	$105.51	**15J**	**11T**	**9I**	**View**

Divers & Tenders	Manifold Operator (Life Support Technician)	$96.05	**15J**	**11U**	**9I**	**View**
Divers & Tenders	Remote Operated Vehicle Operator/Technician	$91.05	**15J**	**11T**	**9I**	**View**
Divers & Tenders	Remote Operated Vehicle Operator/Technician	$91.05	**15J**	**11U**	**9I**	**View**
Divers & Tenders	Remote Operated Vehicle Tender	$84.75	**15J**	**11T**	**9I**	**View**
Divers & Tenders	Stand-by Diver	$100.51	**15J**	**11T**	**9I**	**View**
Dredge Workers	Assistant Engineer	$89.47	**5D**	**3F**		**View**
Dredge Workers	Assistant Mate (Deckhand)	$88.78	**5D**	**3F**		**View**
Dredge Workers	Boatmen	$89.47	**5D**	**3F**		**View**
Dredge Workers	Engineer Welder	$91.20	**5D**	**3F**		**View**
Dredge Workers	Leverman, Hydraulic	$93.03	**5D**	**3F**		**View**
Dredge Workers	Mates	$89.47	**5D**	**3F**		**View**
Dredge Workers	Oiler	$88.78	**5D**	**3F**		**View**
Drywall Applicator	Journey Level	$81.71	**15O**	**11S**		**View**
Drywall Tapers	Journey Level	$81.71	**15O**	**11S**		**View**
Electrical Fixture Maintenance Workers	Journey Level	$43.32		**1**		**View**
Electricians - Inside	Cable Splicer	$91.45	**5A**	**11F**		**View**
Electricians - Inside	Journey Level	$88.34	**5A**	**11F**		**View**
Electricians - Inside	Welder	$103.90	**5A**	**11F**		**View**
Electricians - Motor Shop	Craftsman	$17.13		**1**		**View**
Electricians - Motor Shop	Journey Level	$17.13		**1**		**View**

Electricians - Powerline Construction	Cable Splicer	$107.31	**5A**	**4D**		**View**
Electricians - Powerline Construction	Certified Line Welder	$98.45	**5A**	**4D**		**View**
Electricians - Powerline Construction	Groundperson	$61.75	**5A**	**4D**		**View**
Electricians - Powerline Construction	Heavy Line Equipment Operator	$98.45	**5A**	**4D**		**View**
Electricians - Powerline Construction	Journey Level Lineperson	$98.45	**5A**	**4D**		**View**
Electricians - Powerline Construction	Line Equipment Operator	$84.18	**5A**	**4D**		**View**
Electricians - Powerline Construction	Meter Installer	$61.75	**5A**	**4D**	**8W**	**View**
Electricians - Powerline Construction	Pole Sprayer	$98.45	**5A**	**4D**		**View**
Electricians - Powerline Construction	Powderperson	$72.81	**5A**	**4D**		**View**
Electronic Technicians	Journey Level	$53.13	**5I**	**1B**		**View**
Elevator Constructors	Mechanic	$119.17	**7D**	**4A**		**View**
Elevator Constructors	Mechanic In Charge	$128.95	**7D**	**4A**		**View**
Fabricated Precast Concrete Products	Craftsman - In-Factory Work Only	$17.13		**1**		**View**
Fabricated Precast Concrete Products	Journey Level	$17.13		**1**		**View**
Fabricated Precast Concrete Products	Journey Level - In-Factory Work Only	$17.13		**1**		**View**
Fence Erectors	Fence Erector	$51.98	**15J**	**11P**	**8Y**	**View**
Fence Erectors	Fence Laborer	$51.98	**15J**	**11P**	**8Y**	**View**

Flaggers	Journey Level	$51.98	**15J**	**11P**	**8Y**	**View**
Glaziers	Journey Level	$48.20	**7L**	**4L**		**View**
Heat & Frost Insulators And Asbestos Workers	Journey Level	$96.42	**15H**	**11C**		**View**
Heating Equipment Mechanics	Journey Level	$81.31	**5A**	**1X**		**View**
Hod Carriers & Mason Tenders	Journey Level	$58.36	**15J**	**11P**	**8Y**	**View**
Industrial Power Vacuum Cleaner	Journey Level	$17.13		**1**		**View**
Inland Boatmen	Journey Level	$17.13		**1**		**View**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Cleaner Operator	$54.56	**15M**	**11O**		**View**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Foamer Operator	$54.56	**15M**	**11O**		**View**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Grout Truck Operator	$54.56	**15M**	**11O**		**View**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Head Operator	$52.40	**15M**	**11O**		**View**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	Technician	$45.97	**15M**	**11O**		**View**
Inspection/Cleaning/Sealing Of Sewer & Water Systems By Remote Control	TV Truck Operator	$49.20	**15M**	**11O**		**View**
Insulation Applicators	Journey Level	$83.21	**15J**	**11U**		**View**
Ironworkers	Journeyman	$78.44	**15K**	**11N**		**View**
Laborers	Erosion Control Worker	$55.11	**15J**	**11P**	**8Y**	**View**

Laborers	Air, Gas Or Electric Vibrating Screed	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Airtrac Drill Operator	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Ballast Regular Machine	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Batch Weighman	$51.98	**15J**	**11P**	**8Y**	**View**
Laborers	Brick Pavers	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Brush Cutter	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Brush Hog Feeder	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Burner	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Caisson Worker	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Carpenter Tender	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Cement Dumper-paving	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Cement Finisher Tender	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Change House Or Dry Shack	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Chipping Gun (30 Lbs. And Over)	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Chipping Gun (Under 30 Lbs.)	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Choker Setter	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Chuck Tender	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Clary Power Spreader	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Clean-up Laborer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Concrete Dumper/Chute Operator	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Concrete Form Stripper	$55.11	**15J**	**11P**	**8Y**	**View**

Laborers	Concrete Placement Crew	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Concrete Saw Operator/Core Driller	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Crusher Feeder	$51.98	**15J**	**11P**	**8Y**	**View**
Laborers	Curing Laborer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Demolition: Wrecking & Moving (Incl. Charred Material)	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Ditch Digger	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Diver	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Drill Operator (Hydraulic, Diamond)	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Dry Stack Walls	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Dump Person	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Epoxy Technician	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Faller & Bucker Chain Saw	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Fine Graders	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Firewatch	$51.98	**15J**	**11P**	**8Y**	**View**
Laborers	Form Setter	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Gabian Basket Building	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Gaurdrail Erector	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	General Laborer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Grade Checker & Transit Person	$58.36	**15J**	**11P**	**8Y**	**View**
Laborers	Grinders	$55.11	**15J**	**11P**	**8Y**	**View**

Laborers	Grout Machine Tender	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Groutmen (Pressure) Including Post Tension Beams	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Hazardous Waste Worker (Level A)	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Hazardous Waste Worker (Level B)	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Hazardous Waste Worker (Level C)	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	High Scaler	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Jackhammer	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Laserbeam Operator	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Maintenance Person	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Manhole Builder-Mudman	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Material Yard Person	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Miner	$58.46	**15J**	**11P**	**8Y**	**View**
Laborers	Mold Abatement Worker	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Motorman-Dinky Locomotive	$58.46	**15J**	**11P**	**8Y**	**View**
Laborers	Nozzleman (Concrete Pump, Green Cutter When Using Combination Of High Pressure Air & Water On Concrete & Rock, Sandblast, Gunite, Shotcrete, Water Blaster, Vacuum Blaster)	$58.36	**15J**	**11P**	**8Y**	**View**
Laborers	Pavement Breaker	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Pilot Car	$51.98	**15J**	**11P**	**8Y**	**View**

Laborers	Pipe Layer (Lead)	$58.36	**15J**	**11P**	**8Y**	**View**
Laborers	Pipe Layer/Tailor	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Pipe Pot Tender	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Pipe Reliner	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Pipe Wrapper	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Pot Tender	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Powderman	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Powderman's Helper	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Power Jacks	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Power Washer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Railroad Spike Puller - Power	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Raker - Asphalt	$58.36	**15J**	**11P**	**8Y**	**View**
Laborers	Re-timberman	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Remote Equipment Operator	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Rigger/Signal Person	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Rip Rap Person	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Rivet Buster	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Rodder	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Scaffold Erector	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Scale Person	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Sloper (Over 20")	$56.00	**15J**	**11P**	**8Y**	**View**

Laborers	Sloper Sprayer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Spreader (Concrete)	$56.64	**15J**	**11P**	**8Y**	**View**
Laborers	Stake Hopper	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Stock Piler	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Swinging Stage/Boatswain Chair	$51.98	**15J**	**11P**	**8Y**	**View**
Laborers	Tamper & Similar Electric, Air & Gas Operated Tools	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Tamper (Multiple & Self-propelled)	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Timber Person - Sewer (Lagger, Shorer & Cribber)	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Toolroom Person (at Jobsite)	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Topper	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Track Laborer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Track Liner (Power)	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Traffic Control Laborer	$54.89	**15J**	**11P**	**9C**	**View**
Laborers	Traffic Control Supervisor	$58.32	**15J**	**11P**	**9C**	**View**
Laborers	Truck Mounted Attenuator	$54.89	**15J**	**11P**	**9C**	**View**
Laborers	Truck Spotter	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Tugger Operator	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Tunnel Work-Guage and Lock Tender	$58.46	**15J**	**11P**	**8Y**	**View**
Laborers	Tunnel Work-Guage and Lock Tender	$58.46	**15J**	**11P**	**8Y**	**View**
Laborers	Vibrator	$56.64	**15J**	**11P**	**8Y**	**View**

Laborers	Vinyl Seamer	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers	Watchmen	$47.72	**15J**	**11P**	**8Y**	**View**
Laborers	Welder	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Well Point Laborer	$56.00	**15J**	**11P**	**8Y**	**View**
Laborers	Window Washer/Cleaner	$47.72	**15J**	**11P**	**8Y**	**View**
Laborers - Underground Sewer & Water	General Laborer & Topman	$55.11	**15J**	**11P**	**8Y**	**View**
Laborers - Underground Sewer & Water	Pipe Layer	$56.00	**15J**	**11P**	**8Y**	**View**
Landscape Construction	Landscape Construction/landscaping Or Planting Laborers	$47.72	**15J**	**11P**	**8Y**	**View**
Landscape Construction	Landscape Operator	$88.60	**15J**	**11G**	**8X**	**View**
Landscape Maintenance	Groundskeeper	$17.13		**1**		**View**
Lathers	Journey Level	$81.71	**15O**	**11S**		**View**
Marble Setters	Journey Level	$61.09	**5A**	**1M**		**View**
Metal Fabrication (In Shop)	Fitter	$17.13		**1**		**View**
Metal Fabrication (In Shop)	Laborer	$17.13		**1**		**View**
Metal Fabrication (In Shop)	Machine Operator	$17.13		**1**		**View**
Metal Fabrication (In Shop)	Painter	$17.13		**1**		**View**
Metal Fabrication (In Shop)	Welder	$17.13		**1**		**View**
Millwright	Journey Level	$80.28	**15J**	**4C**		**View**
Modular Buildings	Journey Level	$17.13		**1**		**View**
Painters	Commercial Painter	$49.90	**15P**	**11V**		**View**

Painters	Industrial Painter	$57.22	**15P**	**11V**	**9D**	**View**
Pile Driver	Crew Tender	$80.50	**15J**	**11U**	**9L**	**View**
Pile Driver	Journey Level	$84.81	**15J**	**11U**		**View**
Plasterers	Journey Level	$78.60	**7Q**	**1R**		**View**
Plasterers	Nozzleman	$82.70	**7Q**	**1R**		**View**
Playground & Park Equipment Installers	Journey Level	$17.13		**1**		**View**
Plumbers & Pipefitters	Journey Level	$100.41	**6Z**	**1Q**		**View**
Power Equipment Operators	Asphalt Plant Operators	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Assistant Engineer	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Barrier Machine (zipper)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Batch Plant Operator: concrete	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Boat Operator	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Bobcat	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Brokk - Remote Demolition Equipment	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Brooms	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Bump Cutter	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Cableways	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Chipper	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Compressor	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Concrete Finish Machine - Laser Screed	$84.69	**15J**	**11G**	**8X**	**View**

Power Equipment Operators	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Conveyors	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Cranes Friction: 200 tons and over	$90.88	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes, A-frame: 10 tons and under	$82.95	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	$89.09	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: 20 tons through 44 tons with attachments	$87.42	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$90.00	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: 300 tons and over or 300' of boom including jib with attachments	$90.88	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: Friction cranes through 199 tons	$90.00	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Cranes: through 19 tons with attachments, a-frame over 10 tons	$86.75	**7A**	**11H**	**8X**	**View**

Power Equipment Operators	Crusher	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Deck Engineer/Deck Winches (power)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Derricks, On Building Work	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Dozers D-9 & Under	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Drill Oilers: Auger Type, Truck Or Crane Mount	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Drilling Machine	$91.00	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Elevator and man-lift: permanent and shaft type	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Forklift: 3000 lbs and over with attachments	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Forklifts: under 3000 lbs. with attachments	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Gradechecker/Stakeman	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Guardrail Punch	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Horizontal/Directional Drill Locator	$88.60	**15J**	**11G**	**8X**	**View**

Power Equipment Operators	Horizontal/Directional Drill Operator	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Hydralifts/Boom Trucks Over 10 Tons	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Hydralifts/boom trucks: 10 tons and under	$82.95	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Leverman	$91.94	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Loaders, Overhead Under 6 Yards	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Loaders, Plant Feed	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Loaders: Elevating Type Belt	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Locomotives, All	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Material Transfer Device	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Mechanics: All (Leadmen - $0.50 per hour over mechanic)	$91.00	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Motor Patrol Graders	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Overhead, bridge type Crane: 20 tons through 44 tons	$87.42	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Overhead, bridge type: 100 tons and over	$89.09	**7A**	**11H**	**8X**	**View**

Power Equipment Operators	Overhead, bridge type: 45 tons through 99 tons	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Pavement Breaker	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Pile Driver (other Than Crane Mount)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Plant Oiler - Asphalt, Crusher	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Posthole Digger, Mechanical	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Power Plant	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Pumps - Water	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Quad 9, Hd 41, D10 And Over	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Quick Tower: no cab, under 100 feet in height base to boom	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Remote Control Operator On Rubber Tired Earth Moving Equipment	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Rigger and Bellman	$82.95	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Rigger/Signal Person, Bellman(Certified)	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Rollagon	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Roller, Other Than Plant Mix	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Roller, Plant Mix Or Multi-lift Materials	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Roto-mill, Roto-grinder	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Saws - Concrete	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Scraper, Self Propelled Under 45 Yards	$89.28	**15J**	**11G**	**8X**	**View**

Power Equipment Operators	Scrapers - Concrete & Carry All	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Scrapers, Self-propelled: 45 Yards And Over	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Service Engineers: Equipment	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Shotcrete/Gunite Equipment	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$91.00	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$91.94	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Slipform Pavers	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Spreader, Topsider & Screedman	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Subgrader Trimmer	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Tower Bucket Elevators	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Tower Crane: over 175' through 250' in height, base to boom	$90.00	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Tower crane: up to 175' in height base to boom	$89.09	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Tower Cranes: over 250' in height from base to boom	$90.88	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Transporters, All Track Or Truck Type	$90.09	**15J**	**11G**	**8X**	**View**

Power Equipment Operators	Trenching Machines	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Truck Crane Oiler/Driver: 100 tons and over	$87.42	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Truck crane oiler/driver: under 100 tons	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators	Truck Mount Portable Conveyor	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Vac Truck (Vactor Guzzler, Hydro Excavator)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Welder	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Wheel Tractors, Farmall Type	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators	Yo Yo Pay Dozer	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Asphalt Plant Operators	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Assistant Engineer	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Barrier Machine (zipper)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Batch Plant Operator, Concrete	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Boat Operator	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Bobcat	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Brokk - Remote Demolition Equipment	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Brooms	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Bump Cutter	$89.28	**15J**	**11G**	**8X**	**View**

Power Equipment Operators-Underground Sewer & Water	Cableways	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Chipper	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Compressor	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Concrete Finish Machine - Laser Screed	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Concrete Pump - Mounted Or Trailer High Pressure Line Pump, Pump High Pressure	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Over 42 M	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Concrete Pump: Truck Mount With Boom Attachment Up To 42m	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Conveyors	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes Friction: 200 tons and over	$90.88	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes, A-frame: 10 tons and under	$82.95	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes: 100 tons through 199 tons, or 150' of boom (including jib with attachments)	$89.09	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes: 20 tons through 44 tons with attachments	$87.42	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes: 200 tons- 299 tons, or 250' of boom including jib with attachments	$90.00	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes: 300 tons and over or 300' of boom including jib with	$90.88	**7A**	**11H**	**8X**	**View**

	attachments					
Power Equipment Operators-Underground Sewer & Water	Cranes: 45 tons through 99 tons, under 150' of boom(including jib with attachments)	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes: Friction cranes through 199 tons	$90.00	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Cranes: through 19 tons with attachments, a-frame over 10 tons	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Crusher	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Deck Engineer/Deck Winches (power)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Derricks, On Building Work	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Dozers D-9 & Under	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Drill Oilers: Auger Type, Truck Or Crane Mount	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Drilling Machine	$91.00	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Elevator and man-lift: permanent and shaft type	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Finishing Machine, Bidwell And Gamaco & Similar Equipment	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Forklift: 3000 lbs and over with attachments	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Forklifts: under 3000 lbs. with attachments	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Grade Engineer: Using Blue Prints, Cut Sheets, Etc	$89.28	**15J**	**11G**	**8X**	**View**

Power Equipment Operators-Underground Sewer & Water	Gradechecker/Stakeman	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Guardrail Punch	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off- Road Equipment 45 Yards. & Over	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Hard Tail End Dump Articulating Off-road Equipment Under 45 Yards	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Horizontal/Directional Drill Locator	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Horizontal/Directional Drill Operator	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom trucks: 10 tons and under	$82.95	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Hydralifts/boom trucks: over 10 tons	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Leverman	$91.94	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Loader, Overhead, 6 Yards. But Not Including 8 Yards	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Loaders, Overhead Under 6 Yards	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Loaders, Plant Feed	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Loaders: Elevating Type Belt	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Locomotives, All	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Material Transfer Device	$89.28	**15J**	**11G**	**8X**	**View**

Power Equipment Operators-Underground Sewer & Water	Mechanics: All (Leadmen - $0.50 per hour over mechanic)	$91.00	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Motor Patrol Graders	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Mucking Machine, Mole, Tunnel Drill, Boring, Road Header And/or Shield	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Oil Distributors, Blower Distribution & Mulch Seeding Operator	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Outside Hoists (Elevators and Manlifts), Air Tuggers, Strato	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Overhead, bridge type Crane: 20 tons through 44 tons	$87.42	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Overhead, bridge type: 100 tons and over	$89.09	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Overhead, bridge type: 45 tons through 99 tons	$88.20	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Pavement Breaker	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Pile Driver (other Than Crane Mount)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Plant Oiler - Asphalt, Crusher	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Posthole Digger, Mechanical	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Power Plant	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Pumps - Water	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Quad 9, Hd 41, D10 And Over	$90.09	**15J**	**11G**	**8X**	**View**

Power Equipment Operators-Underground Sewer & Water	Quick Tower: no cab, under 100 feet in height base to boom	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Remote Control Operator On Rubber Tired Earth Moving Equipment	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Rigger and Bellman	$82.95	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Rigger/Signal Person, Bellman(Certified)	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Rollagon	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Roller, Other Than Plant Mix	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Roller, Plant Mix Or Multi-lift Materials	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Roto-mill, Roto-grinder	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Saws - Concrete	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Scraper, Self Propelled Under 45 Yards	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Scrapers - Concrete & Carry All	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Scrapers, Self-propelled: 45 Yards And Over	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Shotcrete/Gunite Equipment	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoe, Tractors Under 15 Metric Tons	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoe: Over 30 Metric Tons To 50 Metric Tons	$90.09	**15J**	**11G**	**8X**	**View**

Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes, Tractors: 15 To 30 Metric Tons	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 50 Metric Tons To 90 Metric Tons	$91.00	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Shovel, Excavator, Backhoes: Over 90 Metric Tons	$91.94	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Slipform Pavers	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Spreader, Topsider & Screedman	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Subgrader Trimmer	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Tower Bucket Elevators	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Tower Crane: over 175' through 250' in height, base to boom	$90.00	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Tower crane: up to 175' in height base to boom	$89.09	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Tower Cranes: over 250' in height from base to boom	$90.88	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Transporters, All Track Or Truck Type	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Trenching Machines	$88.60	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Truck Crane Oiler/Driver: 100 tons and over	$87.42	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Truck crane oiler/driver: under 100 tons	$86.75	**7A**	**11H**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Truck Mount Portable Conveyor	$89.28	**15J**	**11G**	**8X**	**View**

Power Equipment Operators-Underground Sewer & Water	Vac Truck (Vactor Guzzler, Hydro Excavator)	$89.28	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Welder	$90.09	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Wheel Tractors, Farmall Type	$84.69	**15J**	**11G**	**8X**	**View**
Power Equipment Operators-Underground Sewer & Water	Yo Yo Pay Dozer	$89.28	**15J**	**11G**	**8X**	**View**
Power Line Clearance Tree Trimmers	Journey Level In Charge	$69.62	**5A**	**4A**		**View**
Power Line Clearance Tree Trimmers	Spray Person	$65.89	**5A**	**4A**		**View**
Power Line Clearance Tree Trimmers	Tree Equipment Operator	$69.62	**5A**	**4A**		**View**
Power Line Clearance Tree Trimmers	Tree Trimmer	$62.19	**5A**	**4A**		**View**
Power Line Clearance Tree Trimmers	Tree Trimmer Groundperson	$45.93	**5A**	**4A**		**View**
Refrigeration & Air Conditioning Mechanics	Journey Level	$100.41	**6Z**	**1Q**		**View**
Residential Brick Mason	Journey Level	$37.47		**1**		**View**
Residential Carpenters	Journey Level	$56.28		**1**		**View**
Residential Cement Masons	Journey Level	$28.00		**1**		**View**
Residential Drywall Applicators	Journey Level	$39.60		**1**		**View**
Residential Drywall Tapers	Journey Level	$32.94		**1**		**View**
Residential Electricians	Journey Level	$28.40		**1**		**View**
Residential Glaziers	Journey Level	$26.00		**1**		**View**
Residential Insulation Applicators	Journey Level	$21.74		**1**		**View**

Residential Laborers	Journey Level	$17.13		1	View
Residential Marble Setters	Journey Level	$37.47		1	View
Residential Painters	Journey Level	$21.59		1	View
Residential Plumbers & Pipefitters	Journey Level	$28.62		1	View
Residential Refrigeration & Air Conditioning Mechanics	Journey Level	$37.30	5A	11R	View
Residential Sheet Metal Workers	Journey Level (Field or Shop)	$58.36	5A	1X	View
Residential Soft Floor Layers	Journey Level	$30.83		1	View
Residential Sprinkler Fitters (Fire Protection)	Journey Level	$18.40		1	View
Residential Stone Masons	Journey Level	$18.19		1	View
Residential Terrazzo Workers	Journey Level	$17.13		1	View
Residential Terrazzo/Tile Finishers	Journey Level	$21.96		1	View
Residential Tile Setters	Journey Level	$19.07		1	View
Roofers	Irritable Bituminous Roofer	$53.53	7G	4I	View
Roofers	Journeyman Roofer, Waterproofer, Kettleman	$50.53	7G	4I	View
Sheet Metal Workers	Journey Level (Field or Shop)	$81.31	5A	1X	View
Sign Makers & Installers (Electrical)	Journey Level	$17.13		1	View
Sign Makers & Installers (Non-Electrical)	Journey Level	$17.13		1	View
Soft Floor Layers	Journey Level	$62.66	7C	3J	View
Solar Controls For Windows	Journey Level	$17.13		1	View

Sprinkler Fitters (Fire Protection)	Journey Level	$76.94	**7J**	**1R**		**View**
Stage Rigging Mechanics (Non Structural)	Journey Level	$17.13		**1**		**View**
Stone Masons	Journey Level	$61.09	**5A**	**1M**		**View**
Street And Parking Lot Sweeper Workers	Journey Level	$17.13		**1**		**View**
Surveyors	Assistant Construction Site Surveyor	$86.75	**7A**	**11H**	**8X**	**View**
Surveyors	Chainman	$82.95	**7A**	**11H**	**8X**	**View**
Surveyors	Construction Site Surveyor	$88.20	**7A**	**11H**	**8X**	**View**
Surveyors	Drone Operator (when used in conjunction with survey work only)	$82.95	**7A**	**11H**	**8X**	**View**
Surveyors	Ground Penetrating Radar Operator	$82.95	**7A**	**11H**	**8X**	**View**
Telecommunication Technicians	Journey Level	$53.13	**5I**	**1B**		**View**
Telephone Line Construction - Outside	Cable Splicer	$42.62	**5A**	**2B**		**View**
Telephone Line Construction - Outside	Hole Digger/Ground Person	$27.97	**5A**	**2B**		**View**
Telephone Line Construction - Outside	Telephone Equipment Operator (Light)	$35.60	**5A**	**2B**		**View**
Telephone Line Construction - Outside	Telephone Lineperson	$40.28	**5A**	**2B**		**View**
Terrazzo Workers	Journey Level	$43.81	**5A**	**1M**		**View**
Tile Setters	Journey Level	$43.81	**5A**	**1M**		**View**
Tile, Marble & Terrazzo Finishers	Journey Level	$35.93	**5A**	**1M**		**View**

Traffic Control Stripers	All cleanup required in connection with traffic control stripers work (Group 1)	$95.41	**15L**	**1K**	**View**
Traffic Control Stripers	Handling, painting and installing of all car stops, stop signs and any other type sign (Group 2)	$55.54	**15L**	**1K**	**View**
Traffic Control Stripers	Installation of guard rail and posts and similar protective devices (Group 2)	$55.54	**15L**	**1K**	**View**
Traffic Control Stripers	Installation of parking gates, ticket spitters and other mechanical and automatic control devices (Group 2)	$55.54	**15L**	**1K**	**View**
Traffic Control Stripers	Installation of plastic metal or composition button, or lines used instead of paint (Group 1)	$95.41	**15L**	**1K**	**View**
Traffic Control Stripers	Line removal; chemical sand and hydro-blast, paint and button (Group 1)	$95.41	**15L**	**1K**	**View**
Traffic Control Stripers	Manufacturing and installation of all car stops and control devices and similar traffic regulators (Group 2)	$55.54	**15L**	**1K**	**View**
Traffic Control Stripers	Manufacturing, painting, stenciling, servicing, repairing, placing and removal of traffic safety and control devices/barricades (Group 2)	$55.54	**15L**	**1K**	**View**
Traffic Control Stripers	Painting and installing lines, arrows, bumpers, curbs, etc., on parking lots, air fields, highways, game courts (Group 1)	$95.41	**15L**	**1K**	**View**
Traffic Control Stripers	Preparation and maintenance of all surfaces (Group 1)	$95.41	**15L**	**1K**	**View**

Traffic Control Stripers	Seal coating, slurry coating and other surface protection (Group 2)	$55.54	**15L**	**1K**		**View**
Truck Drivers	Asphalt Mix Over 20 Yards	$66.73	**5D**	**1V**	**8M**	**View**
Truck Drivers	Asphalt Mix To 20 Yards	$66.52	**5D**	**1V**	**8M**	**View**
Truck Drivers	Dump Truck	$66.52	**5D**	**1V**	**8M**	**View**
Truck Drivers	Dump Truck & Trailer	$66.73	**5D**	**1V**	**8M**	**View**
Truck Drivers	Other Trucks	$62.14	**5D**	**1V**	**8M**	**View**
Truck Drivers - Ready Mix	Transit Mixers 20 yards and under	$66.73	**5D**	**1V**	**8M**	**View**
Truck Drivers - Ready Mix	Transit Mixers over 20 yards	$67.10	**5D**	**1V**	**8M**	**View**
Well Drillers & Irrigation Pump Installers	Irrigation Pump Installer	$25.44		**1**		**View**
Well Drillers & Irrigation Pump Installers	Oiler	$17.13		**1**		**View**
Well Drillers & Irrigation Pump Installers	Well Driller	$18.00		**1**		**View**

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Overtime Codes

Overtime calculations are based on the hourly rate actually paid to the worker. On public works projects, the hourly rate must be not less than the prevailing rate of wage minus the hourly rate of the cost of fringe benefits actually provided for the worker.

1. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

B. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

C. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

D. The first two (2) hours before or after a five-eight (8) hour workweek day or a four-ten (10) hour workweek day and the first eight (8) hours worked the next day after either workweek shall be paid at one and one-half times the hourly rate of wage. All additional hours worked and all worked on Sundays and holidays shall be paid at double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

G. The first ten (10) hours worked on Saturdays and the first ten (10) hours worked on a fifth calendar weekday in a four-ten hour schedule, shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

H. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions or equipment breakdown) shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. All hours worked on Sundays and holidays shall also be paid at double the hourly rate of wage.

J. The first two (2) hours after eight (8) regular hours Monday through Friday and the first ten (10) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage.

K. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

M. All hours worked on Saturdays (except makeup days if work is lost due to inclement weather conditions) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

1. N. All hours worked on Saturdays (except makeup days) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

O. The first ten (10) hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays, holidays and after twelve (12) hours, Monday through Friday and after ten (10) hours on Saturday shall be paid at double the hourly rate of wage.

P. All hours worked on Saturdays (except makeup days if circumstances warrant) and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

Q. The first two (2) hours after eight (8) regular hours Monday through Friday and up to ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of ten (10) hours per day Monday through Saturday and all hours worked on Sundays and holidays (except Christmas day) shall be paid at double the hourly rate of wage. All hours worked on Christmas day shall be paid at two and one-half times the hourly rate of wage.

R. All hours worked on Sundays and holidays shall be paid at two times the hourly rate of wage.

U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays (except Labor Day) shall be paid at two times the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage.

V. All hours worked on Sundays and holidays (except Thanksgiving Day and Christmas day) shall be paid at one and one-half times the hourly rate of wage. All hours worked on Thanksgiving Day and Christmas day shall be paid at double the hourly rate of wage.

X. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked over twelve (12) hours Monday through Saturday, Sundays and holidays shall be paid at double the hourly rate of wage. When holiday falls on Saturday or Sunday, the day before Saturday, Friday, and the day after Sunday, Monday, shall be considered the holiday and all work performed shall be paid at double the hourly rate of wage.

Y. All hours worked outside the hours of 5:00 am and 5:00 pm (or such other hours as may be agreed upon by any employer and the employee) and all hours worked in excess of eight (8) hours per day (10 hours per day for a 4 x 10 workweek) and on Saturdays and holidays (except labor day) shall be paid at one and one-half times the hourly rate of wage. (except for employees who are absent from work without prior approval on a scheduled workday during the workweek shall be paid at the straight-time rate until they have worked 8 hours in a day (10 in a 4 x 10 workweek) or 40 hours during that workweek.) All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and Labor Day shall be paid at double the hourly rate of wage.

Z. All hours worked on Saturdays and Sundays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid the straight time rate of pay in addition to holiday pay.

Overtime Codes Continued

2. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   B. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

   F. The first eight (8) hours worked on holidays shall be paid at the straight hourly rate of wage in addition to the holiday pay. All hours worked in excess of eight (8) hours on holidays shall be paid at double the hourly rate of wage.

   M. This code appears to be missing. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage.

   R. All hours worked on Sundays and holidays and all hours worked over sixty (60) in one week shall be paid at double the hourly rate of wage.

   U. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked over 12 hours in a day or on Sundays and holidays shall be paid at double the hourly rate of wage.

3. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   F. All hours worked on Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sunday shall be paid at two times the hourly rate of wage. All hours worked on paid holidays shall be paid at two and one-half times the hourly rate of wage including holiday pay.

   H. All work performed on Sundays between March 16th and October 14th and all Holidays shall be compensated for at two (2) times the regular rate of pay. Work performed on Sundays between October 15th and March 15th shall be compensated at one and one half (1-1/2) times the regular rate of pay.

   J. All hours worked between the hours of 10:00 pm and 5:00 am, Monday through Friday, and all hours worked on Saturdays shall be paid at a one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

   K. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

Overtime Codes Continued

4. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

A. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturdays, Sundays and holidays shall be paid at double the hourly rate of wage

C. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay. On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay. All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

D. All hours worked in excess of eight (8) hours per day or forty (40) hours per week shall be paid at double the hourly rate of wage. All hours worked on Saturday, Sundays and holidays shall be paid at double the hourly rate of pay. Rates include all members of the assigned crew.

EXCEPTION:
On all multipole structures and steel transmission lines, switching stations, regulating, capacitor stations, generating plants, industrial plants, associated installations and substations, except those substations whose primary function is to feed a distribution system, will be paid overtime under the following rates:

The first two (2) hours after eight (8) regular hours Monday through Friday of overtime on a regular workday, shall be paid at one and one-half times the hourly rate of wage. All hours in excess of ten (10) hours will be at two (2) times the hourly rate of wage. The first eight (8) hours worked on Saturday will be paid at one and one-half (1-1/2) times the hourly rate of wage. All hours worked in excess of eight (8) hours on Saturday, and all hours worked on Sundays and holidays will be at the double the hourly rate of wage.

All overtime eligible hours performed on the above described work that is energized, shall be paid at the double the hourly rate of wage.

E. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one and one half (1½) times the regular shift rate for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

G. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

I. The First eight (8) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) per day on Saturdays shall be paid at double the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. J. The first eight (8) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked in excess of eight (8) hours on a Saturday shall be paid at double the hourly rate of wage. All hours worked over twelve (12) in a day, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

K. All hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage, so long as Saturday is the sixth consecutive day worked. All hours worked over twelve (12) in a day Monday through Saturday, and all hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

L. The first twelve (12) hours worked on a Saturday shall be paid at one and one-half times the hourly rate of wage. All hours worked on a Saturday in excess of twelve (12) hours shall be paid at double the hourly rate of pay. All hours worked over twelve (12) in a day Monday through Friday, and all hours worked on Sundays shall be paid at double the hourly rate of wage. All hours worked on a holiday shall be paid at one and one-half times the hourly rate of wage, except that all hours worked on Labor Day shall be paid at double the hourly rate of pay.

S. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, work performed in excess of (10) hours shall be paid at one and one half (1-1/2) times the hourly rate of pay. On Monday through Friday, work performed outside the normal work hours of 6:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations).

All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Multiple Shift Operations: When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. Special Shifts: The Special Shift Premium is the basic hourly rate of pay plus $2.00 an hour. When due to conditions beyond the control of the employer or when an owner (not acting as the contractor), a government agency or the contract specifications require more than four (4) hours of a special shift can only be performed outside the normal 6am to 6pm shift then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid the special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday).

U. The first four (4) hours after eight (8) regular hours Monday through Friday and the first twelve (12) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. (Except on makeup days if work is lost due to inclement weather, then the first eight (8) hours on Saturday may be paid the regular rate.) All hours worked over twelve (12) hours Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

Overtime Codes Continued

4. X. All hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays and holidays shall be paid at double the hourly rate of wage. Work performed outside the normal shift of 6 am to 6pm shall be paid at one and one-half the straight time rate, (except for special shifts or three shift operations). All work performed on Sundays and holidays shall be paid at double the hourly rate of wage. Shifts may be established when considered necessary by the Employer.

   The Employer may establish shifts consisting of eight (8) or ten (10) hours of work (subject to WAC 296-127-022), that shall constitute a normal forty (40) hour work week. The Employer can change from a 5-eight to a 4-ten hour schedule or back to the other. All hours of work on these shifts shall be paid for at the straight time hourly rate. Work performed in excess of eight hours (or ten hours per day (subject to WAC 296-127-022) shall be paid at one and one-half the straight time rate.

   When due to conditions beyond the control of the Employer, or when contract specifications require that work can only be performed outside the regular day shift, then by mutual agreement a special shift may be worked at the straight time rate, eight (8) hours work for eight (8) hours pay. The starting time shall be arranged to fit such conditions of work.

   When an employee returns to work without at a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Overtime Codes Continued

11. ALL HOURS WORKED IN EXCESS OF EIGHT (8) HOURS PER DAY OR FORTY (40) HOURS PER WEEK SHALL BE PAID AT ONE AND ONE-HALF TIMES THE HOURLY RATE OF WAGE.

   B After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

   C The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other overtime hours worked, except Labor Day, and all hours on Sunday shall be paid at double the hourly rate of wage. All hours worked on Labor Day shall be paid at three times the hourly rate of wage. All non-overtime and non-holiday hours worked between 4:00 pm and 5:00 am, Monday through Friday, shall be paid at a premium rate of 15% over the hourly rate of wage.

   D. All hours worked on Saturdays and holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on Sundays shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

   E. The first two (2) hours after eight (8) regular hours Monday through Friday, the first ten (10) hours on Saturday, and the first ten (10) hours worked on Holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked over ten (10) hours Monday through Saturday, and Sundays shall be paid at double the hourly rate of wage.

   After an employee has worked eight (8) hours, all additional hours worked shall be paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

Overtime Codes Continued

11. F. The first two (2) hours after eight (8) regular hours Monday through Friday and the first eight (8) hours on Saturday shall be paid at one and one-half times the hourly rate of wage. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

On a four-day, ten-hour weekly schedule, either Monday thru Thursday or Tuesday thru Friday schedule, all hours worked after ten shall be paid at double the hourly rate of wage. The Monday or Friday not utilized in the normal four-day, ten hour work week, and Saturday shall be paid at one-half times the hourly rate of wage for the first eight (8) hours. All other hours worked Monday through Saturday, and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

G. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.

All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of nine (9) hours or more. When an employee returns to work without at least nine (9) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the nine (9) hours rest period.

H. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 5 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage.

All work performed after 6:00 pm Saturday to 5:00 am Monday and Holidays, and all hours worked in excess of twelve (12) hours in a single shift shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of ten (10) hours or more. When an employee returns to work without at least ten (10) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the ten (10) hours rest period.

J. All hours worked on holidays shall be paid at double the hourly rate of wage.

K. On Monday through Friday hours worked outside 4:00 am and 5:00 pm, and the first two (2) hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked over 10 hours per day Monday through Friday, and all hours worked on Saturdays, Sundays, and Holidays worked shall be paid at double the hourly rate of wage.

L. An employee working outside 5:00 am and 5:00 pm shall receive an additional two dollar ($2.00) per hour for all hours worked that shift. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at one and one-half times the hourly rate of wage.

Overtime Codes Continued

11. M. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of a multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 am to 6:00 pm, then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shift shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten shifts.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay. All work performed after 6:00 pm Saturday to 5:00 am Monday, all work performed over twelve (12) hours, and all work performed on holidays shall be paid at double the straight time rate of pay.

Shift Pay Premium: In an addition to any overtime already required, all hours worked between the hours of 6:00 pm and 5:00 am shall receive an additional two dollars ($2.00) per hour.

N. All work performed over twelve hours in a shift and all work performed on Sundays and Holidays shall be paid at double the straight time rate.

Any time worked over eight (8) hours on Saturday shall be paid double the straight time rate, except employees assigned to work six 10-hour shifts per week shall be paid double the straight time rate for any time worked on Saturday over 10 hours.

O. All work performed on Saturdays, Sundays, and Holidays shall be paid at one and one half (1-1/2) times the straight time rate of pay.

Overtime Codes Continued

11. P. Work performed in excess of ten (10) hours of straight time per day when four ten (10) hour shifts are established and all work on Saturdays, except for make-up days shall be paid at time and one-half (1 ½) the straight time rate.

Work performed outside the normal work hours of 5:00 a.m. and 6:00 p.m. shall be paid at one and one-half (1-1/2) times the straight time rate, (except for special shifts or multiple shift operations). When the first shift of multiple shift (a two or three shift) operation is started at the basic straight time rate or at a specific overtime rate, all shifts of that day's operation shall be completed at that rate. When due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift of 5:00 a.m. to 6:00 p.m., then a special shift may be worked at the straight time rate, plus the shift pay premium when applicable. The starting time of work will be arranged to fit such conditions of work. Such shifts shall consist of eight (8) hours work for eight (8) hours pay or ten (10) hours work for ten (10) hours pay for four ten-hour shifts.

In the event the job is down due to weather conditions, then Saturday may, be worked as a voluntary make-up day at the straight time rate. However, Saturday shall not be utilized as a make-up day when a holiday falls on Friday. All work performed on Sundays and holidays and work in excess of twelve (12) hours per day shall be paid at double (2x) the straight time rate of pay.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Q. All hours worked between the hours of 6:00 pm and 6:00 am, Monday through Saturday, shall be paid at a premium rate of 35% over the hourly rate of wage. Work performed on Sundays shall be paid at double time. All hours worked on holidays shall be paid at double the hourly rate of wage.

R On Monday through Saturday hours worked outside 6:00 am and 7:00 pm, and all hours after eight (8) hours worked shall be paid at one and one-half times the hourly rate. All hours worked on Sundays and Holidays shall be paid at double the hourly rate of wage.

When a holiday falls on a Saturday, the Friday before shall be the observed holiday. When a holiday falls on a Sunday, the following Monday shall be the observed holiday.

S. The first ten (10) hours worked on Saturdays shall be paid at one and one-half times the hourly rate of wage. In the event the job is down due to weather conditions, or other conditions beyond the control of the Employer, then Saturday may be worked at the straight time rate, for the first eight (8) hours, or the first ten (10) hours when a four day ten hour workweek has been established.

All hours worked Monday through Saturday over twelve (12) hours and all hours worked on Sundays and holidays shall be paid at double the hourly rate of wage.

When an employee returns to work without a break of eight (8) hours since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until such time as the employee has had a break of eight (8) hours.

Overtime Codes Continued

11. T. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay.

All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

U. On Monday through Friday, the first four (4) hours of overtime after eight (8) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay, unless a four (4) day ten (10) hour workweek has been established. On a four (4) day ten (10) hour workweek scheduled Monday through Thursday, or Tuesday through Friday, the first two (2) hours of overtime after ten (10) hours of straight time work shall be paid at one and one half (1-1/2) times the straight time rate of pay.

On Saturday, the first twelve (12) hours of work shall be paid at one and one half (1-1/2) times the straight time rate of pay, except that if the job is down on Monday through Friday due to weather conditions or other conditions outside the control of the employer, the first ten (10) hours on Saturday may be worked at the straight time rate of pay.

All hours worked over twelve (12) hours in a day and all hours worked on Sunday and Holidays shall be paid at two (2) times the straight time rate of pay.

If, due to conditions beyond the control of the Employer or when contract specifications require that work can only be performed outside the regular day shift, then a Special Shift may be worked, Monday through Friday, at the straight-time rate. The starting time of work for the Special Shift will be arranged to fit such conditions of work. Such Special Shift shall consist of eight (8) hours of work for eight (8) hours of pay or ten (10) hours of work for ten(10) hours of pay on a four-ten workday schedule.

V. All hours worked on Saturdays and Sundays (except make-up days due to conditions beyond the control of the employer) shall be paid at one and one-half times the hourly rate of wage. All hours worked on holidays shall be paid at double the hourly rate of wage.

W. Work performed in excess of eight (8) hours of straight time per day, or ten (10) hours of straight time per day when four ten (10) hour shifts are established, or forty (40) hours of straight time per week, Monday through Friday, or outside the normal 6 am to 6pm shift, and all work on Saturdays shall be paid at one and one-half times the hourly rate of wage. All work performed on Sundays and Holidays shall be paid at double the hourly rate of wage.

After an employee has worked eight (8) hours at an applicable overtime rate, all additional hours shall be at the applicable overtime rate until such time as the employee has had a break of eight (8) hours or more.

When an employee returns to work without at least eight (8) hours time off since their previous shift, all such time shall be a continuation of shift and paid at the applicable overtime rate until he/she shall have the eight (8) hours rest period.

Holiday Codes

5. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, and Christmas Day (7).

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, the day before Christmas, and Christmas Day (8).

C. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

D. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8).

H. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Day after Thanksgiving Day, And Christmas (6).

I. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

K. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9).

L. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (8).

N. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, The Friday After Thanksgiving Day, And Christmas Day (9).

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday And Saturday After Thanksgiving Day, The Day Before Christmas, And Christmas Day (9). If A Holiday Falls On Sunday, The Following Monday Shall Be Considered As A Holiday.

Q. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6).

R. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Day After Thanksgiving Day, One-Half Day Before Christmas Day, And Christmas Day. (7 1/2).

S. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, And Christmas Day (7).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8).

Holiday Codes Continued

6. G. Paid Holidays: New Year's Day, Martin Luther King Jr. Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Christmas Eve Day (11).

H. Paid Holidays: New Year's Day, New Year's Eve Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday After Thanksgiving Day, Christmas Day, The Day After Christmas, And A Floating Holiday (10).

T. Paid Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Last Working Day Before Christmas Day, And Christmas Day (9).

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). If a holiday falls on Saturday, the preceding Friday shall be considered as the holiday. If a holiday falls on Sunday, the following Monday shall be considered as the holiday.

Holiday Codes Continued

7. A. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any Holiday Which Falls On A Sunday Shall Be Observed As A Holiday On The Following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

B. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

C. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

D. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (8). Unpaid Holidays: President's Day. Any paid holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any paid holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

E. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

F. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the last working day before Christmas day and Christmas day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Holiday Codes Continued

7. G. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day and Christmas Day (6). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Last Work Day before Christmas Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. When Christmas falls on a Saturday, the preceding Friday shall be observed as a holiday.

P. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, And Christmas Day (7). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Q. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

S. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day, Christmas Day, the Day after Christmas, and A Floating Holiday (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

V. Holidays: New Year's Day, President's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, the day before or after Christmas, and the day before or after New Year's Day. If any of the above listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

W. Holidays: New Year's Day, Day After New Year's, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, Christmas Day, the day after Christmas, the day before New Year's Day, and a Floating Holiday.

Holiday Codes Continued

7. X. Holidays: New Year's Day, Day before or after New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and the day before or after Christmas day. If a holiday falls on a Saturday or on a Friday that is the normal day off, then the holiday will be taken on the last normal workday. If the holiday falls on a Monday that is the normal day off or on a Sunday, then the holiday will be taken on the next normal workday.

Y. Holidays: New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day. (8) If the holiday falls on a Sunday, then the day observed by the federal government shall be considered a holiday and compensated accordingly.

Z. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, Christmas Eve, and Christmas Day (9). Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday. Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

Holiday Codes Continued

15. G. New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, the last scheduled workday before Christmas, and Christmas Day (9). If any of the listed holidays falls on a Sunday, the day observed by the Nation shall be considered a holiday and compensated accordingly.

H. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, the Last Working Day before Christmas Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

I. Holidays: New Year's Day, President's Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, The Friday After Thanksgiving Day, The Day Before Christmas Day And Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

J. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

K. Holidays: New Year's Day, Memorial Day, Independence Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

L. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

M. Holidays: New Year's Day, Martin Luther King Jr. Day, Independence Day, Memorial Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day and Christmas Day (9). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. If any of the listed holidays falls on a Saturday, the preceding Friday shall be a regular work day.

Holiday Codes Continued

15. N. Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

O. Holidays: New Year's Day, Martin Luther King Jr. Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday and Saturday after Thanksgiving Day, the day before Christmas day, and Christmas Day (10). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday.

P. Holidays: New Year's Day, Memorial Day, Labor Day, Independence Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Eve Day, And Christmas Day (8). Any holiday which falls on a Sunday shall be observed as a holiday on the following Monday. Any holiday which falls on a Saturday shall be observed as a holiday on the preceding Friday.

Note Codes

8. D. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

M. Workers on hazmat projects receive additional hourly premiums as follows: Levels A & B: $1.00, Levels C & D: $0.50.

N. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

S. Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

T. Effective August 31, 2012 – A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. This classification is only effective on or after August 31, 2012.

U. Workers on hazmat projects receive additional hourly premiums as follows – Class A Suit: $2.00, Class B Suit: $1.50, And Class C Suit: $1.00. Workers performing underground work receive an additional $0.40 per hour for any and all work performed underground, including operating, servicing and repairing of equipment. The premium for underground work shall be paid for the entire shift worked. Workers who work suspended by a rope or cable receive an additional $0.50 per hour. The premium for work suspended shall be paid for the entire shift worked. Workers who do "pioneer" work (break open a cut, build road, etc.) more than one hundred fifty (150) feet above grade elevation receive an additional $0.50 per hour.

Note Codes Continued

8. V. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

   Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

   Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

   W. Meter Installers work on single phase 120/240V self-contained residential meters. The Lineman/Groundmen rates would apply to meters not fitting this description.

   X. Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, and Class D Suit: $0.50. Special Shift Premium: Basic hourly rate plus $2.00 per hour.

   When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 5 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

   Y. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

   Swinging Stage/Boatswains Chair: Employees working on a swinging state or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

   Z. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

   Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as a contractor), a government agency or the contract specifications require that more than (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they will be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Note Codes Continued

9. A. Workers working with supplied air on hazmat projects receive an additional $1.00 per hour.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications require that more than four (4) hours of a special shift can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic straight time for the entire shift. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in overtime or double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Certified Crane Operator Premium: Crane operators requiring certifications shall be paid $0.50 per hour above their classification rate.

Boom Pay Premium: All cranes including tower shall be paid as follows based on boom length:

(A) – 130’ to 199’ – $0.50 per hour over their classification rate.
(B) – 200’ to 299’ – $0.80 per hour over their classification rate.
(C) – 300’ and over – $1.00 per hour over their classification rate.

B. The highest pressure registered on the gauge for an accumulated time of more than fifteen (15) minutes during the shift shall be used in determining the scale paid.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

C. Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay. Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

Effective August 31, 2012 – A Traffic Control Supervisor shall be present on the project whenever flagging or spotting or other traffic control labor is being utilized. A Traffic Control Laborer performs the setup, maintenance and removal of all temporary traffic control devices and construction signs necessary to control vehicular, bicycle, and pedestrian traffic during construction operations. Flaggers and Spotters shall be posted where shown on approved Traffic Control Plans or where directed by the Engineer. All flaggers and spotters shall possess a current flagging card issued by the State of Washington, Oregon, Montana, or Idaho. These classifications are only effective on or after August 31, 2012.

D. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, bridges, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

E. Heavy Construction includes construction, repair, alteration or additions to the production, fabrication or manufacturing portions of industrial or manufacturing plants, hydroelectric or nuclear power plants and atomic reactor construction. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $1.00, Level B: $0.75, Level C: $0.50, And Level D: $0.25.

Note Codes Continued

9. F. Industrial Painter wages are required for painting within industrial facilities such as treatment plants, pipelines, towers, dams, power generation facilities and manufacturing facilities such as chemical plants, etc., or anywhere abrasive blasting is necessary to prepare surfaces, or hazardous materials encapsulation is required.

H. One (1) person crew shall consist of a Party Chief. (Total Station or similar one (1) person survey system). Two (2) person survey party shall consist of a least a Party Chief and a Chain Person. Three (3) person survey party shall consist of at least a Party Chief, an Instrument Person, and a Chain Person.

I. In addition to the hourly wage and fringe benefits, the following depth and enclosure premiums shall be paid. The premiums are to be calculated for the maximum depth and distance into an enclosure that a diver reaches in a day. The premiums are to be paid one time for the day and are not used in calculating overtime pay.

Depth premiums apply to depths of fifty feet or more. Over 50' to 100' - $2.00 per foot for each foot over 50 feet. Over 101' to 150' - $3.00 per foot for each foot over 101 feet. Over 151' to 220' - $4.00 per foot for each foot over 220 feet. Over 221' - $5.00 per foot for each foot over 221 feet.

Enclosure premiums apply when divers enter enclosures (such as pipes or tunnels) where there is no vertical ascent and is measured by the distance travelled from the entrance. 25’ to 300’ - $1.00 per foot from entrance. 300’ to 600’ - $1.50 per foot beginning at 300’. Over 600’ - $2.00 per foot beginning at 600’.

Employees may be required to perform any combination of work within the Diving team/crew, (with the exception of dive Supervisor) provided they are paid at the highest rate at which he/she has worked for the shift.

L. Workers on hazmat projects receive additional hourly premiums as follows -Level A: $0.75, Level B: $0.50, And Level C: $0.25.

Tide Work: When employees are called out between the hours of 6:00 p.m. and 6:00 a.m. to work on tide work (work located in the tide plane) all time worked shall be at one and one-half times the hourly rate of pay.

Swinging Stage/Boatswains Chair: Employees working on a swinging stage or boatswains chair or under conditions that require them to be tied off to allow their hands to be free shall receive seventy-five cents ($0.75) per hour above the classification rate.

M. Certified Crane Operator Premium: Crane operators requiring certifications shall be paid $1.50 per hour above their classification rate.

Workers on hazmat projects receive additional hourly premiums as follows - Class A Suit: $2.00, Class B Suit: $1.50, Class C Suit: $1.00, and Class D Suit: $0.50.

Special Shift Premium: Basic hourly rate plus $2.00 per hour. When due to conditions beyond the control of the Employer or when an owner (not acting as the contractor), a government agency or the contract specifications requires that work can only be performed outside the normal 6 am to 6pm shift, then the special shift premium will be applied to the basic hourly rate. When an employee works on a special shift, they shall be paid a special shift premium for each hour worked unless they are in OT or Double-time status. (For example, the special shift premium does not waive the overtime requirements for work performed on Saturday or Sunday.)

Washington State Department of Labor and Industries
Policy Statement
(Regarding the Production of "Standard" or "Non-standard" Items)

Below is the department's (State L&I's) list of criteria to be used in determining whether a prefabricated item is "standard" or "non-standard". For items not appearing on WSDOT's predetermined list, these criteria shall be used by the Contractor (and the Contractor's subcontractors, agents to subcontractors, suppliers, manufacturers, and fabricators) to determine coverage under RCW 39.12. The production, in the State of Washington, of non-standard items is covered by RCW 39.12, and the production of standard items is not. The production of any item outside the State of Washington is not covered by RCW 39.12.

1. Is the item fabricated for a public works project? If not, it is not subject to RCW 39.12. If it is, go to question 2.

2. Is the item fabricated on the public works jobsite? If it is, the work is covered under RCW 39.12. If not, go to question 3.

3. Is the item fabricated in an assembly/fabrication plant set up for, and dedicated primarily to, the public works project? If it is, the work is covered by RCW 39.12. If not, go to question 4.

4. Does the item require any assembly, cutting, modification or other fabrication by the supplier? If not, the work is not covered by RCW 39.12. If yes, go to question 5.

5. Is the prefabricated item intended for the public works project typically an inventory item which could reasonably be sold on the general market? If not, the work is covered by RCW 39.12. If yes, go to question 6.

6. Does the specific prefabricated item, generally defined as standard, have any unusual characteristics such as shape, type of material, strength requirements, finish, etc? If yes, the work is covered under RCW 39.12.

Any firm with questions regarding the policy, WSDOT's Predetermined List, or for determinations of covered and non-covered workers shall be directed to State L&I at (360) 902-5330.

WSDOT's
Predetermined List for
Suppliers - Manufactures - Fabricator

Below is a list of potentially prefabricated items, originally furnished by WSDOT to Washington State Department of Labor and Industries, that may be considered non-standard and therefore covered by the prevailing wage law, RCW 39.12. Items marked with an X in the "YES" column should be considered to be non-standard and therefore covered by RCW 39.12. Items marked with an X in the "NO" column should be considered to be standard and therefore not covered. Of course, exceptions to this general list may occur, and in that case shall be evaluated according to the criteria described in State and L&I's policy statement.

	ITEM DESCRIPTION	YES	NO
1.	Metal rectangular frames, solid metal covers, herringbone grates, and bi-directional vaned grates for Catch Basin Types 1, 1L, 1P, and 2 and Concrete Inlets. See Std. Plans		X
2.	Metal circular frames (rings) and covers, circular grates, and prefabricated ladders for Manhole Types 1, 2, and 3, Drywell Types 1, 2, and 3 and Catch Basin Type 2. See Std. Plans		X
3.	Prefabricated steel grate supports and welded grates, metal frames and dual vaned grates, and Type 1, 2, and 3 structural tubing grates for Drop Inlets. See Std. Plans.		X
4.	Concrete Pipe - Plain Concrete pipe and reinforced concrete pipe Class 2 to 5 sizes smaller than 60 inch diameter.		X
5.	Concrete Pipe - Plain Concrete pipe and reinforced concrete pipe Class 2 to 5 sizes larger than 60 inch diameter.		X
6.	Corrugated Steel Pipe - Steel lock seam corrugated pipe for culverts and storm sewers, sizes 30 inch to 120 inches in diameter. May also be treated, 1 thru 5.		X
7.	Corrugated Aluminum Pipe - Aluminum lock seam corrugated pipe for culverts and storm sewers, sizes 30 inch to 120 inches in diameter. May also be treated, #5.		X

	ITEM DESCRIPTION	YES	NO
8.	Anchor Bolts & Nuts - Anchor Bolts and Nuts, for mounting sign structures, luminaries and other items, shall be made from commercial bolt stock. See Contract Plans and Std. Plans for size and material type.		X
9.	Aluminum Pedestrian Handrail - Pedestrian handrail conforming to the type and material specifications set forth in the contract plans. Welding of aluminum shall be in accordance with Section 9-28.14(3).	X	
10.	Major Structural Steel Fabrication - Fabrication of major steel items such as trusses, beams, girders, etc., for bridges.	X	
11.	Minor Structural Steel Fabrication - Fabrication of minor steel Items such as special hangers, brackets, access doors for structures, access ladders for irrigation boxes, bridge expansion joint systems, etc., involving welding, cutting, punching and/or boring of holes. See Contact Plans for item description and shop drawings.	X	
12.	Aluminum Bridge Railing Type BP - Metal bridge railing conforming to the type and material specifications set forth in the Contract Plans. Welding of aluminum shall be in accordance with Section 9-28.14(3).		X
13.	Concrete Piling--Precast-Prestressed concrete piling for use as 55 and 70 ton concrete piling. Concrete to conform to Section 9-19.1 of Std. Spec..	X	
14.	Precast Manhole Types 1, 2, and 3 with cones, adjustment sections and flat top slabs. See Std. Plans.		X
15.	Precast Drywell Types 1, 2, and with cones and adjustment Sections. See Std. Plans.		X
16.	Precast Catch Basin - Catch Basin type 1, 1L, 1P, and 2 With adjustment sections. See Std. Plans.		X

	ITEM DESCRIPTION	YES	NO
17.	Precast Concrete Inlet - with adjustment sections, See Std. Plans		X
18.	Precast Drop Inlet Type 1 and 2 with metal grate supports. See Std. Plans.		X
19.	Precast Grate Inlet Type 2 with extension and top units. See Std. Plans		X
20.	Metal frames, vaned grates, and hoods for Combination Inlets. See Std. Plans		X
21.	Precast Concrete Utility Vaults - Precast Concrete utility vaults of various sizes. Used for in ground storage of utility facilities and controls. See Contract Plans for size and construction requirements. Shop drawings are to be provided for approval prior to casting.		X
22.	Vault Risers - For use with Valve Vaults and Utilities Vaults.		X
23.	Valve Vault - For use with underground utilities. See Contract Plans for details.		X
24.	Precast Concrete Barrier - Precast Concrete Barrier for use as new barrier or may also be used as Temporary Concrete Barrier. Only new state approved barrier may be used as permanent barrier.		X
25.	Reinforced Earth Wall Panels – Reinforced Earth Wall Panels in size and shape as shown in the Plans. Fabrication plant has annual approval for methods and materials to be used. See Shop Drawing. Fabrication at other locations may be approved, after facilities inspection, contact HQ. Lab.	X	
26.	Precast Concrete Walls - Precast Concrete Walls - tilt-up wall panel in size and shape as shown in Plans. Fabrication plant has annual approval for methods and materials to be used	X	

	ITEM DESCRIPTION	YES	NO
27.	Precast Railroad Crossings - Concrete Crossing Structure Slabs.	X	
28.	12, 18 and 26 inch Standard Precast Prestressed Girder – Standard Precast Prestressed Girder for use in structures. Fabricator plant has annual approval of methods and materials To be used. Shop Drawing to be provided for approval prior to casting girders. See Std. Spec. Section 6-02.3(25)A	X	
29.	Prestressed Concrete Girder Series 4-14 - Prestressed Concrete Girders for use in structures. Fabricator plant has annual approval of methods and materials to be used. Shop Drawing to be provided for approval prior to casting girders. See Std. Spec. Section 6-02.3(25)A.	X	
30.	Prestressed Tri-Beam Girder - Prestressed Tri-Beam Girders for use in structures. Fabricator plant has annual approval of methods and materials to be used. Shop Drawing to be provided for approval prior to casting girders. See Std. Spec. Section 6-02.3(25)A	X	
31.	Prestressed Precast Hollow-Core Slab – Precast Prestressed Hollow-core slab for use in structures. Fabricator plant has Annual approval of methods and materials to be used. Shop Drawing to be provided for approval prior to casting girders. See Std. Spec. Section 6-02.3(25)A.	X	
32.	Prestressed-Bulb Tee Girder - Bulb Tee Prestressed Girder for use in structures. Fabricator plant has annual approval of methods and materials to be used. Shop Drawing to be provided for approval prior to casting girders. See Std. Spec. Section 6-02.3(25)A	X	
33.	Monument Case and Cover See Std. Plan.		X

	ITEM DESCRIPTION	YES	NO
34.	Cantilever Sign Structure - Cantilever Sign Structure fabricated from steel tubing meeting AASHTO-M-183. See Std. Plans, and Contract Plans for details. The steel structure shall be galvanized after fabrication in accordance with AASHTO-M-111.	X	
35.	Mono-tube Sign Structures - Mono-tube Sign Bridge fabricated to details shown in the Plans. Shop drawings for approval are required prior to fabrication.	X	
36.	Steel Sign Bridges - Steel Sign Bridges fabricated from steel tubing meeting AASHTO-M-138 for Aluminum Alloys. See Std. Plans, and Contract Plans for details. The steel Structure shall be galvanized after fabrication in accordance with AASHTO-M-111.	X	
37.	Steel Sign Post - Fabricated Steel Sign Posts as detailed in Std Plans. Shop drawings for approval are to be provided prior to fabrication		X
38.	Light Standard-Prestressed - Spun, prestressed, hollow concrete poles.	X	
39.	Light Standards - Lighting Standards for use on highway illumination systems, poles to be fabricated to conform with methods and materials as specified on Std. Plans. See Specia Provisions for pre-approved drawings.	X	
40.	Traffic Signal Standards - Traffic Signal Standards for use on highway and/or street signal systems. Standards to be fabricated to conform with methods and material as specified on Std. Plans. See Special Provisions for pre-approved drawings	X	
41.	Precast Concrete Sloped Mountable Curb (Single and Dual Faced) See Std. Plans.		X

	ITEM DESCRIPTION	YES	NO
42.	Traffic Signs - Prior to approval of a Fabricator of Traffic Signs, the sources of the following materials must be submitted and approved for reflective sheeting, legend material, and luminum sheeting. **NOTE:** *** Fabrication inspection required. Only signs tagged "Fabrication Approved" by WSDOT Sign Fabrication Inspector to be installed.	X	X
		Custom Message	Std Signing Message
43.	Cutting & bending reinforcing steel		X
44.	Guardrail components	X	X
		Custom End Sec	Standard Sec
45.	Aggregates/Concrete mixes	Covered by WAC 296-127-018	
46.	Asphalt	Covered by WAC 296-127-018	
47.	Fiber fabrics		X
48.	Electrical wiring/components		X
49.	treated or untreated timber pile		X
50.	Girder pads (elastomeric bearing)	X	
51.	Standard Dimension lumber		X
52.	Irrigation components		X

ITEM DESCRIPTION	YES	NO
53. Fencing materials		X
54. Guide Posts		X
55. Traffic Buttons		X
56. Epoxy		X
57. Cribbing		X
58. Water distribution materials		X
59. Steel "H" piles		X
60. Steel pipe for concrete pile casings, standard		X
Steel pipe for concrete pile casings, custom	X	
61. Steel pile tips, standard		X
62. Steel pile tips, custom	X	

Prefabricated items specifically produced for public works projects that are prefabricated in a county other than the county wherein the public works project is to be completed, the wage for the offsite prefabrication shall be the applicable prevailing wage for the county in which the actual prefabrication takes place.

It is the manufacturer of the prefabricated product to verify that the correct county wage rates are applied to work they perform.

See RCW 39.12.010
(The definition of "locality" in RCW 39.12.010(2) contains the phrase "wherein the physical work is being performed." The department interprets this phrase to mean the actual work site.

WSDOT's List of State Occupations not applicable to Heavy and Highway Construction Projects

This project is subject to the state hourly minimum rates for wages and fringe benefits in the contract provisions, as provided by the state Department of Labor and Industries.
The following list of occupations, is comprised of those occupations that are not normally used in the construction of heavy and highway projects.
When considering job classifications for use and / or payment when bidding on, or building heavy and highway construction projects for, or administered by WSDOT, these Occupations will be excepted from the included "Washington State Prevailing Wage Rates For Public Work Contracts" documents.

- Building Service Employees
- Electrical Fixture Maintenance Workers
- Electricians - Motor Shop
- Heating Equipment Mechanics
- Industrial Engine and Machine Mechanics
- Industrial Power Vacuum Cleaners
- Inspection, Cleaning, Sealing of Water Systems by Remote Control
- Laborers - Underground Sewer & Water
- Machinists (Hydroelectric Site Work)
- Modular Buildings
- Playground & Park Equipment Installers
- Power Equipment Operators - Underground Sewer & Water
- Residential *** ALL ASSOCIATED RATES ***
- Sign Makers and Installers (Non-Electrical)
- Sign Makers and Installers (Electrical)
- Stage Rigging Mechanics (Non Structural)

The following occupations may be used only as outlined in the preceding text concerning "WSDOT's list for Suppliers - Manufacturers - Fabricators"

- Fabricated Precast Concrete Products
- Metal Fabrication (In Shop)

Definitions for the Scope of Work for prevailing wages may be found at the Washington State Department of Labor and Industries web site and in WAC Chapter 296-127.

Washington State Department of Labor and Industries
Policy Statements
(Regarding Production and Delivery of Gravel, Concrete, Asphalt, etc.)

WAC 296-127-018 Agency filings affecting this section

Coverage and exemptions of workers involved in the production and delivery of gravel, concrete, asphalt, or similar materials.

(1) The materials covered under this section include but are not limited to: Sand, gravel, crushed rock, concrete, asphalt, or other similar materials.

(2) All workers, regardless of by whom employed, are subject to the provisions of chapter 39.12 RCW when they perform any or all of the following functions:

(a) They deliver or discharge any of the above-listed materials to a public works project site:

(i) At one or more point(s) directly upon the location where the material will be incorporated into the project; or

(ii) At multiple points at the project; or

(iii) Adjacent to the location and coordinated with the incorporation of those materials.

(b) They wait at or near a public works project site to perform any tasks subject to this section of the rule.

(c) They remove any materials from a public works construction site pursuant to contract requirements or specifications (e.g., excavated materials, materials from demolished structures, clean-up materials, etc.).

(d) They work in a materials production facility (e.g., batch plant, borrow pit, rock quarry, etc.,) which is established for a public works project for the specific, but not necessarily exclusive, purpose of supplying materials for the project.

(e) They deliver concrete to a public works site regardless of the method of incorporation.

(f) They assist or participate in the incorporation of any materials into the public works project.

(3) All travel time that relates to the work covered under subsection (2) of this section requires the payment of prevailing wages. Travel time includes time spent waiting to load, loading, transporting, waiting to unload, and delivering materials. Travel time would include all time spent in travel in support of a public works project whether the vehicle is empty or full. For example, travel time spent returning to a supply source to obtain another load of material for use on a public works site or returning to the public works site to obtain another load of excavated material is time spent in travel that is subject to prevailing wage. Travel to a supply source, including travel from a public works site, to obtain materials for use on a private project would not be travel subject to the prevailing wage.

(4) Workers are not subject to the provisions of chapter 39.12 RCW when they deliver materials to a stockpile.

(a) A "stockpile" is defined as materials delivered to a pile located away from the site of incorporation such that the stockpiled materials must be physically moved from the stockpile and transported to another location on the project site in order to be incorporated into the project.

(b) A stockpile does not include any of the functions described in subsection (2)(a) through (f) of this section; nor does a stockpile include materials delivered or distributed to multiple locations upon the project site; nor does a stockpile include materials dumped at the place of incorporation, or adjacent to the location and coordinated with the incorporation.

(5) The applicable prevailing wage rate shall be determined by the locality in which the work is performed. Workers subject to subsection (2)(d) of this section, who produce such materials at an off-site facility shall be paid the applicable prevailing wage rates for the county in which the off-site facility is located. Workers subject to subsection (2) of this section, who deliver such materials to a public works project site shall be paid the applicable prevailing wage rates for the county in which the public works project is located.

[Statutory Authority: Chapter 39.12 RCW, RCW 43.22.051 and 43.22.270. 08-24-101, § 296-127-018, filed 12/2/08, effective 1/2/09. Statutory Authority: Chapters 39.04 and 39.12 RCW and RCW 43.22.270. 92-01-104 and 92-08-101, § 296-127-018, filed 12/18/91 and 4/1/92, effective 8/31/92.]

SECTION 6 – SPECIAL PROVISIONS AND TECHNICAL SPECIFICATIONS

CITY OF GRANDVIEW
YAKIMA COUNTY, WASHINGTON

SPECIAL PROVISIONS AND TECHNICAL SPECIFICATIONS
FOR

WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1

HLA PROJECT NO. 23030

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DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 11 00 – SUMMARY OF WORK

This Contract provides for the improvement of the Wastewater Treatment Plant Improvements - Phase 1 and other work, all in accordance with the attached Contract Plans, these Contract Provisions, and the Standard Specifications.

Refer to 1-09.3(1) of Section 01 11 50 – Special Provisions for further descriptions of unit price bid items of the proposal.

The quantities of work indicated in the proposal are to be considered as estimates and are for comparative bidding purposes only. All payments will be made on the basis of actual field measurement of Contract work completed.

The work on this project shall be accomplished in accordance with the *Standard Specifications for Road, Bridge and Municipal Construction*, 2025 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.

END OF SECTION 01 11 00

SECTION 01 11 50 – SPECIAL PROVISIONS

INTRODUCTION

These Special Provisions are made up of both General Special Provisions (GSPs) from various sources, which may have project-specific fill-ins; and project-specific Special 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 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)

Project specific special provisions are labeled without a date as such:
(*****)

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 Manual M21-01, 2025 edition

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

1-01 DEFINITIONS AND TERMS

1-01.3 Definitions
(January 19, 2022 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 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.

Further supplement this section with the following:

Agent(s)
Any and all representatives or delegates, who, on behalf of the Contracting Agency, represent the Contracting Agency's interests, including but not limited to employees, consultants and subconsultants.

The terms defined in Section 1-01.3 of the Standard Specifications shall be further described by the following:

Contracting Agency
City of Grandview
207 W. Second Street
Grandview, WA 98930

The terms "Contracting Agency", "Agency" and "Owner" are interchangeable.

Engineer
HLA Engineering and Land Surveying, Inc. (HLA)
2803 River Road
Yakima, WA 98902

Working Drawings
Working drawings are further defined as electrical diagrams, catalog cut sheets, manufacturer's informational sheets describing salient features, performance curves, or samples of fabricated and manufactured items (including mechanical and electrical equipment) required for the construction project.

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.

1-02.2 Plans and Specifications

Delete this section and replace it with the following:

Information as to where Bid Documents can be obtained or reviewed will be found in the Call for Bids (Advertisement for Bids) for the work. During the bid period, electronic PDF plans and specifications, including any addenda will be available to download at https://hlacivil.com/bid. Following bid period, electronic PDF plans and specifications will only be available upon request. No paper copies will be provided.

1-02.4 Examination of Plans, Specifications, and Site of 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 four (4) business days preceding the bid opening to allow a written reply to reach all prospective Bidders before the submission of their Bids.

Add the following paragraph:

> No pre-bid approval on any proposed substitute equipment shall be granted prior to the bid opening unless specified otherwise in these Specifications.

1-02.5 Proposal Forms
(November 25, 2024 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 DBE commitment, if applicable, a State of Washington Contractor's Registration Number; and a Business License Number, if applicable. Bids shall be in legible figures (not words) written in ink or typed and expressed in U.S. dollars. 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
(April 22, 2025 APWA GSP, Option B)

The first sentence of the second paragraph is revised to read as follows:

All prices shall be in legible figures (not words) written in ink or typed, and expressed in U.S. dollars.

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.

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

> 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 bid by a joint venture shall be executed in the joint venture name and signed by a member of the joint venture.

Subcontractor's List
(June 11, 2025 APWA GSP, Option C)

The fourth paragraph of Section 1-02.6 is revised to read:

The Bidder shall submit with the Bid the completed Subcontractor List included in the Contracting Agency Proposal Package. If a Subcontractor List Form is not included in the package, use DOT Form 271-015LP. The Form shall contain the following:

1. Subcontractors who will perform the work of structural steel installation, rebar installation, heating, ventilation, air conditioning, and plumbing as described in RCW 18.106 and electrical as described in RCW 19.28,

2. The Work those subcontractors will perform on the Contract and the proof of license when required as described in RCW 39.30.060; and

3. No more than one subcontractor for each category of work identified, except, when subcontractors vary with Bid alternates, in which case the Bidder shall identify which subcontractor will be used for which alternate.

Section 1-02.6 is supplemented with the following:

Any bid item which has a unit price but no extension column amount shall have the extension amount determined by multiplying the unit price times the unit quantity. Any bid item which does not have a unit price but does have an extension column amount shall have the unit price determined by dividing the extension amount by the unit quantity. Should both the unit price and the extension column amount be left blank, then the entire bid shall be considered non-responsive.

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 in a sealed envelope, with the Project Title and Project Number as stated in the Call for Bids clearly marked on the outside of the envelope, or as otherwise required in the Bid Documents, to ensure proper handling and delivery.

Proposals that are received as required will be publicly opened and read as specified in Section 1-02.12. The Contracting Agency will not open or consider any Bid Proposal that is received after the time specified in the Call for Bids for receipt of Bid Proposals, 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 the time specified for receipt of the Proposal will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which the normal work processes of the Contracting Agency resume.

1-02.10 Withdrawing, Revising, or Supplementing Proposal
(July 23, 2015 APWA GSP)

Delete this section, and replace it with the following:

After submitting a physical Bid Proposal to the Contracting Agency, the Bidder may withdraw, revise, or supplement it if:

1. The Bidder submits a written request signed by an authorized person and physically delivers it to the place designated for receipt of Bid Proposals, and
2. The Contracting Agency receives the request before the time set for receipt of Bid Proposals, and
3. The revised or supplemented Bid Proposal (if any) is received by the Contracting Agency before the time set for receipt of Bid Proposals.

If the Bidder's request to withdraw, revise, or supplement its Bid Proposal is received before the time set for receipt of Bid Proposals, the Contracting Agency will return the unopened Proposal package to the Bidder. The Bidder must then submit the revised or supplemented package in its entirety. If the Bidder does not submit a revised or supplemented package, then its bid shall be considered withdrawn.

Late revised or supplemented Bid Proposals or late withdrawal requests will be date recorded by the Contracting Agency and returned unopened. Mailed, emailed, or faxed requests to withdraw, revise, or supplement a Bid Proposal are not acceptable.

1-02.13 Irregular Proposals
(November 21, 2025 APWA GSP)

Delete this section and replace it with the following:

1. A Proposal will be considered irregular and will be rejected if:
   a. The Bidder is not prequalified when so required;
   b. The Bidder adds provisions reserving the right to reject or accept the Award, or enter into the Contract;
   c. A price per unit cannot be determined from the Bid Proposal;
   d. The Proposal form is not properly executed;
   e. The Bidder fails to submit or properly complete a subcontractor list as required in Section 1-02.6;

f. The Bidder fails to submit the Bidder Questionnaire, if applicable, as required by Section 1-02.6, or if the documentation that is submitted fails to meet the requirements of the Special Provisions; or
g. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation.

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. The authorized Proposal Form furnished by the Contracting Agency is not used or is altered;
   d. The completed Proposal form contains unauthorized additions, deletions, alternate Bids, or conditions;
   e. Receipt of Addenda is not acknowledged;
   f. 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
   g. If Proposal form entries are not made in ink.

1-02.14 Disqualification of Bidders
(May 17, 2018 APWA GSP, Option B)

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 1-7 listed 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 1-2. Evidence that the Bidder meets Supplemental Criteria 3-7 shall be provided by the Bidder as stated later in this Section.

1. **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, if and when required as detailed below, shall sign a statement (on a form to be provided by the Contracting Agency) that the Bidder does not owe delinquent taxes to the Washington State Department of Revenue, or if delinquent taxes are owed to the Washington State Department of Revenue, the Bidder must submit a written payment plan approved by the Department of Revenue, to the Contracting Agency by the deadline listed below.

2. **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).

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 submit a copy of its standard subcontract form for review by the Contracting Agency, and a written description of its procedure for validating the responsibility of subcontractors with which it contracts.

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 three 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, if and when required as detailed below, shall submit a list of the public works projects completed in the three 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 five 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 five 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 five 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 five 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 five 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.

As evidence that the Bidder meets the Supplemental Criteria stated above, the apparent low Bidder 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 the supplemental criteria together with supporting documentation (sufficient in the sole judgment of the Contracting Agency) demonstrating compliance with the Supplemental Criteria. 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 two (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 two 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 five (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.

1-03 AWARD AND EXECUTION OF CONTRACT

1-03.1 Consideration of Bids
(December 30, 2022 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.

1-03.2 Award of Contract
(*****)

Supplement this section with the following:

The Contract will be awarded to the apparent low bidder on the basis of the total of all bid items and schedules accepted by the Contracting Agency. The Contractor shall submit bids for all bid schedules, including all alternate and/or additive bid schedules as applicable, to be considered a responsive bidder. The Contracting Agency reserves the right to select any bid schedules for award, in no particular order.

1-03.3 Execution of Contract
(July 8, 2024 APWA GSP Option A)

Revise this section to read:

Within 3 calendar days of Award date (not including Saturdays, Sundays and Holidays), the successful Bidder shall provide the information necessary to execute the Contract to the Contracting Agency. The Bidder shall send the contact information, including the full name, email address, and phone number, for the authorized signer and bonding agent to the Contracting Agency.

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 ten (10) 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, a satisfactory bond as required by law and Section 1-03.4, the Transfer of Coverage form for the Construction Stormwater General Permit with sections I, III, and VIII completed when provided. 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 twenty (20) additional calendar days for return of the documents, provided the Contracting Agency deems the circumstances warrant it.

(*****)
Supplement this section with the following:

Failure to return the required documents within the allotted time shall be considered as non-responsive and shall result in forfeiture of the bid bond or deposit of the bidder in accordance with Section 1-03.5.

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 a 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).

(*****)
Supplement this section with the following:

The Contractor shall guarantee the material provided and workmanship performed under the Contract for a period of one year from and after the final acceptance thereof by the Contracting Agency. Repair and/or replacement of defective materials and workmanship shall be as specified in Section 1-05.12(1).

In addition to the requirements for the Contract Bond according to Section 1-03.4 of the Standard Specifications, the Bond shall further indemnify and hold the Contracting Agency harmless from defects appearing or developing in the material or workmanship provided or performed under the Contract within a period of one year after final acceptance by the Contracting Agency. The Contract Bond document is bound in these Specifications.

1-03.7 Judicial Review
(December 30, 2022 APWA GSP)

Revise this section to read:

All decisions made by the Contracting Agency regarding the Award and execution of the Contract or Bid rejection shall be conclusive subject to the scope of judicial review permitted under Washington Law. Such review, if any, shall be timely filed 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.

1-04 SCOPE OF THE WORK

1-04.1 Intent of the Contract

1-04.1(2) Bid Items Not Included in the Proposal
(*****)

Delete the first paragraph in its entirety and replace it with the following:

If work is required to complete the project according to the intent of the Plans and Specifications but no bid item is provided in the Bid Schedule, then the Contractor shall include the cost for providing the necessary work in the unit or lump sum price for the bid item most closely related to the 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.

1-04.4 Changes
(January 19, 2022 APWA GSP)

The first two sentences of the last paragraph of Section 1-04.4 are deleted.

(*****)
Section 1-04.4 is supplemented with the following:

No changes in the work covered by the approved Contract Documents shall be made without having prior written or oral (as deemed appropriate due to urgency of change) approval of the Owner. If oral approval is granted, it shall be documented in writing shortly thereafter. Charges or credits for the work covered by the approved change shall be determined by one or more, or a combination of the following methods:

a. Unit bid prices previously approved.

b. An agreed lump sum.

c. The actual costs of:

(1) Labor, including foremen;

(2) Materials entering permanently into the work;

(3) The ownership or rental costs of construction plant and equipment during the time of use on the extra work;

(4) Power and consumable supplies for the operation of power equipment;

(5) Insurance;

(6) Social Security and Medicare and unemployment contributions.

Should authorized changes be made based upon the actual cost of material and labor, the costs thereof and costs allowed for overhead profit, bonds, insurance, etc., shall be determined via Section 1-09.6 Force Account of the Standard Specifications.

1-04.4(1) Minor Changes
(*****)

Delete the first paragraph and replace it with the following:

Payments or credits for changes may be made under the Bid item “Minor Change”. At the discretion of the Contracting Agency, this procedure for Minor Changes may be used in lieu of the more formal procedure as outlined in Section 1-04.4, Changes. All “Minor Change” work will be within the scope of the Contract Work and will not change Contract Time.

1-04.5 Procedure, Protest, and Dispute by the Contractor
(January 19, 2022 APWA GSP)

Revise item 1 of the first paragraph to read:

1. Give a signed written notice of protest to the Engineer or the Engineer’s field Inspectors within seven (7) calendar days of receiving a change order or an Engineer’s Written Determination.

1-04.6 Variation in Estimated Quantities
(*****)

Supplement this section with the following:

The quantities listed in the unit price Bid Proposal are estimates for bidding purposes only. There will be no adjustments in price due to increases or decreases in quantities regardless of the magnitude. The 25 percent provisions of this Section 1-04.6 shall not apply to: **All Bid Items.** Payment will be made at the unit contract price for actual quantities of work completed.

1-04.11 Final Cleanup
(*****)

Supplement this section with the following:

Partial cleanup shall be done by the Contractor when he feels it is necessary or when, in the opinion of the Contracting Agency, partial cleanup should be done prior to either final cleanup or final inspection. The cleanup work shall be done immediately upon written notification of the Engineer and other work shall not proceed until this partial cleanup is accomplished. Should the Contractor not conduct the cleanup as directed and in a timely manner, the Owner shall take action to have such cleanup work completed by others and will deduct such costs from any payment due the Contractor.

1-05 CONTROL OF WORK

1-05.1 Authority of the Engineer

1-05.1(2) Requests for Information
(November 4, 2024 WSDOT GSP)

The fourth paragraph of Section 1-05.1(2) is revised to read:

The Contractor may submit a RFI for one of the following reasons:

1. The Contractor believes there is information missing from the Contract Documents (Missing Information).

2. The Contractor believes a clarification of one or more of the Contract requirements is necessary (Clarification).

3. The Contractor needs to substitute a material that provides an equal or better level of performance as the one specified in the Contract (RFC - Material Substitution). Requests shall indicate the location(s), quantity, and shall describe how the material provides an equal or better level of performance as the material originally specified.

4. The Contractor requests a change to the Contract requirements for a reason other than one listed in items 1-3 of this Section (RFC - Other). To be considered, the request must not meet the requirements of a Value Engineering Change Proposal. To be considered, the request shall qualify as a Minor Change in accordance with Section 1-04.4(1) and shall describe how the change is beneficial to the project.

(*****)
Supplement this section with the following:

Unless otherwise expressly provided in the Contract Drawings, Specifications, and Addenda, the means and methods of construction shall be such as the Contractor may choose; subject, however, to the Engineer's right to reject means and methods proposed by the Contractor which (1) will constitute or create a hazard to the work, or to persons or property; or (2) will not produce finished work in accordance with the terms of the Contract. The Engineer's approval of the Contractor's means and methods of construction or his failure to exercise his right to reject such means or methods shall not relieve the Contractor of the obligation to accomplish the result intended by the Contract; nor shall the exercise of such right to reject create a cause for action for damages.

At the Contractor's risk, the Engineer may suspend all or part of the work according to Section 1-08.6.

1-05.3 Working Drawings
(*****)

Supplement this section with the following:

Working Drawings shall be transmitted to HLA with the Submittal Transmittal sheet provided to the Contractor after project award. The Submittal Transmittal form includes certification language stating the submittal has been reviewed by the Contractor and complies with the Plans and Specifications. Catalog cuts shall include marks to indicate the specific item that is to be provided for the project and shall include applicable bid item number. If alternate items are submitted for approval, the Contractor shall indicate the proposed location and use of the item.

If PDF format is found to be unacceptable, the Contractor shall submit to the Engineer for review and approval a copy of all Working Drawings required in the project documents. The data shown on the Working Drawings will be complete with respect to dimensions, design criteria, products and materials of construction, and like information to enable the Engineer to review the submittal. At the time of submittal, the Contractor shall, in writing, call attention to any deviations that the item or material submitted may have from the requirements of the Contract Specifications. When the Contractor does call such deviations to the attention of the Engineer, the Contractor shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.

Unless otherwise approved by the Engineer, Working Drawings and samples shall be submitted only by the Prime Contractor, who shall indicate by a signed stamp on the Working Drawing, or other means, that he (the Prime Contractor) has checked the Working Drawing. The Contractor's stamp of approval on the Working Drawings shall constitute a representation to the Owner and Engineer that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, or similar data and assumes full responsibility for doing so, and that he has reviewed or coordinated each Working Drawing or sample with the requirements of the Contract Documents. Working Drawings submitted by subcontractors, directly to the Owner or sub-consultants, will be rejected for the purpose of approval.

The practice of submitting incomplete or unchecked Working Drawings for the Engineer to correct or finish will not be acceptable, and Working Drawings which, in the opinion of the Engineer, clearly indicate that they have not been checked by the Contractor will be considered as not complying with the intent of the Contract Documents and will be returned to the Contractor for resubmission in proper form.

The Engineer will review with reasonable promptness Working Drawings and samples, but the Engineer's review shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to the means, methods, sequences, techniques or procedures of construction, or to safety precautions or programs incidental thereto. The review by the Engineer of a separate item as such will not indicate review of the assembly in which the item functions.

When the Working Drawings have been reviewed by the Engineer, an electronic (.pdf) copy including a transmittal memo will be returned to the Contractor. No submittal or Working Drawing will be recognized without the Engineer’s review attached. In case of dispute, the Engineer’s electronic copy will be recognized as the accepted copy of record. If major changes or corrections are necessary, the Working Drawings may be rejected, and one set will be returned to the Contractor with such changes or corrections indicated. The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected Working Drawings or samples for review. No changes shall be made by the Contractor to resubmitted Working Drawings other than those changes indicated by the Engineer, unless such changes are clearly described in a letter accompanying the resubmitted Working Drawings.

Where a Working Drawing or sample is required by the Specifications, no related work shall be commenced until the submittal has been reviewed and approved by the Engineer.

1-05.3(3) "Or Equal" Materials (New Section)

The following new section shall be added to the Standard Specifications:

The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Contract Documents, including "or equal" materials and equipment as specified in the Technical Specifications, or those substitute materials and equipment approved by the Engineer and identified by Addendum. The materials and equipment described in the Contract Documents establish a standard of required type, function, and quality to be met by any proposed substitute or "or equal" item. Request for Engineer's clarification of materials and equipment considered "or equal" must be received by the Engineer at least five (5) days prior to the bid opening date. The burden of proof of the merit of the proposed item is upon the Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any proposed substitute item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.

The Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal. The Engineer may require the Contractor to furnish additional data regarding the proposed substitute item. The Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until the Engineer's review is complete, which will be evidenced by either a Change Order for a substitute or an approved Working Drawing for an "or equal." The Engineer will advise the Contractor in writing of any negative determination.

The Engineer will record the Engineer's costs in evaluating a substitute proposed or submitted by the Contractor. Whether or not the Engineer approves a substitute item so proposed or submitted by Contractor, the Contractor shall reimburse the Owner for the charges of the Engineer for evaluating each such proposed substitute. The Contractor shall also reimburse the Owner for the Engineer's fees of making changes in the Contract Documents (or in the provisions of any other direct contract with the Owner) resulting from acceptance of each proposed substitute.

1-05.4 Conformity With and Deviations From Plans and Stakes

(*****)
Supplement this section with the following:

Upon request, and as available, a surface model may be provided by the Contracting Agency for the Contractor's use in utilizing GPS equipped construction equipment. Surface models are provided for the Contractor's convenience, and if adjustments to grades are made by the Engineer during the project, no payment will be made to the Contractor to modify their model/data.

Add the following new sub-sections:

1-05.4(1) Roadway and Utility Surveys (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

The Engineer shall furnish to the Contractor one time only all principal lines, grades, and measurements the Engineer deems necessary for completion of the work. These shall generally consist of one initial set of offset points to establish line and grade for underground utilities such as water, sewers, and storm drains.

The Engineer will establish the line and grade of proposed construction by offset stakes, the centerline for minor structures, and establish bench marks at convenient locations for use by the Contractor. The Contractor shall establish grades from the Engineer's stakes at suitable intervals in accordance with good practice and which meet with the approval of the Engineer. Where any information on the Plans is insufficient for establishing line and/or grade, the Contractor shall request additional information from the Engineer. Where new construction adjoins existing construction, the Contractor shall make such adjustments in grade as are directed by the Engineer. The Engineer will perform all surveying necessary to check compliance with the Specifications and as required for measuring the quantities of work as specified. The Contractor shall furnish assistance to the Engineer in checking depth and measuring quantities for payment purposes.

The Engineer will provide slope staking one time only in areas of significant sloping, establish the centerline for minor structures, and establish bench marks at convenient locations for use by the Contractor.

Any charges incurred by the Engineer to replace stakes, markers, and monumentation which were not to be disturbed, but were damaged by the Contractor’s operations, shall be calculated on an hourly basis at the Engineer’s normal hourly billing rates in effect at that time for the individuals and equipment required to do the work, including travel time and overtime. The Contractor does hereby authorize the Contracting Agency to deduct such costs from the amounts due or to become due to him.

Any claim by the Contractor for extra compensation by reason of alterations or reconstruction work allegedly due to error in the Engineer’s line and grade, will not be allowed unless the original control points set by the Engineer still exist, or unless other satisfactory substantiating evidence to prove the error is furnished the Engineer. Three consecutive points set on line or grade shall be the minimum points used to determine any variation from a straight line or grade. Any such variation shall, upon discovery, be reported to the Engineer. In the absence of such report, the Contractor shall be liable for any error in alignment or grade.

1-05.4(2) Construction Staking Requests (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

All staking requests shall be made on the “Construction Staking Request Form” found in Appendix A. The form shall be emailed or delivered to the Engineer's office at least three (3) working days prior to the date requested for staking. The Contractor shall provide a brief description of the staking requested, the approximate location (station to station), when the staking will be required, and shall sign the form. Requests for re-stakes shall be marked boldly in the description.

1-05.6 Inspection of Work and Materials

1-05.6(1) Testing (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

The Contractor shall be responsible for scheduling and paying for all material and compaction testing required by these Technical Specifications. The cost of testing shall be considered incidental to the various bid items. All testing services shall be performed by an independent, certified testing firm and/or laboratory meeting the approval of the Engineer. The Contractor shall submit information relating to the qualifications of the proposed testing firm to the Engineer for review and approval prior to the preconstruction conference. The Contractor shall provide a test report to the Engineer within 24 hours of any test completion. Test reports shall become the property of the Owner. Testing frequencies listed below may be modified to assure compliance with the Specifications.

Roadway Embankment

Copies of the moisture density curves for each type of material encountered and copies of all test results shall be provided to the Engineer as construction progresses.

Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 5,000 square feet of surface area for each lift of roadway embankment.

The Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required subgrade densities.

Roadway embankment compaction shall be as specified in Section 2-03.3(14)C, Method C. Embankment shall be compacted to at least 95% of maximum density as determined by ASTM D 698 (Standard Proctor).

Roadway Subgrade

Copies of the moisture density curves for each type of material encountered and copies of all test results shall be provided to the Engineer as construction progresses.

Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 5,000 square feet of subgrade.

The Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required subgrade densities.

Subgrade compaction shall be as specified for Roadway Embankment.

Ballast and Crushed Surfacing

Copies of the moisture density curves and gradation for each type of material incorporated into the project and copies of all test results shall be provided to the Engineer or Owner as construction progresses.

Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 3,000 square feet of surface area for each lift of ballast or crushed surfacing.

The Engineer or Owner may request additional tests be performed at the Contractor's expense, if test results do not meet the required densities.

Portland Cement Concrete for Curbs, Sidewalks, and Pavement

Sample the first truck and each load until a load meets specifications, and then randomly test one load for every 100 cubic yards. If at any time one load fails to meet specifications, continue testing every load until two successive loads meet specifications, and then randomly test one load for every 100 cubic yards.

For total daily quantities less than four (4) cubic yards, testing requirements shall be at the discretion of the Engineer.

Asphalt Paving

Copies of the reference maximum density test for each class of Hot Mix Asphalt pavement and copies of all test results shall be provided to the Engineer as construction progresses.

Density tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 3,000 square feet of surface area for each lift of asphalt concrete pavement.

The Engineer or Owner may request additional tests be performed at the Contractor's expense, if test results do not meet the required densities.

Compaction of Hot Mix Asphalt pavement shall be as specified in Section 5-04.3(10)A.

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.

1-05.8 Survey Monuments (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

The Contracting Agency will, at its own cost, reference all known existing monuments or markers relating to subdivisions, plats, roads, street centerline intersections, etc. The Contractor shall take special care to protect these monuments or markers and also the reference points. In the event the Contractor is negligent in preserving such monuments and markers, the points will be reset by a licensed surveyor at the Contractor's expense.

1-05.11 Final Inspection

Delete this section and replace it with the following:

1-05.11 Final Inspections and Operational Testing
(October 1, 2005 APWA GSP)

1-05.11(1) Substantial Completion Date

When the Contractor considers the work to be substantially complete, the Contractor shall so notify the Engineer, in writing, 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 therefore.

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.

When a Project contains multiple locations, the Engineer may require all work to be completed prior to beginning work in another location. This may include completion of all work, including between substantial and physical completion, at the Engineer's discretion.

A Contractor's representative with authority shall be present during the 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.

1-05.11(3) Operational Testing

It is the intent of the Contracting Agency to have at the Physical Completion Date a complete and operable system. Therefore, when the work involves the installation of machinery or other mechanical equipment; street lighting, electrical distribution or signal systems; irrigation systems; buildings; or other similar work it may be desirable for the Engineer to have the Contractor operate and test the work for a period of time after final inspection but prior to the physical completion date. Whenever items of work are listed in the Contract Provisions for operational testing they shall be fully tested under operating conditions for the time period specified to ensure their acceptability prior to the Physical Completion Date. During and following the test period, the Contractor shall correct any items of workmanship, materials, or equipment which prove faulty, or that are not in first class operating condition. Equipment, electrical controls, meters, or other devices and equipment to be tested during this period shall be tested under the observation of the Engineer, so that the Engineer may determine their suitability for the purpose for which they were installed. The Physical Completion Date cannot be established until testing and corrections have been completed to the satisfaction of the Engineer.

The costs for power, gas, labor, material, supplies, and everything else needed to successfully complete operational testing, shall be included in the unit contract prices related to the system being tested, unless specifically set forth otherwise in the proposal.

Operational and test periods, when required by the Engineer, shall not affect a manufacturer's guaranties or warranties furnished under the terms of the contract.

1-05.12 Final Acceptance

Add the following new section:

1-05.12(1) One-Year Guarantee Period
(March 8, 2013 APWA GSP)

The Contractor shall return to the project and repair or replace all defects in workmanship and material discovered within one year after Final Acceptance of the Work. The Contractor shall start work to remedy any such defects within 7 calendar days of receiving Contracting Agency's written notice of a defect and shall complete such work within the time stated in the Contracting Agency's notice. In case of an emergency, where damage may result from delay or where loss of services may result, such corrections may be made by the Contracting Agency's own forces or another contractor, in which case the cost of corrections shall be paid by the Contractor. In the event the Contractor does not accomplish corrections within the time specified, the work will be otherwise accomplished and the cost of same shall be paid by the Contractor.

When corrections of defects are made, the Contractor shall then be responsible for correcting all defects in workmanship and materials in the corrected work for one year after acceptance of the corrections by Contracting Agency.

This guarantee is supplemental to and does not limit or affect the requirements that the Contractor's work comply with the requirements of the Contract or any other legal rights or remedies of the Contracting Agency.

(*****)
Supplement this section with the following:

The Contractor agrees the above one-year limitation shall not exclude nor diminish the Contracting Agency's rights under any law to obtain damages and recover costs resulting from defective and unauthorized work discovered after one year.

1-05.13 Superintendents, Labor and Equipment of Contractor
(August 14, 2013 APWA GSP)

Delete the sixth and seventh paragraphs of this section.

1-05.16 Water and Power (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

Water Supply: Water for use on this project shall be furnished by the Contracting Agency at no cost to the Contractor. The Contractor shall be required to follow Contracting Agency requirements to obtain a hydrant water meter and report use. The Contractor shall convey the water from the nearest convenient hydrant or other source at his own expense. The hydrants shall be used in accordance with the appropriate Water Department regulations. The Contracting Agency reserves the right to deny the use of fire hydrants where deemed inappropriate by the Contracting Agency.

Power Supply: The Contractor shall make necessary arrangements and shall bear the costs for power necessary for the performance of the work.

Measurement and Payment: No separate measurement and payment for water and power will be made. This pertains to water required for dust control, water settling trenches (when approved by the Engineer), and any other water as required by the Contract Documents. All costs for hauling, conveying, and applying water shall be included in the various bid items of the proposal.

1-06 CONTROL OF MATERIAL

1-06.1 Approval of Materials Prior to Use

1-06.1(1) Qualified Products List (QPL)
(*****)

Add the following to the third paragraph:

Should a QPL require sampling and/or testing, the Contractor shall be responsible for all coordination, deliveries, and costs for sampling and/or testing, in securing approvals from the WSDOT Materials Laboratory. The Contracting Agency will not coordinate with the WSDOT Materials Laboratory.

1-06.1(4) Fabrication Inspection Expense
(*****)

Delete this section in its entirety.

1-06.6 Recycled Materials

Delete this section, including its subsections, and replace it with the following:

The Contractor shall make their best effort to utilize recycled materials in the construction of this project. Approval of such material use shall be as detailed elsewhere in the Standard Specifications.

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.

(*****)
Amend the second sentence of the first paragraph to read:

The Contractor shall indemnify and save harmless the State (including the Commission, the Secretary, and any agents, officers, and employees) and the Contracting Agency (including any agents, officers, employees, and representatives) against any claims which may arise because the Contractor (or any employee of the Contractor or subcontractor or materialman) violated a legal requirement.

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).

1-07.3 Fire Prevention and Merchantable Timber Requirements
(*****)

Delete this section and all submittal requirements.

1-07.6 Permits and Licenses
(*****)

Supplement this section with the following:

The Contractor and all subcontractors are responsible for obtaining and paying for business licenses in the City of Grandview.

The Contractor is responsible for obtaining and paying for the building permits for this project. The estimated cost of the building permits is $12,000. Building permit fees are identified in City of Grandview Municipal Code Section 15.70.020.

No hydraulic permits are required for this project unless the Contractor’s operations use, divert, obstruct, or change the natural flow or bed of any river or stream, or utilize any of the waters of the State or materials from gravel or sand bars, or from stream beds.

All costs required to comply with this section shall be the responsibility of the Contractor.

1-07.7 Load Limits
(March 13, 1995 WSDOT GSP)

Section 1-07.7 is supplemented with the following:

If the sources of materials provided by the Contractor necessitates hauling over roads other than State Highways, the Contractor shall, at the Contractor's expense, make all arrangements for the use of the haul routes.

1-07.9 Wages

1-07.9(3) Apprentices
(*****)

Supplement this section with the following:

Apprentice Utilization
This Contract includes an Apprentice Utilization Requirement. Fifteen percent or more of project Labor Hours shall be performed by Apprentices unless Good Faith Efforts are accepted. Apprentice Utilization will be determined using the Department of Labor and Industries (L&I) online Prevailing Wage Intent & Affidavit (PWIA) system.

Definitions
For the purposes of this specification the following definitions apply:

1. Apprentice is a person enrolled in a State-approved Apprenticeship Training Program.

2. Apprentice Utilization is the apprentice labor hours, on the project, expressed as a percentage of project Labor Hours based on certified payrolls or the affidavits of wages paid, whichever is least. The percentage is not rounded up.

3. Apprentice Utilization Requirement is the minimum percentage of apprentice labor hours required by the Contract.

4. Good Faith Effort(s) (GFE) describes the Contractor's efforts to meet the Apprentice Utilization Requirement including but not limited to the specific steps as described elsewhere in this specification.

5. Labor Hours are the total hours performed by all workers receiving an hourly wage who are subject to prevailing wage requirements for work performed on the Contract as defined by RCW 39.04.310. Labor Hours are determined based on the scope of work performed by the individuals, rather than the title of their occupations in accordance with WAC 296-127.

6. State-approved Apprenticeship Training Program is an apprenticeship training program approved by the Washington State Apprenticeship Council.

7. Apprentice Wage Rates are the applicable wage rates that are to be paid for an apprentice registered in a training program, separate from Journey Level rates, as set by the Washington State Apprenticeship Training Council and Washington State Department of Labor and Industries (L&I).

Electronic Reporting
The Contractor shall use the PWIA System to submit the "Apprentice Utilization Plan". Reporting instructions are available in the application.

Apprentice Utilization Plan
The Contractor shall submit an "Apprentice Utilization Plan" by filling out the Apprentice Utilization Plan Form (WSDOT Form 424-004) or other form approved by the Contracting Agency within 30 calendar days of Contract execution, however no later than the preconstruction meeting, demonstrating how and when they intend to achieve the Apprentice Utilization Requirement. The Plan shall be in sufficient detail for the Engineer to track the Contractor's progress in meeting the utilization requirements. An Apprentice Utilization Plan shall be updated and resubmitted as the Work progresses or when requested by the Engineer or other Contracting Agency representative.

If the Contractor is unable to demonstrate the ability to meet the Apprentice Utilization Requirement with their initial Apprentice Utilization Plan submission, an effort must be made to find additional registered apprentices to perform on the contract. If after attempts have been made at every tier and every scope, the Contractor must submit GFE documentation to the Contracting Agency. The Contractor shall actively seek out opportunities to meet the Apprentice Utilization Requirement during the construction Work.

Subcontracts
The Contractor must not require subcontractors to attain more than 15% of a subcontract's proposed labor hours for the subcontract's scope of Work.

Contacts
The Contractor may obtain information on State-approved Apprenticeship Training Programs by using the Apprentice Registration and Tracking System (ARTS) https://secure.lni.wa.gov/arts-public/#/program-search or contacting the Department of Labor and Industries directly at:

Specialty Compliance and Services Division, Apprenticeship Section, P.O. Box 44530, Olympia, WA 98504-4530 or by phone at (360) 902-5320.

Compliance
The Contractor is expected to make attempts to employ Apprentices and shall include the requirement in any subcontracts at any tier. In the event that the Contractor is unable to achieve the Apprentice Utilization Requirement, the Contractor shall submit GFE documentation demonstrating the efforts and attempts they made. Final GFE documentation shall be submitted to the Contracting Agency after Substantial Completion but no later than 30 days after Physical Completion.

If the Contractor fails to actively attempt to employ Apprentices, submit GFE documentation, or if the Engineer does not approve the GFE, the Contractor will be assessed a penalty. The Engineer will provide the Contractor with a written notice at Final Acceptance of the project informing the Contractor of the failure to comply with this specification which will include a calculation of the penalty to be assessed as provided for in the Payment section in this special provision.

If the Contractor achieves the required Apprentice Utilization an incentive will be assessed with Final Payment.

Good Faith Efforts
The GFE shall document the attempts (efforts) the Contractor (and any subcontractor at any tier) made to meet the Apprentice Utilization Requirement. Emails, letters, or other written communications with letterhead, titles, and contact information are required.

Documentation must include one or more of the following accepted GFEs:

1. Demonstrated Lack of Availability of Apprentices. Correspondence from State-approved Apprenticeship Training Program(s), with project specific responses confirming there is a lack of availability of Apprentices for this project.

2. Demonstrated Disproportionate Ratio of Material/Equipment/Products to Labor Hours. Documentation explaining the bid includes a disproportionate high cost of material/equipment/products to Labor Hours. (E.g., a $2 M estimated contract includes $1 M or more in procurement costs of equipment to be installed.)

3. Demonstrated Lack of Necessary Labor Hours. Correspondence from a State-approved Apprentice Training Programs confirming there is not enough time in the project to meet required journey level to apprentice training ratios.

4. Demonstrated Lack of Available Approved Programs. Correspondence from State-approved Apprentice Training Programs, confirming there are no programs that train for the scopes included/anticipated on the project. Contractor and state programs to submit training program detail needs and details that could be used for future program creation.

5. Funding Precedent. Documentation that shows conflicting, more restrictive, or precedent requirements for other training on the Project. Examples include, but are not limited to, Tribal Employment Rights (TERO), Federal Training Hours, or Special Training that affect the ability to use state-registered apprentices.

6. Warranty Work. Documentation from Original Equipment Manufacturers, or similar, confirming that Work performed must only be completed by certified journey-level installers or risk voiding warranty, or similar.

7. Other Effort. The Contractor may submit other evidence, documentation, or rationale for not being able to achieve the required Apprentice Utilization that are not covered in the other efforts named. Other efforts will still need to be corroborated by an independent, knowledgeable third-party.

Contractors may receive a GFE credit for graduated Apprentice hours through the end of the calendar year for all projects worked on as long as the Apprentice remains continuously employed with the same Contractor/subcontractor they were working for when they graduated. If an Apprentice graduates during employment on a project of significant duration, they may be counted towards a GFE credit for up to one year after their graduation or until the end of the project (whichever comes first). Determination of whether Contract requirements were met in good faith will be made by subtracting the hours from the journeyman total reported hours for the project and adding them to the apprentice hour total. If the new utilization percentage meets the Contract requirement, the Contractor will be reported as meeting the requirement in good faith.

Approving Good Faith Efforts
The Contracting Agency will review submitted Good Faith Efforts and issue a determination. The Engineer may request additional information, documentation, evidence or similar in order to approve such efforts. A determination by the Engineer is final. The approved Good Faith Efforts will be loaded into the PWIA system by the Contracting Agency.

Measurement
Apprenticeship hours used to calculate the item “Apprentice Incentive/Penalty”, by calculation, will be measured for each hour of Work performed by an apprentice as shown on the Monthly Apprentice Utilization Report, based on certified payrolls or the affidavits of wages paid, whichever is least. The percentage is not rounded up. The calculation of incentive/penalty will be assessed based on the Final Payment for Contractors who meet the Apprentice Utilization Requirement without a reduction by Good Faith Effort. The calculation will occur one month following the substantial completion date or at the physical completion date, whichever is earlier, such that the incentive/penalty will be included in the next Progress Estimate.

Payment
Payment will be made for the following Bid Items when included in the proposal:

“Apprenticeship Incentive/Penalty”, by calculation.

When the Contractor meets the apprenticeship requirement of 15% an incentive will be assessed. When the Contractor fails to meet the apprenticeship requirement of 15%, a penalty will be assessed for each hour that is not achieved, unless a Good Faith Effort is approved by the Contracting Agency.

Apprenticeship Incentive/Penalty will be calculated as described below:

Apprentice Utilization (as reported by L&I PWIA system)	Incentive	Penalty of unmet requirement
15% of more	$2,000	N/A
14% to 14.99%	N/A	$2,000
12% to 13.99%	N/A	$4,000
10% to 11.99%	N/A	$6,000
0%	N/A	$10,000

For the purpose of providing a common proposal for all bidders, the Contracting Agency has entered an Incentive amount in the proposal to become a part of the total bid by the Contractor.

The Contractor shall include all related costs in the unit Bid prices of the Contract, included but not limited to implementing, developing, documenting, and administering an apprenticeship utilization program, recording and reporting hours and all other costs to comply with this provision.

1-07.11 Requirements for Nondiscrimination

1-07.11(2) Contractual Requirements
(November 25, 2024 APWA GSP)

Delete item 11 of the first paragraph of Section 1-07.11(2).

1-07.13 Contractor's Responsibility for Work

1-07.13(3) Relief of Responsibility for Damage by Public Traffic
(*****)

Delete this section and replace it with the following:

When it is necessary for public traffic to utilize the street and associated facilities during construction, the Contractor shall be responsible for damages to improvements. The Contractor shall provide all necessary protection and temporary facilities to accommodate both vehicular and pedestrian traffic during construction.

1-07.15 Temporary Water Pollution Prevention

Delete this section and all submittal requirements.

1-07.17 Utilities and Similar Facilities
(*****)

Supplement this section with the following:

Public and private utilities, or their contractors, will furnish all work necessary to adjust, relocate, replace, or construct their facilities unless otherwise provided for in the Plans or these Special Provisions. Such adjustment, relocation, replacement, or construction will be done during the prosecution of the work for this project.

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

Utility Company	Address	Phone Number
City of Grandview	207 West Second Street, Grandview, WA 98930	(509) 882-9200
Charter Communications	1005 North 16th Avenue, Yakima, WA 98902	(509) 728-2738
Williams Gas	295 Chipeta Way, Salt Lake City, UT 84108	(801) 652-8134
Lumen Technologies	12301 Tukwila International Blvd., Tukwila, WA 98168	(425) 507-2082
Congruex	1705 S IL RT 31, McHenry, IL 60050	(217) 663-0123
Pacific Power	500 North Keys Road, Yakima, WA 98901	(509) 952-3101

Locations and dimensions shown on the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification. It shall be the Contractor's responsibility to investigate the presence and location of all utilities prior to bid opening and to assess their impacts on his construction activities.

The Contractor shall call the Utility Notification Center (One-Call Agency) for field location, not less than two or more than ten business days before the scheduled date for commencement of excavation which 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 Agency for this project is 1-800-424-5555. If no one-number locator service is available, notice shall be provided individually by the Contractor to those owners known to or suspected of having underground facilities within the area of proposed excavation.

It is the responsibility of the Contractor to verify pertinent locations and elevations of utility connection points and utility crossings. The Contractor shall field verify depths of utilities by potholing prior to beginning any new construction to allow for adjustment in grade or alignment. Potholing shall be considered incidental to other bid items and no additional compensation will be paid.

Utilities, new or old, may be renewed, relocated, or adjusted for the proposed construction. The Contractor shall, prior to beginning any work, meet with all utility organizations (public and private) in the field to familiarize himself with existing utility locations, along with familiarizing himself with plans and schedules for the installation of new, relocated, or adjusted utilities. Both public and private utility organizations, along with private contractors working for these organizations, may be doing utility installations within the area. The Contractor shall coordinate the proposed construction work with these utility installations. Additionally, the Contractor shall coordinate and bear the cost of any needs for supporting utility poles in place.

The Contractor shall arrange with the owners and operators of the respective utility systems to mark the locations and, if necessary or prudent, to expose the existing utilities prior to construction of the facilities contained in this Contract.
The Contractor shall coordinate his work with other contractors who may be working in the project area and cooperate with them.

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. In addition to the requirements of RCW 19.122, the Contractor shall use surface features and other evidence in determining the approximate utility location prior to excavation.

Where the location of the work is in proximity to overhead wires and power lines, the Contractor shall coordinate all work with the utility and shall provide for such measures as may be necessary for the protection of workmen.

1-07.18 Public Liability and Property Damage Insurance

Delete this section in its entirety, with the exception of the following:

1-07.18 Insurance
(January 4, 2024 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-: 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.

I. Under no circumstances shall a wrap up policy be obtained, for either initiating or maintaining coverage, to satisfy insurance requirements for any policy required under this Section. A **"**wrap up policy**"** is defined as an insurance agreement or arrangement under which all the parties working on a specified or designated project are insured under one policy for liability arising out of that specified or designated project**.**

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
- HLA Engineering and Land Surveying, Inc. (HLA)
- Connetix Engineering, Inc.
- LSB Consulting Engineers

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 <u>not</u> 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.

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:

$2,000,000	Each Occurrence
$3,000,000	General Aggregate
$3,000,000	Products & Completed Operations Aggregate
$2,000,000	Personal & Advertising Injury each offense
$2,000,000	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

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.

1-07.23 Public Convenience and Safety

1-07.23(1) Construction Under Traffic
(*****)

Add the following after the fourth sentence of the second paragraph:

Deficiencies not caused by the Contractor's operations shall be repaired by the Contractor when directed by the Engineer, at the Contracting Agency's expense.

Replace item 2. of the second paragraph with the following:

2. Keep existing traffic signal and lighting systems in operation as the work proceeds. (The Contracting Agency will continue the routine maintenance on such system.)

Add the following to the third paragraph:

5. Maintain vehicular and pedestrian access to businesses at all times that businesses are open.

Add the following to the sixth paragraph:

7. Open trenches and excavations shall be protected with proper barricades and at night, they shall be distinctively indicated by adequately placed lights.

Add the following paragraph:

It shall be the responsibility of the Contractor to seek the approval of and notify the Resident Engineer and the Police and Fire Departments at least 24 hours prior to closing any street, in addition to coordinating the proposed closures with the Contracting Agency to ensure proper detouring of traffic. When the street is re-opened, it shall again be the responsibility of the Contractor to notify the above named departments and persons.

1-07.23(2) Construction and Maintenance of Detours
(*****)

Add the following to the third paragraph:

The Contractor shall maintain vehicular and pedestrian access to businesses at all times that businesses are open, unless work is occurring immediately in front of the doorway. It shall be the responsibility of the Contractor to maintain pedestrian traffic and business access throughout the duration of the project. At a minimum, the Contractor shall:

1. Minimize the disruption in front of the business access by removing sidewalk on either side of the access and leaving the existing sidewalk in place as long as possible and, likewise, shall sequence the installation of the new sidewalk to provide access to the business;
2. Provide gravel surfacing (crushed surfacing top course) access across the construction area to the door of the business;
3. Provide boardwalks and bridging where gravel surfacing cannot be provided or, by the nature of the business or where directed by the Engineer, wheeled access by strollers and wheelchairs is critical to the business and cannot be provided through the gravel surfacing;
4. Provide temporary sidewalk signs directing pedestrians through the construction, notifying pedestrians of alternative routes, and directing pedestrians to businesses where means of access is not obvious; and
5. Adjusting times of construction immediately in front of a business access to times of the day when the business is closed, or business activity is light. For example, construction in front of a deli would be restricted during the lunch hour.
6. When construction activities will affect ingress and egress or utility service to a property along the project alignment, the Contractor shall be responsible for notifying the occupant/occupants of the property 24 hours prior to the construction activity beginning. If personal contact with the occupant is not possible, the Contractor shall leave written notification in both English and Spanish. Property owner notification requirements shall be coordinated with the Owner.
7. Local access shall be maintained to the residents within the project limits at all times.

1-07.24 Rights of Way
(April 22, 2025 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 as described below.

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.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.

1-07.30 Safety Standards (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

All work shall be performed in accordance with all applicable local, state, and federal health and safety codes, standards, regulations, and/or accepted industry standards. It shall be the responsibility of the Contractor to ensure that his work force and the public are adequately protected against any hazards.

The Contracting Agency shall have the authority at all times to issue a stop work order at no penalty to the Contracting Agency if, in its opinion, working conditions present an undue hazard to the public, property, or the work force. Such authority shall not, however, relieve the Contractor of responsibility for the maintenance of safe working conditions or assess any responsibility to the Contracting Agency or Engineer for the identification of any or all unsafe conditions.

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 21, 2025 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 review Training or Apprenticeship Plans, when applicable.
5. To discuss FSBE Goals when applicable.
6. To establish normal working hours for the work;
7. To review safety standards and traffic control; and
8. 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 five (5) working days prior to the day(s) 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.

1-08.0(3) Reimbursement for Overtime Work of Contracting Agency Employees (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

Where the Contractor elects to work on a nonworking day, as defined in Section 1-08.5 of the Standard Specifications, or longer than the normal working hours specified in Section 1-08.0(2), such work shall be considered as overtime work. If a 4-10 schedule is approved and the Contractor elects to work the fifth day or works multiple shifts in a single 24-hour period, such work shall be considered overtime work, or the Contractor will be charged an additional working day, at his option. On all such overtime work, a Resident Engineer will be present and a survey crew may be required at the discretion of the Engineer. In all such cases, the Contracting Agency may deduct overtime costs of employees and/or representatives of the Contracting Agency from amounts due or to become due to the Contractor.

The Contractor by these specifications does hereby authorize the Engineer to deduct such costs from the amount due or to become due to the Contractor.

1-08.1 Subcontracting

1-08.1(7)A Payment Reporting
(November 25, 2024 APWA GSP)

Delete this section and replace it with the following:

1-08.1(7)A Vacant

1-08.1(8)B Clauses Required in Subcontracts of All Tiers
(November 25, 2024 APWA GSP)

Delete item 8 of the second paragraph of Section 1-08.1(8)B.

1-08.1(9) Submittal of Executed Subcontracts
(April 22, 2025 APWA GSP, Option B)

Section 1-08.1(9) content and title are deleted and replaced with the following:

Vacant

1-08.3 Progress Schedule

1-08.3(2) General Requirements
(*****)

Supplement this section with the following:

Seasonal weather conditions shall be considered in the planning and scheduling of work influenced by high or low ambient temperature or precipitation to ensure the completion of the work within the Contract Time. No time extensions will be granted for the Contractor's failure to take into account such weather conditions for the location of the work and for the period of time in which the work is to be accomplished.

1-08.3(2)E Weekly Look-Ahead Schedule
(*****)

Supplement this section with the following:

In addition to submitting the schedule, the Contractor shall present the weekly look-ahead schedule at a weekly construction meeting. A deduction of $150 may be subtracted from the Progress Estimate, for every day the Contractor is late in supplying a weekly look-ahead schedule.

1-08.3(5) Payment
(*****)

Delete the second and third paragraph of this section.

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.

(*****)
Supplement this section with the following:

Failure of the Contractor to begin work by the date set forth in the Notice to Proceed will be considered grounds for Termination for Default as specified under Section 1-08.10(1) of the Standard Specifications.

1-08.5 Time for Completion
(*****)

Add the following to the first paragraph:

Two hundred sixty (260) working days after the date set forth in the Notice to Proceed shall be allowed for completion of all Contract work. This includes actual force account work up to those original force account contract amounts. If original force account amounts are exceeded, the Engineer may consider granting additional working day(s) for force account work.

Add the following paragraph after the second paragraph:

Inclement weather shall not be a prima facie reason for the granting of an extension of time, and the Contractor shall make every effort to continue work under prevailing conditions. The Owner may, however, grant an extension of time if an unavoidable delay as a result of inclement weather in fact occurs, and such shall then be classified as a “delay”. An “inclement” weather delay day is defined as a day on which the Contractor is prevented by inclement weather or conditions resulting immediately therefrom adverse to the current controlling operation or critical path activity, as determined by the Resident Engineer, from proceeding with at least 75 percent of the normal labor and equipment force engaged on such operation for at least 60 percent of the total daily time being currently spent on the controlling operation or critical path activity.

(November 25, 2024 APWA GSP, Option A)

Revise the third and fourth paragraphs to read:

Contract time shall begin on the first working day following the Notice to Proceed Date.

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 The statement will be identified as a Written Determination by the Engineer. If the Contractor does not agree with the Written Determination of working days, the Contractor shall pursue the protest procedures in accordance with Section 1-04.5. By failing to follow the procedures of Section 1-04.5, 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. Material Acceptance Certification Documents
    b. Final Contract Voucher Certification
    c. Copies of the approved "Affidavit of Prevailing Wages Paid" for the Contractor and all Subcontractors
    d. Property owner releases per Section 1-07.24

1-08.9 Liquidated Damages
(*****)

Replace Section 1-08.9 with the following:

Time is of the essence of the Contract. Delays inconvenience the public, interfere with public works staff operations and maintenance activities and increase risk to public infrastructure and utility users. Delays also cost taxpayers undue sums of money, adding time needed for administration, engineering, inspection, and supervision.

Accordingly, the Contractor agrees:

1. To pay liquidated damages in the amount of $3,000 for each working day beyond the number of working days established for Physical Completion.

2. To authorize the Engineer to deduct these liquidated damages from any money due or coming due to the Contractor.

When the Contract Work has progressed to Substantial Completion as defined in the Contract, the Engineer may determine the Contract 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, liquidated damages identified 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.

Liquidated damages will not be assessed for any days for which an extension of time is granted. No deduction or payment of liquidated damages will, in any degree, release the Contractor from further obligations and liabilities to complete the entire Contract.

1-09 MEASUREMENT AND PAYMENT

1-09.2 Weighing Equipment

1-09.2(1) General Requirements for Weighing Equipment
(January 4, 2024 APWA GSP, Option B)

Revise item 4 of the fifth paragraph to read:

1. Test results and scale weight records for each day's hauling operations are provided to the Engineer daily. Reporting shall utilize WSDOT form 422-027LP, Scaleman's Daily Report, unless the printed ticket contains the same information that is on the Scaleman's Daily Report Form. The scale operator must provide AM and/or PM tare weights for each truck on the printed ticket.

(*****)
Supplement this section with the following:

In lieu of E-tickets, the Contractor shall provide certified printed tickets. Certified weight tickets accompanying each truckload of material will be required to be delivered to the Resident Engineer at the site. Should the Resident Engineer or Material Receiver be unavailable, it shall be the responsibility of the Contractor's project superintendent to collect all said certified tickets for the day and deliver them to the Resident Engineer the morning following the day's construction. The certified tickets shall include the same information as required for E-tickets. Any certified weight tickets submitted later than the morning following the day materials are delivered to the site will not be considered for measurement and payment.

1-09.2(3) Specific Requirements for Platform Scales
(*****)

Supplement this section with the following:

The Contractor will furnish a person, at no cost to the Contracting Agency, who will operate the certified scales while the loading and hauling of materials is in progress. The Contractor shall provide the platform scales and any tickets required for self-printing scales.

1-09.2(5) Measurement
(December 30, 2022 APWA GSP)

Revise the first paragraph to read:

Scale Verification Checks – At the Engineer's discretion, the Engineer may perform verification checks on the accuracy of each batch, hopper, or platform scale used in weighing contract items of Work.

1-09.3 Scope of Payment
(*****)

Supplement this section with the following:

Payment for work performed under this Contract will be based on the items listed in the Unit Price Bid Proposal. Should a conflict exist between the item descriptions or the units of measurement and payment listed in the Unit Price Bid Proposal and the "Payment" clauses found in each section of the Standard Specifications, the Unit Price Bid Proposal items will prevail. If work is required to complete the project according to the intent of the Plans and Specifications, but no bid item is provided in the Unit Price Bid Proposal, then the Contractor shall include the cost for providing the necessary work in the unit or lump sum price for the bid item most closely related to the work.

1-09.3(1) Description of Bid Items (New Section)

The following new section shall be added to the Standard Specifications:

Bid items listed in the Bid Schedule are defined to include, but not necessarily limited to, the following:

1. Bid Item No. 1, 13, 21, and 26 - "Minor Change," refer to Section 1-04.4(1) Minor Changes of the Special Provisions.

2. Bid Item No. 2 - "Apprenticeship Incentive," refer to Section 1-07.9(3) Apprentices of the Special Provisions.

3. Bid Item No. 3 – "Apprenticeship Penalty," refer to Section 1-07.9(3) Apprentices of the Special Provisions.

4. Bid Items No. 4, 14, 22, and 27 - The lump sum price bid for "Mobilization," shall be full compensation for all labor, materials, tools, and equipment necessary to mobilize to the project site as defined in the Standard Specifications. Payment will be made in accordance with Standard Specifications.

5. Bid Items No. 5 and 15 - The unit price bid for "Crushed Surfacing Base Course," per ton, shall be full compensation for all labor, materials, tools, equipment, and incidentals necessary to furnish, haul and place the material beneath HMA surfacing, including placement, watering, and compaction. Measurement will be by the ton, based on certified weigh tickets as required by the Specifications.

6. Bid Items No. 6 and 16 - The unit price bid for "Crushed Surfacing Top Course," per ton, shall be full compensation for all labor, materials, tools, equipment, and incidentals necessary to furnish, haul and place the material as final gravel surfacing as shown on the Plans. Work shall include placing, shaping, watering, and compaction of the crushed aggregate material in place on top of prepared subgrade. Measurement will be by the ton, based on certified weigh tickets as required by the Specifications.

7. Bid Items No. 7 and 17 - The unit price bid for "HMA Cl. ½-Inch PG 64H-28," per ton, shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary to furnish and install the materials to the compacted depths shown on the Plans including, but not necessarily limited to, saw cutting, compacting sub-base materials, placing HMA, compacting, trimming, clopping, backfill, tack coat, or and other work required to complete the work, in place. Measurement will be by the ton, based on certified weigh tickets as required by the Specifications.

8. Bid Item No. 8, 19, and 24 - The lump sum price bid for “Site Piping, Fittings, Valves, and Structures, Complete” shall be full compensation for all labor, materials, tools, equipment, and incidentals necessary to furnish and install all site potable water, utility/nonpotable water, sludge, gravity sewer, force main, and drainage piping, drainage swale, fittings, and valves to 5 feet outside of structures; including, but not necessarily limited to, trench excavation, dewatering, laying and joining the pipe, pressure testing, disinfection, connections to existing pipe and structures, connection to new structures, backfill and compaction, imported gravel, pipe zone bedding, concrete thrust blocking, thrust restraints, mechanical joint restraints, grouting, field welding/field joints, painting, valve boxes and extensions, yard hydrants, hose racks and supports, and cleanouts. This bid item also includes complete installation of all required precast concrete structures, including but not limited to aggregate base, core drilling, pipe seals, grating, hatches, castings, ladders, piping, and pipe supports. This bid item also includes the cost for all temporary piping and pump systems needed to construct the improvements not identified in other bid items and all required trench surfacing repairs in areas where new surfacing is not called out.

9. Bid Item No. 9: The lump sum price bid for “New Sludge Holding Tank,” shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary for a complete installation, as specified and shown on the Plans. This bid item includes, but is not limited to, all costs for demolition or modification of existing structures in the vicinity of the work; unclassified excavation, regardless of the material encountered; dewatering, hauling, screening or sorting of excavated materials; structural concrete, compacted structural backfill, imported foundation gravel; galvanized steel stairways, walkways, bridges, and supports, aluminum grating and railings; hyperbolic mixers and appurtenances; piping, fittings, valves, piping specialties, pipe supports, restraints and thrust blocking, hose bibbs, hose racks, wall hydrants and other miscellaneous plumbing connections all to within five (5) feet of the structure. Also included in this bid item is the cost for all required startup, testing, and commissioning services, training, and test reports. Provide all other appurtenances required for complete installation.

10. Bid Item No. 10: The lump sum price bid for “Ex. Sludge Holding Tank Modifications,” shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary for a complete installation, as specified and shown on the Plans. This bid item includes, but is not limited to, all costs for demolition or modification of existing structures in the vicinity of the work; unclassified excavation, regardless of the material encountered; dewatering, hauling, screening or sorting of excavated materials; galvanized steel stairways, walkways, supports, aluminum grating and railings; hyperbolic mixers and appurtenances; piping, fittings, valves, piping specialties, pipe supports, restraints and thrust blocking, hose bibbs, hose racks, wall hydrants and other miscellaneous plumbing connections all to within five (5) feet of the structure. Also included in this bid item is the cost for all required startup, testing, and commissioning services, training, and test reports. Provide all other appurtenances required for complete installation.

11. Bid Item No. 11: The lump sum price bid for “Dewatering Building Modifications,” shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary for a complete installation, as specified and shown on the Plans. The dewatering drain lift station is also included in this bid item. Additionally, this bid item includes, but is not limited to, all costs for demolition or modification of existing structures in the vicinity of the work; modification to the existing conveyor; unclassified excavation, regardless of the material encountered, dewatering, hauling, screening or sorting of excavated materials; structural concrete and compacted backfill, imported foundation gravel, equipment and housekeeping pads, masonry walls, sectional overhead doors and operators, interior and exterior finishes and painting, signage and other required specialties, anchor bolts, piping, fittings, piping specialties (flow meters, pressure transmitters, pressure switches, gauges, etc.), pipe supports, restraints and thrust blocking, filters, hose bibbs, hose racks, wall hydrants and other miscellaneous plumbing connections; unit heaters, fans, dampers, louvers, duct work, miscellaneous sheet metal and flashing, insulation, thermostats, and speed controls; supply and installation of sludge dewatering equipment and appurtenances, including sludge cake conveyor modifications, temporary sludge dewatering modifications, and all associated piping specialties; drainage lift station pumps and appurtenances for compete installation; and supply and installation of all new specialized equipment to be located within the dewatering building. Also included in this bid item is the cost for all required startup, testing, and commissioning services, training, and test reports. Provide all other appurtenances required to make it a complete installation.

12. Bid Item No. 12 and 26: The lump sum price bid for “Standby Generator, Complete” shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary for installation of a complete and operational standby power system. Work shall include, but not necessarily be limited to, furnishing and installing the standby generator set, engine, alternator, enclosure, fuel system and appurtenances, automatic transfer equipment, controls, wiring, conduits, pads or foundations, connections to existing electrical and control systems, testing, startup, and commissioning. O&M manuals, manufacturer services, coordination with equipment suppliers and the serving utility, and all work required to provide a fully functional and integrated standby power installation are required.

13. Bid Item No. 13, 21, 27, and 31: The lump sum price bid for “Electrical and Control System, Complete” shall be full compensation for furnishing all labor, materials, tools, equipment, and incidentals necessary for installation of a complete and operational electrical supply and control system. Work shall include, but not necessarily be limited to, furnishing and installing electrical equipment and components, interior and exterior lighting, interior and remote site control panels and systems, installation of vendor-supplied panels, transformers, electrical vaults, pullholes, junction boxes, conduits, conduit banks, and connecting all equipment and facilities described under bid items within buildings and on-site. O&M manuals, installation of new underground service lines, temporary power and control systems and connections are required, and coordination with Pacific Power regarding temporary and new electrical service, including utility poles, overhead lines, underground lines, transformers, etc.

14. Bid Item No. 19: The lump sum price bid for “New Storage Building, Complete” shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary for a complete installation, as specified and shown on the Plans. This bid item includes, but is not limited to, all costs for demolition or modification of existing structures in the vicinity of the work; unclassified excavation, regardless of the material encountered; dewatering, hauling, screening or sorting of excavated materials; structural concrete and compacted backfill, imported foundation gravel, pre-engineered metal building structure; sheet metal roofing and flashing, gutters and downspouts, hollow metal doors and frames, glazing, door hardware, sectional overhead doors and operators, flood drain system, insulation, interior and exterior finishes and painting, signage and other required specialties, unit heaters, fans, dampers, louvers, duct work, miscellaneous sheet metal and flashing, insulation, thermostats, and speed controls. Also included in this bid item is the cost for all required startup, testing, and commissioning services, training, and test reports. Provide all other appurtenances required to make it a complete installation.

15. Bid Item No. 24: The lump sum price bid for “Influent Lift Station, Complete” shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary for a complete installation, as specified and shown on the Plans. This bid item includes, but is not limited to, all costs for demolition or modification of existing structures in the vicinity of the work; unclassified excavation, regardless of the material encountered, dewatering, hauling, screening or sorting of excavated materials, imported foundation gravel and structural backfill, precast concrete structures, equipment, control panel and instruments, piping and valves, pipe supports, related equipment, and appurtenances. Also included in this bid item is the cost for all required startup, testing, and commissioning services, training, and test reports. Provide all other appurtenances required to make it a complete installation.

16. Bid Item No. 30: The lump sum price bid for “UV Equipment and Building Modifications” shall be full compensation for all labor, tools, materials, equipment, and incidentals necessary for a complete and operable ultraviolet disinfection system, as specified and shown on the Plans. This bid item includes, but is not limited to, all costs limited to furnishing and installing ultraviolet disinfection equipment, demolition, cast-in-place concrete construction, bypass pumping (as necessary), piping and valves, pipe supports, related equipment, and appurtenances. Also included in this bid item is the cost for all required startup, testing, and commissioning services, training, and test reports. Provide all appurtenances required to make it a complete installation.

1-09.4 Equitable Adjustment
(*****)

Replace Item 2.b. with the following:

2.b. Per Section 1-09.6, Force Account.

1-09.6 Force Account
(December 30, 2022 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.

(*****)
Add the following clarification:

The term “project overhead” shall include “jobsite overhead.” The term “general company overhead” shall include “home office overhead.”

Supplement paragraph one of Subsection 2 with the following:

Sales tax will be applied to payment made to the Contractor and shall not be included in the cost of materials provided to the Engineer.

1-09.7 Mobilization
(December 30, 2022 APWA GSP)

Delete this Section and replace it with the following:

Mobilization consists of preconstruction expenses and the costs of preparatory Work and operations performed by the Contractor typically occurring before 10 percent of the total original amount of an individual Bid Schedule is earned from other Contract items on that Bid Schedule. Items which are not to be included in the item of Mobilization include but are not limited to:

1. Portions of the Work covered by the specific Contract item or incidental Work which is to be included in a Contract item or items.
2. Profit, interest on borrowed money, overhead, or management costs.
3. Costs incurred for mobilizing equipment for force account Work.

Based on the lump sum Contract price for “Mobilization”, partial payments will be made as follows:

1. When 5 percent of the total original Bid Schedule amount is earned from other Contract items on that original Bid Schedule, excluding amounts paid for materials on hand, 50 percent of the Bid Item for mobilization on that original Bid Schedule, 5 percent of the total of that original Bid Schedule, or 5 percent of the total original Contract amount, whichever is the least, will be paid.
2. When 10 percent of the total original Bid Schedule amount is earned from other Contract items on that original Bid Schedule, excluding amounts paid for materials on hand, 100 percent of the Bid Item for mobilization on that original Bid Schedule, 10 percent of the total of that original Bid Schedule, or 10 percent of the total original Contract amount, whichever is the least, will be paid.
3. When the Substantial Completion Date has been established for the project, payment of any remaining amount Bid for mobilization will be paid.

Nothing herein shall be construed to limit or preclude partial payments otherwise provided by the Contract.

1-09.9 Payments
(July 8, 2024 APWA GSP Option B)

Delete the fourth paragraph and replace it with the following:

Progress payments for completed work and material on hand will be based upon progress estimates prepared by the Engineer. A progress estimate cutoff date will be established at the preconstruction conference.

The initial progress estimate will be made not later than 30 days after the Contractor commences the work, and successive progress estimates will be made every month thereafter until the Completion Date. Progress estimates made during progress of the work are tentative, and made only for the purpose of determining progress payments. The progress estimates are subject to change at any time prior to the calculation of the Final Payment.

The value of the progress estimate will be the sum of the following:

1. Unit Price Items in the Bid Form — the approximate quantity of acceptable units of work completed multiplied by the unit price.
2. Lump Sum Items in the Bid Form — based on the approved Contractor's lump sum breakdown for that item, or absent such a breakdown, based on the Engineer's determination.
3. Materials on Hand — 100 percent of invoiced cost of material delivered to Job site or other storage area approved by the Engineer.
4. Change Orders — entitlement for approved extra cost or completed extra work as determined by the Engineer.

Progress payments will be made in accordance with the progress estimate less:

1. Retainage per Section 1-09.9(1), on non FHWA-funded projects;
2. The amount of Progress Payments previously made; and
3. Funds withheld by the Contracting Agency for disbursement in accordance with the Contract Documents.

Progress payments for work performed shall not be evidence of acceptable performance or an admission by the Contracting Agency that any work has been satisfactorily completed. The determination of payments under the contract will be final in accordance with Section 1-05.1.

(*****)
Supplement this section with the following:

The progress estimate cutoff date established at the preconstruction conference shall be a minimum of ten (10) working days prior to a regularly scheduled meeting of the Contracting Agency governing body where payments may be authorized. Revisions to the agreed upon progress estimate cutoff date will only be made by written approval of the Contracting Agency. The Contractor shall submit a signed Application for Payment within three (3) working days after the progress estimate cutoff date. The Engineer shall have a minimum of five (5) working days to review the Contractor's Application for Payment. The Contractor shall supply any outstanding material and labor documentation within five (5) working days of the cutoff date, or partial payments may be withheld from applicable bid items. After the application for payment is reviewed by the Engineer, the Engineer will make a recommendation to the Contracting Agency for payment. When payment approval is required by the governing body, the payment recommendation will be reviewed for approval consideration at the next available regular meeting of the governing body. Payment to the Contractor will be made within 30 calendar days from the Contracting Agency's acceptance date of the properly completed progress estimate, as recommended by the Engineer. If a contract is funded by grant, state, or federal money, the public body shall pay the prime contractor for satisfactory performance within thirty calendar days of the date the public body receives a payment request that complies with the contract or within thirty calendar days of the date the public body actually receives the grant or federal money, whichever is later. Failure to submit an Application for Payment within the required time may delay action by the Contracting Agency and further delay payment to the Contractor.

All payments for lump sum items over $5,000.00 or a single payment for a lump sum contract of any amount will be measured by a schedule of values established as follows:

At the Preconstruction Conference, the contractor shall furnish a breakdown for each lump sum bid item or for the total lump sum contract price showing the amount bid for each principal category of the work, in such detail as requested by the Engineer, to provide a basis for determining progress payments. This breakdown, referred to as the "Schedule of Values," will be approved by the Engineer as described in Section 1-08 Prosecution and Progress before the first payment is made.

1-09.9(1) Retainage
(*****)

Add the following to the fourth paragraph:

6. An affidavit is delivered to the Contracting Agency by the Contractor, stating that all persons performing labor or furnishing materials have been paid.

1-09.9(2) Contracting Agency's Right to Withhold and Disburse Certain Amounts (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

In addition to monies retained pursuant to RCW 60.28 and subject to RCW 39.04.250, RCW 39.12, and RCW 39.76, the Contractor authorizes the Engineer to withhold progress payments due or deduct an amount from any payment or payments due the Contractor which, in the Engineer's opinion, may be necessary to cover the Contracting Agency's costs for or to remedy the following situations:

1. Damage to another contractor when there is evidence thereof and a claim has been filed.

2. Where the Contractor has not paid fees or charges to public authorities or municipalities which the Contractor is obligated to pay.

3. Utilizing material, tested and inspected by the Engineer, for purposes not connected with the work (Section 1-05.6).

4. Landscape damage assessments per Section 1-07.16.

5. For overtime work performed by Contracting Agency personnel or its representative, per Section 1-08.0(3).

6. Anticipated or actual failure of the Contractor to complete the work on time:

    a. Per Section 1-08.9 Liquidated Damages; or

    b. Lack of construction progress based upon the Engineer's review of the Contractor's approved progress schedule which indicates the work will not be completed within the Contract Time. When calculating an anticipated time overrun, the Engineer will make allowances for weather delays, approved unavoidable delays, and suspensions of the work. The amount withheld under this subparagraph will be based upon the liquidated damages amount per day set forth in Contract Documents multiplied by the number of days the Contractor's approved progress schedule, in the opinion of the Engineer, indicates the Contract may exceed the Contract time.

7. Failure of the Contractor to perform any of the Contractor's other obligations under the Contract, including but not limited to:

    a. Failure of the Contractor to provide the Engineer with a field office when required by the Contract Provisions.

    b. Failure of the Contractor to protect survey stakes, markers, etc., or to provide adequate survey work as required by Section 1-05.4.

    c. Failure of the Contractor to correct defective or unauthorized work (Section 1-05.7).

    d. Failure of the Contractor to furnish a Manufacturer's Certificate of Compliance in lieu of material testing and inspection as required by Section 1-06.3.

    e. Failure to submit Intent to Pay Prevailing Wage forms, or correct underpayment to employees of the Contractor or subcontractor of any tier as required by Section 1-07.9.

    f. Failure of the Contractor to pay workers' benefits (Title 50 and Title 51 RCW) as required by Section 1-07.10.

    g. Failure of the Contractor to submit and obtain approval of a progress schedule per Section 1-08.3.

The Contractor authorizes the Engineer to act as agent for the Contractor disbursing such funds as have been withheld pursuant to this section to a party or parties who are entitled to payment. Disbursement of such funds, if the Engineer elects to do so, will be made only after giving the Contractor 15 calendar days prior written notice of the Contracting Agency's intent to do so, and if prior to the expiration of the 15-calendar day period:

1. No legal action has commenced to resolve the validity of the claims, and

2. The Contractor has not protested such disbursement.

A proper accounting of all funds disbursed on behalf of the Contractor in accordance with this section will be made. A payment made pursuant to this section shall be considered as payment made under the terms and conditions of the Contract. The Contracting Agency shall not be liable to the Contractor for such payment made in good faith.

If legal action is instituted to determine the validity of the claims prior to expiration of the 15-day period mentioned above, the Engineer will hold the funds until determination of the action or written settlement agreement of the parties.

When the conditions 1-7 are resolved or the Contractor provides a Surety Bond satisfactory to the Contracting Agency which will protect the Contracting Agency in the amount withheld, payment shall be made for amounts withheld because of them.

1-09.9(3) Final Payment (New Section)
(*****)

The following new section shall be added to the Standard Specifications:

Upon completion of all work under this Contract, the Contractor shall notify the Engineer, in writing, that he has completed his part of the Contract and shall request final payment. Upon receipt of such request, the Engineer will inspect and, if acceptable, submit to the Owner his recommendation as to acceptance of the completed work and as to the final estimate of the amount due the Contractor. Upon approval of this final estimate and upon final acceptance of the work under this Contract, the Owner will notify the Department of Revenue of the completion of said Contract. Provided the Department of Revenue certifies there are no taxes or penalties due and owing from the Contractor, and there are no other known claims or liens against the retained funds, and further provided the terms of Section 1-09.9(1) are in compliance, the Owner will pay to the Contractor the balance of monies due under this Contract in accordance with RCW Title 60.28. In the event unsatisfied claims or liens for taxes, material, labor, and other services are known to exist, an amount will be further withheld from the retainage sufficient to satisfy the settlement of such claims and liens, including attorney's fees incurred, and the remainder will be released from escrow, or released from the retained funds and paid to the Contractor.

On contracts for public works, final payment of the retained percentage will not be made until after the Contractor has filed with the Owner the Affidavit of Wages Paid forms required by RCW 39.12.040 certifying that the Contractor and subcontractors have paid not less than the prevailing rate of wages.

The parties further agree that the Owner may, without liability, withhold final payment to the Contractor until such time as the Contractor has completed all forms required by the Owner.

If a contract is funded by grant, state, or federal money, the public body shall pay the prime contractor for satisfactory performance within thirty calendar days of the date the public body receives a payment request that complies with the contract or within thirty calendar days of the date the public body actually receives the grant or federal money, whichever is later.

1-09.11 Disputes and Claims

1-09.11(3) Time Limitation and Jurisdiction
(December 30, 2022 APWA GSP)

Revise this section to read:

For the convenience of the parties to the Contract it is mutually agreed by the parties that all 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 all such claims or causes of action. It is further mutually agreed by the parties that when 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 all records deemed necessary by the Contracting Agency to assist in evaluating the claims or action.

1-09.13 Claims Resolution

1-09.13(1)A General
(December 30, 2022 APWA GSP)

Revise this section to read:

Prior to seeking claims resolution through arbitration or litigation, the Contractor shall proceed in accordance with Sections 1-04.5 and 1-09.11. The provisions of Sections 1-04.5 and 1-09.11 must be complied with in full as a condition precedent to the Contractor's right to seek claim resolution through binding arbitration or litigation.

Any claims or causes of action which the Contractor has against the Contracting Agency arising from the Contract shall be resolved, as prescribed herein, through binding arbitration or litigation.

The Contractor and the Contracting Agency mutually agree that those claims or causes of action which total $1,000,000 or less, which are not resolved by mediation, shall be resolved through litigation unless the parties mutually agree in writing to resolve the claim through binding arbitration.

The Contractor and the Contracting Agency mutually agree that those claims or causes of action in excess of $1,000,000, which are not resolved by mediation, shall be resolved through litigation unless the parties mutually agree in writing to resolve the claim through binding arbitration.

1-09.13(3)A Arbitration General
(January 19, 2022 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.

1-09.13(4) Venue for Litigation
(December 30, 2022 APWA GSP)

Revise this section to read:

Litigation shall be brought in the Superior Court of the county in which the Contracting Agency's headquarters is located, provided that where claims are asserted against a county, RCW 36.01.050 shall control venue and jurisdiction of the Superior Court. It is mutually agreed by the parties that when litigation occurs, the Contractor shall permit the Contracting Agency to have timely access to all records deemed necessary by the Contracting Agency to assist in evaluating the claims or action.

END OF SECTION 01 11 50

SECTION 01 25 50 – SUBSTITUTION OF MAJOR EQUIPMENT ITEMS AND PRODUCTS

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section defines the total bid price contract format using "Basis of Bid" major equipment items, materials, and products for preparation of the TOTAL BID PRICE and outlines the procedure for proposal of substitute items by "Alternate" manufacturers.

B. The use of this bidding format is intended to:

1. Provide a common basis for all Bidders on which to base their TOTAL BID PRICE.

2. Protect the Owner and Bidders so that no one Bidder gains an unfair bid price advantage by quoting a lower price for a major equipment item or product which is not "or equal."

3. Assure that the Owner receives full benefit of the savings in cost involved in any substitution of a major equipment item or product.

C. Bidders shall provide all required information as noted in this section.

1.02 BID SCHEDULE FORMAT

A. The Bid Schedule format is based on a total bid price contract using "Basis of Bid" major equipment items and products which have been identified and described in the Contract Documents. Major equipment items and products identified in Column 1 of Table 1 in the Bid Proposal Form are considered "Basis of Bid" items. Contract Document sections defining "Basis of Bid" major equipment items or products include:

Section 43 21 39 – Submersible Liquid Pumps
Section 46 24 16 – Grinder Pump Control Panel
Section 46 66 23 – UV Disinfection System
Section 46 73 23 – Hyberbolic Mixers
Section 46 76 27 – Belt Conveyors
Section 46 76 27 – Screw Press

B. The TOTAL BID PRICE noted in the Bid Schedule shall include the installed prices of only "Basis of Bid" major equipment items or products. The Bidder shall note the installed price of each "Basis of Bid" major equipment item or product in the space provided in Column 1 of Table 1 in the Bid Schedule. The installed price shall include the labor and material cost, profit and overhead, plus the cost for all necessary appurtenances to provide a complete system.

Failure to furnish the installed price of each "Basis of Bid" item may be cause for rejection of the bid.

C. It is not the intent of the Contract Documents to contain proprietary, exclusionary, or discriminatory requirements other than those based on performance. Manufacturers who believe that their equipment can meet the performance requirements and, with the exception of minor details, the technical requirements of the Contract Documents, are encouraged to submit a quotation to a Bidder for a substitute major equipment item or product. Model number designations for the major equipment items are included for information purposes. Proposed "Basis of Bid" major equipment items and "Alternate" major equipment items will be evaluated on the basis of the requirements contained in the Contract Documents.

D. Bidders desiring to quote a price for a substitute major equipment item or product in lieu of a "Basis of Bid" item may at their option write in the name of one manufacturer to be identified in Column 2 of Table 1 in the Bid Schedule in the space provided. The manufacturer listed by the Bidder in Column 2 shall be considered the proposed "Alternate" major equipment item or product. The Bidder shall note the installed price of each proposed "Alternate" major equipment item or product in Column 2 of Table 1 in the Bid Schedule in the space provided.

The Bidder shall not use the installed price for any proposed "Alternate" major equipment item or product in preparing the TOTAL BID PRICE.

E. If the Bidder writes in the name of a proposed "Alternate" manufacturer and fails to note the installed price or writes in the installed price and fails to identify the name of the proposed "Alternate" manufacturer, the Bidder shall furnish the "Basis of Bid" item for the installed price noted in Column 1 of Table 1 in the Bid Schedule.

1.03 QUALIFICATION PACKAGE

A. All Bidders shall submit with the Bid Package a "Qualification Package" for each "Alternate" major equipment item or product which the Bidder proposes to furnish in lieu of a "Basis of Bid" major equipment item or product identified in Column 1 of Table 1. A “Qualifications Package” may also be submitted prior to the Bid opening in accordance with paragraph H. below.

B. The Bidder shall submit each "Qualification Package" under separate cover. Each "Qualification Package" shall be bound with protective cover, identify the Specification section number and title, and the product manufacturer's name on a cover sheet. The Bidder shall submit all "Qualification Packages" in a sealed sturdy box or suitable container with the Bid Package attached to or enclosed in the box or container. Each package shall be uniquely identified by the manufacturer, by number and date, with the number and date written on the outside of the package. The Contractor shall write the identification number in the right column of Table 1 for each “Qualifications Package” corresponding to the “Alternate” manufacturer listed in Column 2.

C. The "Qualification Package" for the "Alternate" major equipment items or products the Bidder proposes to furnish shall include, but not be limited to, the information defined in paragraph 1.03.D, and special information as required for submittal in each of the individual specification sections for which alternative equipment consideration is desired.

FAILURE TO FURNISH THE REQUIRED INFORMATION WITH THE BID PROPOSAL FORM, OR UNDER SEPARATE COVER PRIOR TO BID OPENING, MAY BE CAUSE FOR REJECTION OF A PROPOSED ALTERNATE MAJOR EQUIPMENT ITEM OR PRODUCT FOR USE ON THIS PROJECT

D. The "Qualifications Package" submittal requirements for each equipment section defined in 1.03.C shall be as follows:

1. A complete set of drawings, specifications, catalog cut-sheets, and detailed descriptive material of proposed major equipment items or products. This information shall identify all technical and performance requirements stipulated on each drawing and in each specification section.

2. Detailed information shall be submitted for all additional items such as hardware, motors, bearings, reducers, belts, sheaves, motor controllers, and instrumentation (field device, major control panel device, and anticipated control panel layout).

3. List showing materials of construction of all components, including all buy-out items.

4. Manufacturer's recommended spare parts.

5. Information on equipment field erection requirements including total weight of assembled components and weight of each subassembly.

6. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants, and other items required at each regular preventive maintenance period.

7. Process equipment electrical requirements and schematic diagrams.

8. Examples of reports and hard copies of CRT displays similar to those required by this project.

9. Detailed written documentation with discussion of all deviations of equipment, including all buy-out items, from the Contract Documents.

E. If the Bidder fails to furnish all of the preceding information which has been deemed necessary by the Engineer to evaluate a proposed "Alternate" major equipment item or product for equivalency with the "Basis of Bid" major equipment item or product, the proposed "Alternate" qualification package will be rejected by the Engineer. If the "Alternate" qualification package is rejected by the Engineer, the Bidder shall furnish the "Basis of Bid" major equipment item or product for the installed price noted in Column 1 of Table 1 in the Bid Proposal Form.

F. No proposed "Alternate" major equipment item or product will be considered unless, in the opinion of the Engineer, it conforms to the Contract Documents in all respects, except for make and manufacturer and minor details.

G. The Engineer shall be the sole authority for determining conformance of a proposed "Alternate" major equipment item or product with the Contract Documents. Under no circumstances will the Engineer be required to prove that an "Alternate" major equipment item or product is not equal to the "Basis of Bid" major equipment item or product.

H. In lieu of submitting the qualifications package with the Bid Package, a qualifications package may also be submitted by the equipment manufacturer directly to the Owner at any time prior to opening of Bids. These pre-submitted qualifications packages will remain unopened until after bids have been opened and shall be submitted to the Owner at the address where Bids are received. Pre-submitted qualifications packages shall be submitted according to the following requirements:

1. The contents of the Qualifications Package shall be identical in all respects to the packages described elsewhere in this section.

2. It shall be the sole responsibility of the Bidder to ensure a Qualifications Package has been submitted by an equipment manufacturer listed as an “Alternate” in Column 2 of Table 1 of the Bid Schedule.

3. Qualifications Packages must be received on or before the time set forth for the receipt of Bids.

4. The Qualifications Package shall be clearly labeled as required for the sealed bids and the words “EQUIPMENT QUALIFICATIONS PACKAGE” shall be clearly written on the outside of the package.

5. Each package shall be uniquely identified by the manufacturer, by number and date, with the number and date written on the outside of the package. The Contractor shall write the identification number in the right margin adjacent to Table 1 for each pre-submitted Qualifications Package.

6. Failure of the manufacturer to pre-submit a Qualifications Package, or failure of the Bidder to provide the identification number on Table 1, may be cause for rejection of a proposed alternate major equipment or product for use on this project.

1.04 CONTRACT AWARD

A. Award of the Contract will be made on the basis of the Bid Schedule from the lowest responsive, responsible, qualified Bidder using the TOTAL BID PRICE.

B. In the event a proposed "Alternate" major equipment item or product is not accepted as "or equal" by the Engineer, the "Basis of Bid" major equipment item or product as specified shall be furnished for the amount noted in Column 1 of Table 1 in the Bid Schedule and without adjustment to the TOTAL BID PRICE.

C. If a proposed "Alternate" qualification package is accepted as "or equal" by the Engineer, the "Alternate" major equipment item or product listed in Column 2 of Table 1 in the Bid Schedule shall be furnished for the amount noted and the CONTRACT PRICE shall be adjusted accordingly, based on the price differences noted in Table 1 between Column 1 and Column 2. The CONTRACT PRICE will be adjusted by subtracting the sum of differences in prices from the subtotal bid price, then adding the applicable sales tax to the adjusted subtotal price in each schedule accepted by the Owner to arrive at the adjusted CONTRACT PRICE.

1.05 SHOP DRAWING SUBMITTALS

A. Acceptance of a proposed "Alternate" major equipment item or product "Qualification Package," or naming of "Basis of Bid" equipment, does not eliminate the need for shop drawing submittals and reviews during construction, nor does it eliminate the requirement that the equipment manufacturer satisfy the requirements of the Contract Documents.

B. Shop drawings shall be furnished in accordance with Section 01 33 00 – Submittals Procedure.

C. Should the Bidder furnish a major equipment item or product requiring changes to the Contract Documents, he shall notify the Engineer in writing of all dimensional, mechanical, electrical, and structural changes and/or requirements for the major equipment item's use in this Project and shall reimburse the Owner for any associated redesign and/or construction drawings. The Bidder shall consider all costs associated in furnishing and installing a major equipment item or product in his installed price proposal. Redesign and contract drawing revisions to accommodate equipment or products will be prepared by the Engineer during the shop drawing review process. Reimbursement shall be based on 2.7 times the Engineer's salary cost plus reimbursable expenses at cost.

END OF SECTION 01 25 50

SECTION 01 33 00 – SUBMITTALS PROCEDURE

PART 1 – GENERAL

1.01 DESCRIPTION

A. This section specifies procedures for Contractor submittals. The Contractor shall submit descriptive information that will enable the City to determine whether the proposed materials, equipment, testing and schedule for fabrication are in general conformance to the design concept and in compliance with the Contract Documents. The information to be submitted shall consist of drawings, specifications, descriptive data, certificates, test procedures, test results and such other information, all as specifically required in the Contract Documents.

1.02 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall ensure that the material, equipment, testing, and schedule for fabrication shall be as described in the submittal. The Contractor shall verify that the material and equipment described in each submittal conforms to the requirements of the Contract Documents. If the information shows deviations from the Contract Documents, the Contractor shall, by statement in writing accompanying the information, identify the deviations and state the reason. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where such submittal may affect the work. The Contractor shall ensure coordination of submittals among related crafts.

B. Unless otherwise approved by the Engineer, all submittals shall be submitted only by the Prime Contractor, who shall indicate by a signed stamp, or other means, on the submittal the Prime Contractor has checked the submittal. The Contractor's stamp of approval shall constitute a representation to the Owner and Engineer that the Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, or similar data and assumes full responsibility for doing so, and that he/she has reviewed or coordinated each submittal with the requirements of the Contract Documents.

PART 2 – PRODUCTS

2.01 SCHEDULE OF VALUES

A. The Contractor shall submit a Schedule of Values for the major components of the work. The Schedule of Values shall be submitted within 20 days of Notice to Proceed. The Schedule of Values shall include a breakdown for each lump sum bid item for the total lump sum contract price showing the amount bid for each principal category of the work, in such detail as requested by the Engineer, to provide a basis for determining progress payments. At a minimum, the breakdown shall be according to the following elements:

1. Major construction and/or structure area, or other site features.

2. Pipe systems with each system divided into major components.

3. Major specification divisions (e.g., Division 26, Division 40, etc.).

4. Major pieces of equipment.

5. Electrical shall be broken down first by construction area, then by major pieces of electrical equipment, process power wiring, process control wiring, lighting fixtures, lighting installation and wiring, and receptacle insulation and wiring.

B. The Contractor and Engineer shall meet and jointly review the Schedule of Values within one week following receipt of the submittal by the Engineer, and make any adjustments in value allocations if in the opinion of the Engineer, these are necessary to establish fair and reasonable allocation values for the major work components. Front end loading will not be permitted. The Engineer may require reallocation of major work components from items in the above listing if, in the opinion of the Engineer, such reallocation is necessary. Within one week of the review meeting a final Schedule of Values will be prepared for distribution to the Engineer and Owner.

C. Approved Change Orders reflected in the Schedule shall be incorporated into the Schedule of Values as a single unit identified by the Change Order number.

D. Changes to the Schedule which add activities not included in the original schedule but included in the original work (schedule omissions) shall have values assigned as approved by the Engineer. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the Engineer.

E. In the event that the Contractor and Engineer agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

2.02 CONSTRUCTION SCHEDULE

A. A Construction Schedule, as required in 1-08.3 of Section 01 11 50 – Special Provisions, shall be submitted. Scheduling of the work under the Contract shall be performed by the Contractor. The development of the Construction Schedule, cost loading of the schedule, monthly payment requisitions and project status requirements of the Contract shall employ a Critical Path Method (CPM) scheduling. (This CPM schedule is encouraged but NOT required to be a computer based system.) A bar chart system delineating the project schedule with development of critical path, approved by the Engineer, will meet the requirements of this section.

B. The Contractor shall submit a project overview bar chart type plan at the preconstruction conference for all work as indicated below to identify the manner in which the Contractor intends to complete all work within the Contract time.

C. The overview bar chart shall indicate the major components of the project work and the sequence relations between major components and subdivisions of major components. The overview bar chart shall indicate the relationships and time frames in which the various components of the work will be made substantially complete and placed into service in order to meet the project milestones as indicated on schedule. Sufficient detail shall be included for the identification of subdivisions of major components into such activities as (1) excavation, (2) foundation subgrade preparation, (3) foundation concrete, (4) completion of all structural concrete, (5) major mechanical work, (6) major electrical work, (7) instrumentation and control work, (8) installation of equipment, (9) startup and testing, and (10) other important work, for each major facility within the overall project scope. Planned durations and start dates shall be indicated for each work item subdivision. Each major component and subdivision component shall be accurately plotted on time scale sheets not to exceed 36 inches by 60 inches in size.

D. The Engineer will review the project overview bar chart. The Engineer’s review and comment on the schedules shall be limited to contract conformance. The Contractor shall make corrections to the schedule necessary to comply with the contract requirements and shall adjust the schedule to incorporate any missing information requested by the Engineer.

E. By way of the Contractor assigning activity durations and proposing the sequence of the work, the Contractor agrees to utilize sufficient and necessary management and other resources to perform the work in accordance with the schedule. Total schedule float identified belongs to the project and shall not be for the exclusive benefit of any party. Upon submittal of a schedule update, the updated schedule shall be considered the "current" project schedule.

F. Submission of the Contractor's progress schedule to the Owner or Engineer shall not relieve the Contractor of total responsibility for scheduling, sequencing, and pursuing the work to comply with the requirements of the Contract Documents, including adverse effects such as delays resulting from ill-timed work.

G. The Contractor shall monitor the progress of the work and adjust the schedule each month to reflect actual progress and any changes in planned future activities, as a minimum for the following calendar month. Each schedule update submitted must be complete including all information requested. Each update shall continue to show all work activities including those already completed. These completed activities shall accurately reflect the "as built" information by indicating when the work was actually started and completed.

H. Neither the submission nor the updating of the Contractor's original schedule submittal nor the submission, updating, change or revision of any other report, curve, schedule or narrative submitted to the Engineer by the Contractor under this Contract, nor the Engineer's review or acceptance of any such report, curve, schedule or narrative shall have the effect of amending or modifying, in any way, the Contract completion date or milestone dates or of modifying or limiting, in any way, the Contractor's obligations under this Contract. Only a signed, fully executed Change Order can modify these contractual obligations.

I. Upon approval of a Change Order, or upon receipt by the Contractor of authorization to proceed with additional work, the change shall be reflected in the next submittal of the schedule by the Contractor. The Contractor shall utilize a sub-network in the schedule depicting the changed work and its effect on other activities. This sub-network shall be tied to the main network with the appropriate logic so that a true analysis of the Critical Path can be made.

2.03 SHOP DRAWINGS

A. Prior to fabrication or release for manufacturing of all components of the project, the manufacturer shall submit shop drawings to the Engineer for review.

B. Drawings: Unless otherwise specifically directed by the Engineer, the manufacturer shall identify each copy of the shop drawings with the drawing number in the lower right hand corner, shall make all shop drawings accurately to a scale sufficiently large enough to show all pertinent features of the item and its method of connection to the work, and shall make all shop drawing prints in blue or black line on white background. Shop drawings shall be submitted in accordance with paragraphs 3.01 and 3.02 A. Each item listed in Paragraph C below shall be included and be appropriately identified.

C. Manufacturer shall submit the following minimum information with their shop drawings for each model or type of unit supplied by the manufacturer.

1. Manufacturer's catalog information, physical and operation description, and specifications.

2. Drawings showing the general dimensions of the equipment and confirming the size of the unit. If applicable, drawings shall include size and location of required piping connections, structural supports, construction details, list of input/output signals for manufacturer provided control panel, wiring diagrams, weights of major components, and utility connection requirements.

3. List of all design modifications to accommodate the equipment proposed.

4. Information and location of nearest parts, service crews, and repair facilities to the project location.

5. Installation list for installations in the U.S. with location, contact names, and phone numbers.

6. List of all variances from the Technical Specifications. Failure to specifically list and fully explain all variances will be cause for rejection of the submittal.

7. Any other information required to clearly and readily demonstrate compliance with all parts of the Technical Specifications.

8. Installation instructions.

9. Design calculations.

10. Manufacturer’s certification of factory applied coating system and coating system technical data sheets.

11. Manufacturer’s guarantee, as specified.

12. Any additional information listed elsewhere in the Technical Specifications and required to be submitted with the shop drawings.

D. When revised for resubmission, manufacturer shall clearly identify changes made since previous submission.

E. Work performed before acceptance of shop drawings shall be at the Contractor's own risk. In the event of termination for convenience, the City will not be responsible for any materials ordered prior to return of acceptable shop drawings marked “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED” as described below.

F. Substitutions: Any substitutions proposed by the manufacturer shall require submittals to fully enable the Engineer to evaluate the proposed substitution. All submittals shall clearly note and explicitly describe all details of any substitutions or deviations from the Contract Documents. The Engineer's acceptance of any shop drawings shall not release the manufacturer from responsibility for deviations from the Contract Documents.

G. The practice of submitting incomplete or unchecked shop drawings for the Engineer to correct or finish will not be acceptable, and shop drawings which, in the opinion of the Engineer, clearly indicate they have not been checked by the manufacturer will be considered as not complying with the intent of Contract Documents and will be returned to the manufacturer for resubmission in proper form.

2.04 SAMPLES

A. Samples, as required in the Technical Specifications, or requested by the Engineer, shall be submitted for review with the shop drawings, or subsequently as soon as possible (Engineer may request Samples for substitute equipment or materials in order to fully assess acceptability), unless otherwise specifically directed by the Engineer.

B. All samples shall be individually and indelibly labeled or tagged, indicating the WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1, Manufacturer's name, equipment name, equipment specification number, contract number, and all specified physical characteristics.

C. Unless otherwise specified, all colors and textures of specified items will be selected by the Engineer from the Manufacturer's standard colors and standard product lines.

2.05 TEST REPORTS

A. Test reports shall be furnished to the Engineer as specified in the Technical Specifications. Test reports required prior to shop drawing approval shall be submitted with the shop drawings. Test reports required for factory testing shall be submitted and accepted prior to shipment of the equipment to the construction site and shall be submitted with the Operation and Maintenance information unless directed otherwise by the Engineer. Test reports required after installation shall be submitted within 30 days after the final test date.

B. Test reports shall be clearly identified with the equipment title, specification number(s), and manufacturer name printed on the front of the report.

C. If test results are required to be witnessed by an independent testing laboratory, the Test report shall be certified by that laboratory.

D. Unless specified otherwise, factory tests shall be non-witnessed tests. Test reports shall be certified by the manufacturer.

2.06 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be submitted in conformance with this section, except as modified in Section 01 78 00 – Operation and Maintenance Manuals.

2.07 MANUFACTURERS GUARANTEE

A. The Manufacturer's Guarantee shall be submitted to the Engineer with the Operation and Maintenance Manuals and shall be in conformance with this section.

2.08 CERTIFICATE OF INSTALLATION AND MANUFACTURER’S CERTIFICATE

A. After equipment installation and on-site performance testing has been completed, the Contractor shall submit a Certificate of Installation and a separate manufacturer’s Certificate of Installation and Startup According to the Specifications and Manufacturer’s Requirements, in accordance with this section and the manufacturer’s standard warranty conditions.

PART 3 – EXECUTION

3.01 TRANSMITTAL PROCEDURE

A. Submittals shall be accompanied by transmittal form/letter. A sample transmittal form/letter is included at the end of this section. Equipment or identification numbers shall be listed on the form for items being submitted. Submittals for various items shall be made with a single form when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.

B. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. Original submittal numbers shall have the following format: “XX”; where “XX” is the sequential number assigned by the manufacturer. Resubmittals shall have the following format: “XX-Y”; where “XX” is the originally assigned submittal number and “Y” is a sequential letter assigned for resubmittals, i.e., A, B, or C being the 1st, 2nd, and 3rd resubmittals, respectively. Submittal 02-B, for example, is the second resubmittal of submittal number 2.

C. Submittal Completeness: Submittals which do not have all the information required to be submitted are not acceptable and will be returned without review.

D. Submittal Priority: Manufacturer shall indicate priority for receipt of reviewed submittals when multiple submittals have been sent to the Engineer for review. Engineer will attempt to review and reply to the highest priority submittals in the timeliest manner when manufacturer indicates that there is a priority; otherwise submittals will be reviewed in the order received, in accordance with the time indicated in paragraph 3.02.

E. See 1.02 B for additional Contractor requirements.

F. Electronic review stamps may be used by the Contractor and shall be applied in accordance with paragraph 3.01 E. Electronically applied stamps shall contain the Contractor's original wet ink signature. High resolution scanned PDF documents, in accordance with paragraph 3.02 A., containing the Contractor's review stamp and signature will be acceptable.

3.02 REVIEW PROCEDURE

A. For each required submittal, the manufacturer shall submit the specified information as follows:

1. For standard 8-1/2 x 11 inch, 8-1/2 x 14 inch, and 11 x 17-inch size sheets, provide one electronic copy of each page, including the transmittal form, in PDF format and meeting the following requirements:

a. Original or scanned PDF files shall have a minimum resolution of 600 dpi, irrespective of document size. Scanned or resized PDF files that do match the original document size, or do not properly fill a standard page size, will not be accepted.

b. PDF files containing multiple submittal items shall be "bookmarked" to match the submittal table of contents, as specified in paragraph 3.01 A., for easy reference and viewing.

2. For all other size sheets, provide one (1) reproducible high-resolution print and one (1) additional print of each page, until approval is obtained.

B. Unless otherwise specified, within ten (10) working days after receipt of the submittal, the Engineer will review the submittal and return the marked-up reproducible original noted in paragraph 1 above. The returned submittal will indicate one (1) of the following actions:

1. If the review indicates that the material, equipment, test or work method is in general conformance with the design concept and complies with the Contract Documents, submittal copies will be marked "NO EXCEPTIONS TAKEN." In this event the manufacturer may begin fabrication of materials and equipment.

2. If the review indicates that the submittal is insufficient or that limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED." The manufacturer may begin fabrication of materials 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; otherwise no further action is required.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked “MAKE CORRECTIONS NOTED” or “REVISE AND RESUBMIT.” If the comments are of a nature that can be confirmed without a resubmittal, copies will be marked “MAKE CORRECTIONS NOTED” with “CONFIRM” or “VERIFY” written where appropriate on the submittal. If the comments require a revision and resubmittal, copies will be marked “REVISE AND RESUBMIT.” Except at its own risk, the manufacturer shall not undertake work covered by this submittal until the attached comments have been either confirmed by a separate written communication or the submittal has been revised, resubmitted and returned to the manufacturer marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED.”

4. If the review indicates that the material, equipment, test, or work method is not in general conformance with the design concept or in compliance with the Contract Documents, copies of the submittal will be marked “REJECTED” and “REVISE AND RESUBMIT,” or “REJECTED” and “SUBMIT SPECIFIED ITEM.” Submittals with deviations that have not been identified clearly may be rejected. Except at its own risk, the manufacturer shall not undertake work covered by such submittals until a new submittal is made and returned marked either “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED.”

3.02 EFFECT OF REVIEW OF MANUFACTURER'S SUBMITTALS

A. Review of drawings, tests, methods of work, or information regarding materials or equipment the manufacturer proposes to provide, shall not relieve the manufacturer of its responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Owner or by any officer or employee of the Owner, and the manufacturer shall have no claim under the Contract on account of the failure, or partial failure, of the method of work and test, material, or equipment so reviewed. A mark of “NO EXCEPTIONS TAKEN” or “MAKE CORRECTIONS NOTED” shall mean that the Owner has no objection to the manufacturer, upon the manufacturer's own responsibility, providing the materials or equipment proposed.

B. The Engineer's review shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The review shall not extend to the means, methods, sequences, techniques, or procedures of construction, or to safety precautions or programs incidental thereto. The review by the Engineer of a separate item as such will not indicate review of the assembly in which the item functions.

END OF SECTION 01 33 00

SUBMITTAL TRANSMITTAL

Project Number: 23030

Project Name: Wastewater Treatment Plant Improvements – Phase 1

Owner: City of Grandview

Prime Contractor: _____

Submittal No.: _____

Submitted by: _____

Each copy of the submittal shall be collated and assembled by the Prime Contractor with the Submittal Transmittal as the cover. Each catalog cut shall be marked with the Bid Item that the Submittal is intended for in the upper right-hand corner and the specific item intended for use shall be highlighted. In the table below, the Prime Contractor shall complete the Bid Item number associated with the Submittal, Product Description (including Supplier, Manufacturer, Model #, Dimensions), as applicable, the page number of the overall submittal, and the spec reference.

Item	Bid Item	Product Description *(Supplier, Manufacturer, Model, Dimensions)*	Pg.	Spec.	Engineer Use Only	
					Engineer Comments	Response

RESPONSE KEY

NET	No Exceptions Taken
MCN	Make Corrections Noted
REJ	Rejected
R&R	Revise and Resubmit
SSI	Submit Specified Item

The individual named below, as an authorized representative of the Prime Contractor, acknowledges the following:
1. We have determined and verified all quantities, dimensions, field construction criteria, material catalog numbers and similar data, and/or assume full responsibility for doing so.
2. We have reviewed and coordinated each submittal with the requirements of the Contract Documents.
3. This submittal does not conflict with other submittals or the Contract Documents.
4. The submittals have been coordinated.

Authorized Representative Name and Title: _____ **Date:** _____

Corrections or comments made on the shop drawings during this review do not relieve Contractor from compliance with requirements of the Drawings and Specifications. This review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating his work with that of all other trades, and performing his work in a safe and satisfactory manner.

Engineer's Signature: _____ **Date:** _____ **Copy to**: _____

SECTION 01 45 11 – TESTING, INSPECTIONS, SUPERVISION

PART 1 – GENERAL

1.01 GENERAL DESCRIPTION

A. The work of this section applies to the Plans, Specifications, and Special Provisions of the Contract. The Contractor shall employ the services of an independent, certified testing firm and/or laboratory to complete on-site inspection, sampling and testing for the following:

1. Earthwork and trenching;

2. Subgrade;

3. Crushed surfacing and granular backfill;

4. Asphalt paving;

5. Concrete strength and reinforcement;

6. Structural steel welds and/or bolting;

B. The Contractor shall be responsible for scheduling all material testing required by these Contract Documents.

C. The Contractor shall coordinate, be responsible for, and pay for the following testing and inspections:

1. Electrical and control system testing and inspections.

2. All required gradation, fertility analysis and other required testing of imported aggregate and soil materials.

3. Factory testing of materials and equipment as required.

4. All required material, equipment, and system testing required for startup and operation of facilities and equipment.

5. Other testing and inspections as specified to be furnished by the Contractor in this section and/or elsewhere in the Contract Documents.

D. Additional requirements for testing may be described in various sections of these Specifications.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with testing company personnel, provide access to work.

B. Furnish usual labor and facilities:

1. To provide access to work to be tested.

2. To obtain and handle samples at the site.

3. To facilitate inspections and tests.

4. For testing company's exclusive use for storage and curing of test samples.

C. Notify testing company and Engineer sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

1.03 QUALITY ASSURANCE

A. Testing, when required, will be in accordance with all pertinent Codes and Regulations and with selected standards of the American Society for Testing and Materials.

1.04 DOCUMENTATION AND DISTRIBUTION

A. Testing company will promptly process and distribute required copies of test reports and related instructions. Contractor shall allow time for necessary retesting and replacement of materials with the least possible delay in progress of the work.

B. When a product is tested for conformance with criteria or standard specifically noted in Specifications, testing report will specifically state conformance or non-conformance with that specific standard.

C. Testing company will distribute copies of the testing reports, with copies sent to the Contractor and the Engineer.

PART 2 – PRODUCTS

2.01 PAYMENT FOR TESTING

A. The Contractor will pay for all sampling and testing costs, except as otherwise noted. The costs for additional sampling and testing, due to failed tests shall be the responsibility of the Contractor.

2.02 CODE COMPLIANCE TESTING AND INSPECTIONS

A. Inspections and tests required by Codes or Ordinances or by a plan review approval authority, and which are made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.

B. Portions of the work are subject to inspection by the building official, and all construction shall remain accessible and exposed for inspection purposes until approved by the building official.

2.03 CONTRACTOR'S CONVENIENCE TESTING

A. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

PART 3 – EXECUTION

3.01 COOPERATION WITH TESTING COMPANY AND ENGINEER'S ON-SITE REPRESENTATIVE

A. Representatives of the testing company and the Engineer shall have access to the Work at all times and at all locations where the work is in progress. Contractor shall provide facilities for such access to enable the Engineer and the testing company to perform its functions properly.

3.02 TAKING SPECIMENS

A. All specimens and samples for testing, unless otherwise provided in the Contract Documents and/or approved in writing by the Engineer prior to the respective phase of work, shall be taken by testing company personnel.

3.03 SCHEDULES FOR TESTING

A. By advance discussion with the testing company, determine the time required for the company to perform its tests and to issue each of its findings.

B. Coordinate the testing schedule of materials with the construction schedule.

C. Revising schedule: When changes of the construction schedule are necessary during construction, coordinate all such changes with the testing company as required.

D. Adherence to schedule: When the testing company is ready to test according to the established schedule, but is prevented from testing or taking specimens due to incompleteness of the work, any delay charges for testing attributable to the delay shall be the responsibility of the Contractor.

E. Testing frequencies specified herein may be modified to assure compliance with the Specifications.

3.04 INSPECTING AND TESTING OF SOILS, GRANULAR BASES, AND PAVEMENT

A. See structural plans for special inspection and testing requirements. Contractor shall coordinate test durations with these special inspections and testing requirements.

B. Inspections and tests include, but are not necessarily limited to:

1. Visually inspect on-site and imported fill and backfill, making such tests as are necessary to determine compliance with the Contract requirements.

2. Field density tests on samples from in-place material as required for compaction compliance.

3. As pertinent, inspect and test the scarifying and recompacting of cleaned subgrade; inspect the progress of excavating, filling, and grading; make density tests at fills and backfills; and verify compliance with provisions of the Contract Documents and governmental agencies having jurisdiction.

C. Trench Backfill

1. Copies of moisture-density curves for each type of material encountered and copies of all test results shall be provided to the Engineer as construction progresses.

2. Compaction tests shall be taken at a frequency and at depths sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for each 100 linear feet of pipeline trench and one (1) test for each lateral trench shorter than 100 feet. At alternating 100-foot locations along the main trench line, tests shall be taken at 1-foot, 2-foot, and 3-foot depths below finish grade.

3. The Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required trench backfill densities.

4. All trenches shall be backfilled and compacted to at least 95 percent of maximum density as determined by ASTM D 1557 (Modified Proctor).

D. Earth Embankments

1. Copies of the moisture density curves for each type of material encountered and copies of all test results shall be provided to the Engineer as construction progresses.

2. Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 2,500 square feet of surface area for each lift of embankment, or one (1) compaction test for each lift in areas smaller than 2,500 square feet.

3. The Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required subgrade densities.

E. Subgrade

1. Copies of the moisture density curves for each type of material encountered and copies of all test results shall be provided to the Engineer as construction progresses.

2. Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 2,500 square feet of subgrade, or one (1) compaction test in each area smaller than 2,500 square feet.

3. The Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required subgrade densities.

4. Subgrade compaction shall be as specified for in Section 31 23 11 – Excavation, Backfill and Compaction for Structures.

F. Aggregate Materials and Crushed Surfacing

1. Copies of the moisture density curves for each type of material incorporated into the project and copies of all test results shall be provided to the Engineer as construction progresses.

2. Compaction tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 2,500 square feet of surface area for each lift of ballast or crushed surfacing, or one (1) compaction test in each area smaller than 2,500 square feet.

3. The Engineer may request additional tests be performed at the Contractor's expense, if test results do not meet the required subgrade densities.

4. Compaction of aggregate materials and crushed surfacing shall be as specified in Section 32 11 11 – Aggregate Materials.

G. Asphalt Paving

1. Copies of Maximum Rice Density test for each class of asphalt pavement and copies of all test results shall be provided to the Engineer as construction progresses.

2. Density tests shall be taken at a frequency sufficient to document that the required density has been achieved. At a minimum, one (1) compaction test shall be taken for every 2,500 square feet of surface area for each lift of asphalt pavement, or one (1) compaction test in each area smaller than 2,500 square feet.

3. The Engineer may request additional test be performed at the Contractor’s expense, if test results do not meet the required densities.

4. Each course of asphalt pavement shall be compacted to a minimum of 91 percent of theoretical Maximum Rice Density, in accordance with ASTM D2041.

3.05 CONCRETE INSPECTING AND TESTING

A. Contractor certification of Portland Cement

1. Contractor shall secure from the cement manufacturer Certificates of Compliance delivered directly to the concrete producer for further delivery directly to the testing laboratory.

B. Molded concrete cylinders by testing company:

1. Three test cylinders will be for each 100 cubic yards, or fraction thereof, of each class of concrete of each day's placement.

2. One cylinder will be tested at seven days, one at 28 days, and one when so directed.

3. A report of the mix, slump, gage, location of concrete in the structure, and test results will be written.

4. Specimens and tests will be done in accordance with the applicable ASTM standard specifications.

C. Core tests:

1. Core test may be done when specifically requested by the Engineer because of non-complying cylinder test results.

2. Cut from locations indicated by the Engineer, securing in accordance with ASTM C 42, and prepare and test in accordance with ASTM C 39. Concrete not in compliance will be removed and replaced at Contractor's expense.

D. Supervision Required by Contractor:

1. On concrete specified to be 2,000 psi or greater, provide continuous supervision or as required by governmental agencies having jurisdiction.

2. Throughout progress of concrete placement, perform slump tests to confirm specified slump.

3. Throughout progress of concrete placement, verify that finished concrete surfaces will have the level or slope required by the Contract Documents by using the proper and necessary personnel and equipment.

E. Refer to Section 03 30 00 – Cast-In-Place Concrete for additional requirements.

3.06 CONCRETE REINFORCEMENT INSPECTING AND SUPERVISION

A. Contractor shall verify that all reinforcement steel bars are in compliance with the specified standards prior to their use in the work.

1. Material identified by mill test reports and certified by the testing company does not require additional testing. Require the supplier to furnish mill test reports to the testing company for certification.

2. If material is not so identified, provide proper tests to the Engineer's satisfaction that the furnished materials meet the Specifications.

3.07 STRUCTURAL STEEL INSPECTING AND SUPERVISION

A. Contractor shall verify all structural steel for compliance with the specified standards prior to their use in the work.

1. Material identified by mill test reports and certified by the testing company does not require additional testing. Require the supplier to furnish mill test reports to the laboratory for certification.

2. If material is not so identified, Contractor shall provide proper tests to the Engineer's satisfaction that the furnished materials meet the Specifications.

B. Field Welding: Contractor shall provide continuous supervision by qualified personnel. Testing company employed by Owner shall inspect welds. Suspect welds will be tested and those not in compliance will be repaired at Contractor's expense.

C. Special Inspection: Testing agency employed by Owner shall provide special inspection as per IBC and as required in the Contract Drawings.

3.08 ROOFING AND WATERPROOFING INSPECTING AND SUPERVISION

A. Contractor shall provide the following inspection and supervision:

1. Prior to start of roofing installation, Contractor shall conduct a job site meeting attended by representatives of the installing subcontractors, the Contractor's field superintendent, and the Engineer, to review procedures to be followed. Verify that the procedures and specifications are approved by the manufacturer for the specific application.

2. Prior to start of installation, verify that materials at the job site comply with the specified standards, that the subcontractor is qualified, and that the installing personnel are fully informed as to procedures to be followed.

3. During installation, verify that materials are installed in strict accordance with the manufacturers' procedures and specifications.

4. When requested by the Engineer, make test cuts to verify conformance with the specified requirements. Costs of cutting, patching, and repair shall be borne by the Contractor. No more than one test cut will be made if the initial test cut shows compliance with the Specification.

3.09 WAIVER OF INSPECTION AND/OR TESTS

A. Specified inspections and/or tests may be waived only in writing by the Engineer.

END OF SECTION 01 45 11

SECTION 01 57 13 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work included in this section consists of all work necessary to prevent erosion due to construction activities, prevent sedimentation of waterways and open drainage way due to construction activities, and restore areas eroded due to insufficient preventative measures or construction activities.

B. This section includes installation of temporary and permanent erosion and sedimentation control systems.

C. Dust control shall be provided for the full duration of the project. The Contractor shall be responsible for obtaining and paying for any required permits from the local clean air agency.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 31 10 00 – Site Clearing

C. Section 31 22 13 – Rough Grading

D. Section 31 23 11 – Excavation, Backfill and Compaction for Structures

E. Section 31 23 15 – Trench Excavation and Backfill

F. Section 31 23 19 – Dewatering

1.03 REGULATORY REQUIREMENTS

A. Comply with all requirements of Washington State Department of Ecology for erosion and sedimentation control including but not limited to the 2017 Construction Stormwater General Permit.

B. Conform to clean air regulations of the Washington Department of Ecology. A copy of the regulations is available at the Central Regional Office of the Washington Department of Ecology located in Yakima, Washington.

C. Comply with the State of Washington regulation regarding disposal of waste material as outlined in WAC 173-304, Subchapter 461.

D. Protect adjacent properties and receiving water resources from erosion and sediment damage until final stabilization is achieved. All stormwater controls and systems must be installed and functioning as designed and free of accumulated sediment and debris before final project approval.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

1.05 QUALITY ASSURANCE

A. Best Management Practices Standard: Stormwater Management Manual for Eastern Washington 2004.

B. Timing: Put preventive measures in place as soon as possible before disturbance of surface cover and before precipitation occurs.

C. Stormwater Runoff: Control increased stormwater runoff due to disturbance of surface cover due to construction activities for this project.

1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.

D. Erosion on Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.

2. Prevent development of ruts due to equipment and vehicular traffic.

3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to owner.

E. Erosion off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.

1. Prevent windblown soil and soil laden water from leaving the project site.

2. Prevent tracking of mud onto public roads outside site.

3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to owner.

F. Open Water: Prevent standing water that could become stagnant.

G. Maintenance: Maintain temporary preventive measures.

PART 2 – PRODUCTS

2.01 MATERIALS

A. High Visibility Fencing

1. UV stabilized, orange, high-density polyethylene or polypropylene mesh, and shall be at least 4 feet in height.

2. Support posts shall be wood or steel and have sufficient strength and durability to support the fence through the life of the project.

B. Perforated Drain Pipe

1. Corrugated Polyethylene (PE) Underdrain Pipe shall be used.

2. Perforated pipes do not require a watertight joint.

3. Pipe shall be jointed with snap-on, screw-on, bell and spigot, or wraparound coupling bands, as recommended by the manufacturer of the pipe.

4. AASHTO Class II perforations shall be used uniformly spaced along the length and circumference of the pipe.

C. Silt Fence

1. Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:

   a. Average Opening Size: 30 U.S. Std. Sieve, max, when tested in accordance with ASTM D 4751.

   b. Permittivity: 0.02 sec-1, minimum, when tested in accordance with ASTM D 4491.

   c. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D 4355 after a 500-hour exposure.

   d. Tensile Strength: 100 lb-f, minimum, in cross-machine direction; 180 lb-f, minimum, in machine direction; when tested in accordance with ASTM D 4632.

   e. Elongation: 15 to 30 percent, when tested in accordance with ASTM D 4632.

   f. Tear Strength: 55 lb-f, minimum, when tested in accordance with ASTM D 4533.

   g. Color: Manufacturer's standard, with embedment and fastener lines preprinted.

2. Posts: One of the following, minimum 5 feet long:

   a. Steel U- or T-section, with minimum mass of 1.33 lb per linear foot.

   b. Wood, 2 by 2 inches in cross section.

D. Gravel

1. Gravel used for filtration or protection of a temporary erosion and sediment control systems shall conform to WSDOT Standard Specifications, Section 9-03.12(4) “Gravel Backfill for Drains.”

E. Quarry Spalls

1. Material shall meet WSDOT Standard Specifications, Section 9-13.6 “Quarry Spalls”.

F. Geotextile Fabric for Soil Stabilization

1. Material shall meet WSDOT Standard Specifications, Section 9-33 “Geotextile for Soil Stabilization”.

G. Catch Basin Insert

1. “Dandy Sock” by Mirafi or equivalent. Insert shall be designed for stormwater to pass through the fabric; filtering sediment before entering the downstream conveyance.

2. The insert shall have overflow holes to pass large stormwater runoff events that exceed filtration capacity.

H. Temporary and Permanent Seeding

1. Refer to Section 8-01 of the WSDOT Standard Specifications for temporary seeding requirements, if used.

2.02 SOURCE QUALITY CONTROL

A. For each type of materials provided to the project, use the same source throughout the work.

PART 3 – EXECUTION

3.01 PREPARATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

B. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

C. In all cases, if permanent erosion resistant measures have been installed (i.e. pavement, gravel surfacing, vegetation, etc.) temporary preventive measures are not required.

3.02 EROSION AND SEDIMENTATION CONTROL IMPLEMENTATION

A. Place erosion and sediment control systems in accordance with the Plans and SWPPP or as may be dictated by site conditions in order to maintain the intent of the specifications and permits.

B. Owner has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to direct Contractor to provide immediate permanent or temporary pollution control measures.

C. Maintain erosion and sedimentation control systems as dictated by site conditions, indicated in the construction documents, or as directed by governing authorities or Owner to control sediment until final stabilization. Contractor shall respond to maintenance or additional work ordered by Owner or governing authorities immediately, but in no case, within not more than 48 hours at no additional cost to the Owner.

D. Contractor shall incorporate permanent erosion control features, paving, permanent slope stabilization, and vegetation into project at earliest practical time to minimize need for temporary controls.

E. Permanently seed and mulch cut and fill slopes as construction proceeds to extent considered desirable and practical.

3.03 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Silt Fences (when applicable):

1. Promptly replace fabric that deteriorates unless need for fence has passed.

2. Remove silt deposits that exceed one-third of the height of the fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

D. Clean out temporary sediment control structures weekly and relocate soil on site.

E. Place sediment in appropriate locations on site and stabilize to prevent erosion.

3.04 CLEANUP

A. Remove temporary measures after permanent measures have been installed.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade, finish to match adjacent ground surfaces, and stabilize with permanent cover (i.e. seeding, sod, or gravel surfacing).

END OF SECTION 01 57 13

SECTION 01 78 00 – OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work included in this section consists of preparing, assembling, and submitting operation and maintenance manuals for all equipment supplied under this Contract, including the following:

1. Building operating systems and equipment.

2. Care, preservation, and maintenance of architectural products and finishes.

3. Mechanical (i.e., pumps, valves, HVAC systems, etc.) equipment.

4. Electrical and control equipment and components.

B. Additional requirements for operation and maintenance manuals may be described in other sections of these Specifications.

PART 2 – PRODUCTS

2.01 OPERATION AND MAINTENANCE MANUALS

A. Provide operations and maintenance manual. The following information shall be included in the manual:

1. Catalog information.

2. Maintenance instructions for all components of the installation, including installation instructions, start-up instructions, and specific instructions for maintenance procedures necessary to sustain and extend the service life of the installed equipment.

3. List of recommended spare parts and materials needed to maintain the equipment.

4. Manufacturer's specifications.

5. Electrical requirements and schematic diagrams.

6. List showing materials of construction of all components.

7. Information and location of parts, service crews, and repair facilities nearest to the City of Grandview.

8. When required, manufacturer's certification of compliance with the specifications.

9. Manufacturer's guarantee.

10. Safety precautions, warnings, and procedures.

B. All operation and maintenance information shall be comprehensive and detailed, and shall contain information adequately covering all normal operation and maintenance procedures, as well as emergency operation and maintenance procedures.

C. Submit one (1) electronic bookmarked PDF file of each O&M manual in accordance with Section 01 33 00 – Submittals Procedure, and two (2) hard copies bound in three-ring, hard-covered binders with insert pockets on the front and spine with project-specific title sheets inserted. Payment will not be made until all manuals are received and approved by the Engineer.

D. Separate O&M manual binders are not required for each piece of equipment. Information may be combined into single, larger O&M manual binders, grouped based on separate pieces of equipment. Binders shall be neatly organized and each binder shall be provided with project-specific cover sheets and a table of contents to easily locate necessary information. The number of binders, division of materials, and size of binders may need to be adjusted based on the volume of material.

E. The electronic O&M manuals shall be organized to match the format and layout of the hard-copy manual binders. A single PDF file shall be created for each binder provided. PDF files shall be “bookmarked” to match to table of contents, as specified in paragraph 3.02 A. of Section 01 33 00 – Submittals Procedure. Manufacturer’s original PDF documents may be combined with type written scanned documents to create a single PDF file. Scanned documents shall meet the requirements of paragraph 3.02 A. of Section 01 33 00 – Submittals Procedure and all text shall be converted so that the final O&M manual file is searchable.

F. One (1) electronic copy and one (1) hard copy of the initial O&M manual submittal may be provided to the Engineer for review and approval prior to preparing final hard copies of the O&M manuals. The initial O&M manuals will be returned to the manufacturer with the Engineer’s comments for preparation of the final documents.

G. Operation and maintenance and/or special warranty information is required for the following specification sections:

1. Section 07 41 11 – Metal Roof and Wall Panels

2. Section 08 36 13 – Sectional Doors

3. Section 08 71 00 – Door Hardware

4. Division 09 – Finishes

5. Division 22 – Plumbing

6. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)

7. Division 26 – Electrical

8. Division 40 – Process Interconnections

9. Division 43 – Process Gas and Liquid Handling Equipment

10. Division 46 – Water and Wastewater Equipment

Additional operation and maintenance information shall be provided by the Contractor if required by the Engineer.

2.02 MAINTENANCE SUMMARY

A. In addition to the above items, the manuals shall include a "maintenance summary." The "maintenance summary" shall be bound into the manual and shall contain the following information compiled by the manufacturer or the manufacturer's representative:

1. Description or name of equipment;

2. Manufacturer;

3. Name, address, telephone number, and FAX number of manufacturer's local representative;

4. Equipment serial number, where applicable;

5. Equipment nameplate data;

6. Recommended maintenance procedures:

   a. Name of part to be maintained and description of procedure;

   b. Frequency of maintenance;

   c. Lubricant(s) or other materials required, where applicable, including type of lubricant, lubricant manufacturer, and specific compound;

   d. Additional information as may be required for proper maintenance;

7. Recommended spare parts.

B. A sample "maintenance summary" form is bound herein for reference.

PART 3 – EXECUTION

3.01 GENERAL

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

B. The above described operations and maintenance information shall be submitted in addition to shop drawings.

C. Payment for furnishing operation and maintenance materials as specified herein shall be included in the bid item for O&M Manuals, as described in Section 1-09.3(1) of the Special Provisions. A minimum bid amount has been entered in the Bid Proposal for this item. The Contractor must bid at least that amount. Payment equal to 100% of the lump sum bid for this item will be paid upon Engineer approval of complete O&M manuals. No partial payment will be made for preliminary or incomplete O&M manual submittals.

MAINTENANCE SUMMARY
FOR
EACH PIECE OF EQUIPMENT

1. EQUIPMENT ITEM:_____

2. MANUFACTURER:_____

3. SERIAL NO. (if applicable):_____

4. NAMEPLATE DATA (horsepower, voltage, speed, etc.):_____

5. MANUFACTURER'S LOCAL REPRESENTATIVE:

   NAME:_____

   ADDRESS:_____

   TELEPHONE NO.:_____

6. MAINTENANCE REQUIREMENTS:

Maintenance operation	Frequency	Lubricant (if applicable)	Comments
List briefly each maintenance operation required and refer to specific information in Manufacturer's standard maintenance manual, if applicable.	List required frequency of each maintenance operation	Refer by symbol to lubricant list as required.	

7. LUBRICANT LIST:

Reference Symbol	Standard Oil of California	Union	Texaco	Shell
List symbols used in Item 6 above	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.			

8. SPARE PARTS: Include your recommendations regarding what spare parts, if any, should be kept on the job.

END OF SECTION 01 78 00

DIVISION 02 – EXISTING CONDITIONS

SECTION 02 41 00 – DEMOLITION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work included in this section consists of all work, tools and equipment necessary to remove and dispose of existing buildings, structures and appurtenances, or portions of existing buildings, structures and appurtenances, as shown on the plans.

B. This section also includes the removal, storage and/or protection of existing materials and equipment that are scheduled to remain, or to be reinstalled in existing and/or new locations.

C. Demolition work will be carried out in a manner as to not jeopardize the integrity of adjacent or connected structures, which are to remain.

D. Repair of the existing concrete structures and/or structure modifications (if needed), following demolition, will be included in this section.

E. Dust control shall be provided for the full duration of the project.

1.02 RELATED SECTIONS

A. Section 03 30 00 – Cast-In-Place Concrete

B. Division 26 – Electrical

C. Section 31 10 00 – Site Clearing

D. Section 31 14 11 – Soil Materials

E. Section 32 11 11 – Aggregate Materials

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable Local, State, and Federal codes for environmental requirements, disposal of debris and removal and disposal of hazardous materials. The Contractor shall be responsible for the appropriate disposal of all debris. No on-site burning will be permitted and no debris, including concrete and asphalt, may be placed in fill areas.

B. The use of explosives for demolition will not be permitted.

C. Coordinate demolition work with all utility companies. The contractor is responsible for obtaining and complying with all requirements of the respective utility companies. The contractor shall protect all existing utilities which are to remain in service.

D. Conform to clean air regulations of the Washington Department of Ecology. A copy of the regulations is available at the Central Regional Office of the Washington Department of Ecology located in Yakima, Washington.

E. Comply with the State of Washington regulation regarding disposal of waste material as outlined in WAC 173-304, Subchapter 461.

1.04 SUBMITTALS

A. No submittals required for this section.

1.05 QUALITY ASSURANCE

A. Work shall be performed in accordance with the requirements of Section 2-01, Clearing, Grubbing, and Roadside Cleanup, and Section 2-02, Removal of Structures and Obstructions, of the WSDOT Standard Specifications, 2025 Edition.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Refer to Section 31 14 11 – Soil Materials and Section 32 11 11 – Aggregate Materials for materials required to fill remaining voids from structure demolition.

B. Refer to Section 03 30 00 – Cast-In-Place Concrete for concrete patching materials, if required

PART 3 – EXECUTION

3.01 PREPARATION

A. The Contractor shall verify that all existing utilities have been disconnected prior to beginning demolition. Coordinate disconnecting the existing power service with the utility company.

B. The Contractor shall be responsible for securing a location to store salvaged materials and equipment during demolition and construction. The storage location shall keep all equipment and materials free from dust, dirt, rain, moisture, or any other environment that will affect the condition of the salvaged material.

C. A waste site has not been provided by the Contracting Agency for disposal of demolition materials. All materials shall be disposed of off-site by the Contractor.

3.02 PROTECTION

A. Locate, identify, and protect from damage any utilities which remain.

B. The Contractor shall provide any shoring or bracing necessary to prevent movement, settlement, or collapse of adjacent structures that are planned to remain.

3.03 DEMOLITION

A. Remove all materials and equipment which are shown on the Plans to be salvaged and store materials in a secured location prior to beginning demolition of existing buildings and/or structures.

B. Perform demolition work in a systematic manner, from a higher to lower level, using required methods to complete all demolition work indicated on the Plans and specified herein. All demolition work shall be done in accordance with governing regulations.

C. Demolish concrete and masonry materials in small sections. Cut and carefully remove concrete and masonry near existing structures to remain using a masonry saw or hand tools. Do not use power impact tools to remove material around portions of existing structures scheduled to remain.

D. Sawcut to remove concrete walls and walkways where called out on the Plans. Other low-impact methods of removal may only be used with approval of the Engineer. Patch concrete with grout as specified in Section 03 30 00 – Cast-In-Place Concrete.

E. Remove and dispose of all exposed fasteners and anchor bolts remaining in existing structure walls and floors after removal of existing equipment and materials, unless otherwise noted on the plans. Patch any holes remaining in existing structures with grout and/or sealant as specified in Section 03 30 00 – Cast-In-Place Concrete.

3.04 DUST CONTROL

A. The Contractor shall be solely responsible for dust control on this project and shall protect motoring public, adjacent homes, and vegetation from damage due to dust, by whatever means necessary. The Contractor shall be responsible for any claims for damages and shall protect the Contracting Agency, Yakima County, and the Consultant from any and all such claims.

B. When directed by the Engineer, the Contractor shall provide water for dust control within two hours of such order and have equipment and manpower available at all times including weekends and holidays to respond to order for dust control measures.

3.05 SALVAGED MATERIAL

A. See the Plans and related sections these specifications for installation of salvaged equipment. The Contractor shall be responsible for salvaging all parts of the equipment necessary for a complete installation in new and/or existing buildings. No additional payment will be made for replacement of materials planned to be reused that are needed for installation of the salvaged equipment.

3.06 CLEANUP AND REPAIR

A. Upon completion of the demolition work all tools, equipment and demolished materials shall be removed from the site.

B. Repair any portion the existing concrete structures which were damaged during demolition, or as directed by the Engineer. See Section 03 30 00 – Cast-In-Place Concrete for specified cementitious repair materials.

END OF SECTION 02 41 00

DIVISION 03 – CONCRETE

SECTION 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work covered by this section consists of furnishing and installing all formwork, embedded items and form ties for cast-in-place concrete to produce the finished concrete elements as shown on the Plans.

B. All formwork and methods of construction shall conform to the requirements of the Department of Labor and Industry of the State of Washington and OSHA Standards.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 20 00 – Concrete Reinforcing

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 05 50 11 – Miscellaneous Metals

1.03 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 301 – Specifications for Structural Concrete for Buildings.

2. ACI 318 – Building Code Requirements for Structural Concrete.

B. American Society for Testing and Materials (ASTM)

1. A 153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. When requested by the Engineer for the purposes of explaining detail or structural integrity, the Contractor shall submit formwork shop drawings. Complete descriptive literature shall be submitted for items proposed as alternatives to products specified.

PART 2 – PRODUCTS

2.01 GENERAL

A. The Contractor shall provide all formwork and those materials required to develop the strength and finishes required of the finished concrete.

1. Except where noted herein, the formwork system used is the Contractor's choice, provided it performs in the manner specified.

2. Form materials: Contractor may use any forming materials and methods which will achieve the finish qualities specified in Section 03 30 00 – Cast-In-Place Concrete, subject to the following limitations.

a. 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 requiring bond or adhesion or impeded wetting of surfaces to be cured with water or curing compound. Do not use form-coating compounds that will cause concrete staining when water comes in contact with the coating after forms are removed.

b. Form ties: Form ties shall be bolts or rods designed so that no metal shall be within the required thickness of reinforcement cover of the finished concrete surface, and to provide a void which shall be grouted to seal the opening. The detail used shall be watertight for all exterior concrete and concrete in contact with earth or water.

2.02 EMBEDDED ITEMS

A. Section 05 50 11 – Miscellaneous Metals for anchor bolts.

B. Inserts shall be as required by other trades or as shown on the Plans. Attach securely to forms. Inserts within reinforcement cover thickness shall be hot dip galvanized, nonferrous or other approved non-rusting material.

C. Waterstops: See Section 03 30 00 – Cast-In-Place Concrete, paragraphs 2.10 and 3.04. Splice to maintain continuity at corners and intersections

D. Embedded conduit: Rigid embedded conduit shall be of hot-dip galvanized steel or plastic specified elsewhere. Conduit shall be approved and listed by Underwriters Laboratories, Inc. and bear the UL label.

E. Miscellaneous embedded items: All exposed items permanently embedded in concrete within the required concrete reinforcement cover thickness shall be hot dip galvanized, nonferrous or plastic as approved, to eliminate the possibility of stained or rusty spots.

PART 3 – EXECUTION

3.01 FORM DESIGN

A. Forms shall be designed on the basis of deflection to maintain true lines within the allowable variations shown in 3.02 A. 1. below. Slab, beam and girder forms shall be cambered for dead load. Forms shall be braced and supported as required.

3.02 FINISH CONCRETE TOLERANCES

A. Every reasonable effort shall be made to maintain plumbness, and alignment as shown on the Plans.

1. Allowable variations – maximum

a. Tops of walls, parapets and curbs exposed to visual alignment + 1/8 inch in 10 feet.

b. Cross-section thicknesses of walls, columns and beams + 1/8 inch.

c. Flat surfaces of walls, slabs and tank sides, + 1/8 inch in 10 feet.

d. Linear alignment of structure lines, tank sides, and column lines as follows:

10-foot length – 1/8 inch
20-foot length – 3/8 inch
40-foot length – 1/2 inch
Over 40 feet – 3/4 inch

e. Footings:

Alignment: + 2 inches
Thickness: Plus-as required. Minus-none.

3.03 CONSTRUCTION DETAILS

A. Exposed edges of concrete on the outside of structures and all those in the inside of structures shall be chamfered or beveled at an angle of 45 degrees, such bevel being 3/4 inch on a side, except where rounded corners are shown on the Plans. If so directed by the Engineer, however, the Contractor shall provide square edges for any portion of the work.

B. Form tie holes: Form tie holes shall be pointed-up fully with mortar as specified in Section 03 30 00 – Cast-In-Place Concrete, paragraph 2.08.

C. Embedded items:

1. Position in forms in location shown. Do not place concrete before receiving approval of placing plan.

2. Provide adequate support to prevent displacement during concreting.

3. Allow other trades ample time and facilities for placing and installing embedded items.

4. Conduits must have same cover as required for reinforcing. Do not embed conduits larger than 1-inch nominal size unless specifically called out on the Plans or written approval of Engineer is obtained. Conduits shall be placed inside the reinforcing.

5. No insert shall be permitted with less cover than the reinforcement unless approval of Engineer is obtained.

3.04 FORM CLEANING

A. All dirt, chips, sawdust, and other foreign matter shall be removed from within the forms before any concrete is deposited therein. Forms previously used shall be thoroughly cleaned of all dirt, mortar and foreign matter before being used.

B. Temporary openings shall be provided at the base of column and wall forms and at other points where necessary to facilitate cleaning and inspection immediately before depositing concrete.

3.05 FORM REMOVAL

A. Form bracing and shores shall be kept in place until concrete has reached adequate strength to properly support itself. In no case shall removal commence earlier than the following schedule unless approved by the Engineer.

Sides of footings	24 hours
Walls and columns not yet supporting load	48 hours
Vertical sides of beams, girders and similar members	48 hours
Slabs, beams and girders	10 days
Shoring for slabs, beams and girders	21 days

Forms shall not be stripped from concrete which has been placed at a temperature under 50 degrees F without first determining if the concrete has properly set, without regard to the time element. If, in the opinion of the Engineer, stripping of forms on the basis of above schedule would result in damage to the concrete, the schedule shall be modified to prevent such an occurrence.

END OF SECTION 03 10 00

SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work covered by this section consists of furnishing and installing all reinforcing steel, wire reinforcement, and accessories required for all cast-in-place concrete.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 10 00 – Concrete Forming and Accessories

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 05 50 11 – Miscellaneous Metals

1.03 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 301 – Specification for Structural Concrete for Buildings.

2. ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures.

3. ACI 318 – Building Code Requirements for Reinforced Concrete.

4. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary. (Applies to all structures designed to contain water/wastewater or any structure with internal hydrostatic pressure.)

5. ACI 350.1 Tightness Testing of Environmental Engineering Concrete Structures. (Applies to all structures designed to contain water/wastewater or any structure with internal hydrostatic pressure.)

B. American Society for Testing and Materials (ASTM)

1. A 185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.

2. A 615 – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

3. A 706 – Standard Specification for Weldable Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

C. American Welding Society (AWS)

1. AWS D1.4 – “Structural Welding Code-Reinforcing Steel”.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Shop Drawings: Prepare complete shop drawings showing bending and placing diagrams in accordance with ACI 315. Shop drawings are to show plan views of all slabs, and elevation views of all walls. Shop drawings are to show all openings and penetrations, and include proper trim steel as shown on the Plans.

C. Shop drawings herein are to be coordinated with shop drawings required under Section 03 30 00 – Cast-In-Place Concrete 1.04. The shop drawings herein are to be submitted after the Section 03 30 00 – Cast-In-Place Concrete 1.04 shop drawings are approved.

D. Shop drawings are to be presented in a format that can be printed on 11-inch x17-inch paper with a text font that is readable at that scale.

1.05 QUALITY ASSURANCE

A. Mill tests: If requested by the Engineer, furnish certified copies of mill test reports showing compliance with structural Plans and Specifications.

PART 2 – PRODUCTS

2.01 STEEL AND WIRE REINFORCEMENT

A. Reinforcing steel shall consist of deformed bars of the sizes called for on the Plans. Steel shall conform to the requirements of ASTM A 615, Grade 60.

B. Wire reinforcement: Welded wire fabric shall conform to ASTM A 185. Mill tests: If requested by the Engineer, furnish certified copies of mill test reports showing compliance with structural Plans and Specifications.

C. Reinforcement to be welded is to conform to the requirements of ASTM A 706.

2.02 TIE WIRE

A. Use No. 16 double annealed iron wire.

2.03 ACCESSORIES

A. Bar supports to be detailed and placed according to minimum standards of Chapter 7, ACI 315. Include all devices necessary for the proper placing spacing, supporting and fastening of steel reinforcement in place. Where bottom surface of concrete is concealed, use standard steel chair and bolsters. Where exposed, use plastic-protected chairs conforming to CRSI Manual of Standard Practice, Chapter 3 (V), "Class 1 - Plastic Protected Bar Supports.”

In footings and slabs, well-cured concrete blocks may be used in lieu of above.

B. Dowel bar replacement systems. Richmond Screw Anchor Company Dowel-In, and Dowel-DB-SAE Dowel Bar Splicer System; Dayton Superior MRC-150 system are pre-approved for use. Other systems must be approved by the Engineer prior to use.

PART 3 – EXECUTION

3.01 FABRICATION

A. Clean, bend and splice reinforcement in accordance with International Building Code and ACI 315. Hooks shall conform to Table 2-1 of ACI 315. Do not straighten or rebend Grade 60 reinforcement. All bars shall be bent cold. No welding of reinforcement is permitted unless prior approval is obtained from the Engineer. If approved, welding shall be performed by welders certified by the American Welding Society and in accordance with AWS D1.4.

B. Bars are to be shop-bent unless specifically approved to be field bent by the Engineer. Bars approved to be field bent shall be bent to a standard bend radius in accordance with ACI 317, Chapter 7.

C. Hoop bars for curved structures shall be shop-bent to the proper radius to fit into the structure. No field bending of straight bars to the radius required for curved structures will be permitted.

3.02 BENDING SCHEDULES

A. Placement drawings and bending schedules shall be submitted to the Engineer for review. Reinforcement shall be carefully formed as indicated on the drawings and according to industry practices. Bend for all bars shall be in accordance with the requirements of ACI 318, Section 7.1.

3.03 PLACING REINFORCING STEEL

Cover is defined as the distance between the face of the concrete and the nearest part of any reinforcing steel. Where reinforcing steel is called out as being on the “face”, that means that the reinforcing steel is to be placed such that its nearest part is just entirely within the cover requirement as shown below. See also paragraph 3.05, Tolerances.

A. Reinforcing steel, before being positioned, shall be cleaned thoroughly of mill scale, dirt, or other coatings that will destroy or reduce the bond. Reinforcement appreciably reduced in section by rust shall be rejected. Prior to placing concrete, the reinforcement shall be re-inspected by the Engineer and, when necessary, cleaned to the satisfaction of the Engineer.

B. Reinforcing steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Plans shall not be used. Heating or welding of bars will not be permitted unless the entire operation is acceptable to the Engineer.

C. Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire or suitable clips at intersections and shall be supported by concrete or metal chairs or spacers, or metal hangers. Reinforcing in slabs on grade will be positioned using chairs or bolsters such as concrete blocks. Reinforcing shall be wired or otherwise secured to bolsters so that the bars do not fall off the supports during concrete placement.

D. Reinforcing steel called out as being on the “face” shall be positioned at the minimum cover distance from the face of the concrete.

E. In slabs, beams, girders and walls subject to lateral pressure, splices of reinforcement shall not be made at points of maximum stress without the express acceptance of the Engineer. Splices, where permitted, shall provide sufficient lap to transfer the stress between bars by bond and shear. Adjacent bars shall not be spliced at the same point. In walls, horizontal bars at a cold joint shall be extended in pairs of three, with splices staggered a distance equal to the lap required for the bars in question. Where not otherwise shown, reinforcement shall be in accordance with the requirements of ACI 350.

F. The clear distance between parallel bars shall not be less than the diameter of the bars and, unless specifically authorized, shall not be less than 1 inch nor less than one and one-third times the maximum size of coarse aggregate specified.

G. Double bars at the top and sides of walls are to be placed in each face, not tied together on each side of the vertical bars.

H. Horizontal bars at the bottom of walls shall be placed not less than 2 inches from the bottom of the wall, nor more than 4 inches from the bottom.

I. Spacings shown as on-center (o.c.) spacings on the Plans shall be the maximum allowed spacing. Where an integral number of bars cannot be placed within the maximum spacing, and the requirements of this section, an additional bar must be provided, which will reduce the spacing below the maximum.

J. Cover: Concrete protection for reinforcement, unless stated otherwise on the Plans, shall have cover as follows:

1. Cast against and permanently exposed to earth: 3 inches

2. All other Concrete: 2 inches

3.04 CUTTING REINFORCEMENT AT EMBEDDED ITEMS

A. Cut no reinforcement which has been placed unless it is absolutely necessary. Reinforcement which must be cut shall be replaced by a like amount of reinforcement, including both size of bars and spacing. Replacement reinforcement shall be spliced into the continuing reinforcement with splice lengths as shown on the Plans.

B. Cutting bars for the placement of embedded items. Reinforcement that must be cut to allow placement of embedded items, such as wall spools, is to be cut only once. The ends of the cut bar that are in the way of the item to be embedded shall be bent to the side to allow the placement of the embedded item. Following placement of the embedded item, the bars are to be bent back to a position near the embedded item.

3.05 TOLERANCES

A. Fabricating and placing tolerances shall be in accordance with ACI 301.

B. Tolerance on concrete cover is ± 1/4-inch.

3.06 WELDING

A. Reinforcement is not to be welded unless specifically shown on the Plans or approved in writing by the Engineer.

B. Where approved as in A., reinforcement to be used is to conform to ASTM A 706 and be welded in accordance with AWS D1.4.

END OF SECTION 03 20 00

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, material and equipment required to construct all walls, footings, slabs, beams, columns and all other items classified as cast-in-place concrete, as shown on the Plans and as specified herein.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 10 00 – Concrete Forming and Accessories

D. Section 03 20 00 – Concrete Reinforcing

E. Section 03 35 11 – Concrete Hardener

1.03 REFERENCE STANDARDS

A. Except where noted otherwise, all concrete and concreting procedures shall conform to applicable sections of ACI 301. Contractor shall have at least one copy of the current edition of this standard available at the site at all times. Contractor is to have at least one copy of the current edition of ACI 305, and ACI 306 available at the site at all times.

B. American Concrete Institute (ACI)

1. ACI 211.1 – Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.

2. ACI 301 – Specifications for Structural Concrete for Buildings.

3. ACI 304.2 – Placing Concrete by Pumping Methods.

4. ACI 305 – Hot Weather Concreting.

5. ACI 306 – Cold Weather Concreting.

6. ACI 318 – Building Code Requirements for Structural Concrete.

7. ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary. (Applies to all structures designed to contain water/wastewater or any structure with internal hydrostatic pressure.)

8. ACI 350.1 Tightness Testing of Environmental Engineering Concrete Structures. (Applies to all structures designed to contain water/wastewater or any structure with internal hydrostatic pressure.)

C. American Society for Testing and Materials (ASTM)

1. C 31 – Standard Method of Making and Curing Concrete Test Specimens in the Field.

2. C 33 – Standard Specification for Concrete Aggregate.

3. C 42 – Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

4. C 94 – Standard Specification for Ready-Mixed Concrete.

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

6. C 138 – Standard Test Method for Unit Weight, Yield, and Air Content (gravimetric) of Concrete.

7. C 143 – Standard Test Method for Slump of Portland Cement Concrete.

8. C 150 – Standard Specification for Portland Cement.

9. C 156 – Standard Test Method for Water Retention by Concrete Curing Materials.

10. C 168 – Definition of Terms Relating to Thermal Insulating Materials.

11. C 172 – Fresh Concrete Sampling.

12. C 231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

13. C 260 – Standard for Air-Entraining Admixtures for Concrete.

14. C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

15. C 412 – Standard Specification for Concrete Drain Tile.

16. C 494 – Standard Specification for Chemical Admixtures for Concrete.

17. C 618 – Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement.

18. D 1751 – Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonrecurring and Resilient Bituminous Types).

19. E 154 – Standard Method of Testing for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.

D. U.S. Army Corps of Engineers (USACE) Handbook for Concrete and Cement

1. CRD – C588 – Expansion Grouts.

E. Federal Specifications (FS)

1. FS-TT-S-00227E – Interim Federal Specification for Sealing Compound: Elastomeric Type, Multi-Component (For Caulking, Sealing, and Glazing in Buildings and Other Structures).

F. Washington State Department of Transportation (WSDOT)

1. Standard Specifications for Road, Bridge, and Municipal Construction.

a. Section 6-02 Concrete Structures.

b. Section 9-01 Portland Cement.

c. Section 9-03 Aggregates.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Mix Designs: Submit mix designs and supporting data in accordance with paragraph 2.12 B.1. for each concrete mix used on the project.

C. Admixture certificates: Contractor shall submit copies of tests showing conformance with requirements specified herein.

D. Epoxy grout and adhesives: Submit manufacturer's data on any epoxy grout or adhesives prior to use.

1.05 QUALITY ASSURANCE

A. Control of materials: All materials indicated to be tested in this section shall be tested by a certified agency and approved for use by Engineer. Tests shall be performed in accordance with International Building Code Section 1905.

1.06 TESTING AGENCY

A. Testing and inspection as described herein shall be performed by a firm in accordance with Section 01 45 11 – Testing, Inspections, Supervision.

PART 2 – PRODUCTS

2.01 CEMENT

A. Cement, except as otherwise specified, shall conform to ASTM C 150 and shall be Type II for all concrete in hydraulic or below grade structures and Type I or II for other cast-in-place concrete. Type I-II cement may be used for all structures.

Cement shall at all times be suitably stored and protected from exposure to the atmosphere. In the event the cement shows signs of deterioration, it shall not be used unless additional tests show that it conforms to the requirements stated above.

2.02 POZZOLAN

A. Fly ash shall conform to ASTM C 618 Class F. Maximum loss on ignition to be 1 percent.

2.03 AGGREGATES

A. Fine and coarse aggregate for concrete shall conform to ASTM C 33.

2.04 WATER

A. Water shall be any potable water, clean and free from injurious amounts of oil, acid, alkali, and organic materials. Water shall meet the requirements set for the in ASTM C 94, Section 4.1.3 "Water".

2.05 ADMIXTURES

A. Water reducing agent: Water reducing admixtures shall comply with ASTM C 494, Types A or F. Admixture shall be free of added calcium chloride. In addition to ASTM requirements, use shall be in strict accordance with the manufacturer's recommendations. Contractor shall use the type best suited for job conditions on the approval of Engineer. Water reducing agent shall be Master Builders “Polyheed N”, “Polyheed 997” low, to mid-range (Type A), or “Glenium 3000 NS” high range (Type F) water reducers, or approved equal.

B. Air entraining agent: Materials proposed for use as air entraining admixture shall conform to ASTM C 260. Air entraining agent added shall result in an entrained air content of 4 percent ± 1 percent unless otherwise noted or specified herein. The air content in the concrete shall be determined by pressure method (ASTM C 231). Master Builders “MB AE 90” or approved equal.

C. Fly ash may be used in concrete mixes. Maximum fly ash content is 150 pounds per cubic yard. Fly ash may replace part of cement content of concrete mix provided that the minimum cement required herein is maintained.

D. A shrinkage-reducing admixture (SRA) may be used to reduce drying shrinkage. Minimum amount of a shrinkage-reducing admixture shall be 1.0 fluid gallon per cubic yard of concrete.

Products:
Masterlife SRA 035 by Master Builders or approved equal.
Masterlife CRA 007 by Master Builders or approved equal.
Eucon SRA-XT by Euclid Chemicals or approved equal.

E. Other admixtures shall not be used unless approved by Engineer prior to use.

2.06 EPOXY BONDING COMPOUNDS

A. Epoxy resin bonding compound shall be "Concresive LPL" as manufactured by DeGussa, “Sikadur" as manufactured by Sika Chemical, or equal. Application of all epoxy bonding compounds shall be in accordance with manufacturer's specifications or instructions.

2.07 GROUT

A. Grout shall be either the non-shrink type, or standard concrete grout class 4000G as specified below.

B. Non-shrink grout shall be a cement-type grout meeting the requirements of ASTM C-1107. Non-shrink grout shall be used where called for on the Plans, and where grout will be placed with a thickness less than 2 inches. Non-shrink grout shall be mixed in proportions to be “flowable”, but not “pourable”. Specimens molded, cured and tested in accordance with ASTM C 109 shall have a minimum compressive strength of 6,200 psi. Grout shall not exhibit visible bleeding.

2.08 MORTAR AND DRYPACK

A. Mortar (drypack) for repair and where called out on the Plans for grouting, shall be composed of non-shrink grout, as above.

2.09 CURING COMPOUND

A. Concrete curing compound shall be of a nature and composition not deleterious to concrete and shall be of a standard and uniform quality ready for use as shipped by the manufacturer. Curing compound shall be of the membrane-forming type. The formulation shall be such that concrete surfaces on which it is applied can be sacked or coated with finish materials such as paints. At time of use, the curing compound shall be in a thoroughly stirred condition. Curing compounds shall not be diluted by addition of solvent or thinners, or be altered in any manner without specific approval of, and in a manner prescribed by, the manufacturer. Curing compound shall be Master Builders or approved equal.

B. Curing compound shall, when tested in accordance with ASTM C 156, be effective in limiting water loss in the concrete test specimens to 3½ percent when applied at the coverage rate recommended by manufacturer.

C. Curing compound shall conform to ASTM C 309 and shall be clear and not discolored. Curing compound and coatings where used, shall be verified by Contractor to be compatible prior to application.

D. Monomolecular film shall be used when conditions are such that surface evaporation is likely. This film shall be applied in accordance with manufacturer's instructions. Master Builders Confilm, or Engineer approved equal.

2.10 VAPOR BARRIER

A. Plastic Vapor Barrier: ASTM E 1745, Class A, with actual tested perm rating of less than 0.100, tensile strength not less than 45 lbf/in, puncture resistance 2200 grams. Include manufacturer's recommended adhesive or pressure-sensitive tape and pipe boots. Subject to compliance with requirements, provide one of the products:

1. Fortifber Corporation, Moistop Ultra 15
2. Insulation Solutions, Inc, Vipor Vaporcheck II 15-mil
3. Raven Industries, Vaporblock 15
4. Stego Industries, LLC, Stego Wrap 15

2.11 WATERSTOPS

A. Waterstops embedded in concrete shall be polyvinyl chloride (PVC) plastic meeting the following minimum requirements:

Tensile Strength	1,800 psi
Elongation	300%
Shore A Durometer	50

B. Test for materials shall be in accordance with ASTM D 412. No reclaimed PVC will be allowed.

C. Waterstop shall be 6 inches wide, 3/8-inch thick heavy-duty type, unless indicated otherwise on the Plans or Specifications. Installation and splicing shall be as recommended by manufacturer. Waterstops shall be Greenstreak #732, Horn Durajoint Type 9, or equal. Split-flange waterstops may not be used unless approved in advance by the Engineer.

2.12 JOINT SEALANT

A. Use joint sealant appropriate for use with concrete, and one which is compatible with any finishes which are to be applied as specified elsewhere. Use polyethylene rope backing where necessary in larger width cracks.

2.13 MIX DESIGN AND CONTROL

A. Concrete

1. Quality: Concrete shall be designated by class with a minimum required 28-day strength. Water/cement ratio shall be varied as specified below. Calculations of water/cement ratios shall include all cementitious materials, including fly ash, in the denominator. The proportions of materials shall be such as to produce a workable, dense, impermeable concrete of the strength required.

    a. Class 5000LS (low shrinkage) concrete shall have a minimum 28-day strength of 5,000 psi. Class 5000LS concrete shall have a maximum water/cement ratio of 0.40, a minimum water/cement ratio of 0.35, contain a minimum of 588 pounds of cement per cubic yard. Class 5000LS used for slabs and interior tank walls shall contain 1 percent to 3 percent entrained air with no air entraining admixture. Class 5000LS used for exterior walls shall contain 5 percent entrained through the use of an air entraining admixture. Type F fly ash may be used in 5000LS concrete to a maximum of 20 percent by weight, of the total cementitious materials. Water-reducing admixtures shall be used as required in Class 5000LS concrete to maintain workability. Class 5000LS concrete shall be used for water-retaining structures and as specified below in the Concrete Schedule.

    b. Class 4000 concrete shall have a minimum 28-day strength of 4,000 psi. Maximum water/cement ratio shall be 0.45. Class 4000 concrete that is not exposed to the elements need not have air entrainment.

    c. Class 4000A concrete shall have a minimum 28-day strength of 4,000 psi, a maximum water/cement ratio of 0.42, air entrainment of 4 percent to 6 percent. Class 4000A concrete shall be used for sidewalks and exterior concrete stairs.

    d. Class 4000G concrete shall have a minimum 28-day strength of 4,000 psi, a maximum water/cement ratio of 0.38, and a maximum aggregate size of 3/8 inch. Class 4000G concrete shall be used for grout, where the thickness of the grout is greater than 2 inches. This does not include grout for clarifiers. 4000G concrete that is used at the bottom of water-retaining structures need not be air entrained. 4000G concrete that will be exposed to the elements shall have air entrainment of 4 percent to 6 percent.

    e. Class 3000 concrete shall have a minimum 28-day strength of 3,000 psi, a maximum water/cement ratio of 0.55, air entrainment is not required for Class 3000 concrete. Class 3000 concrete shall be used for encasement of pipes under structures, and for encasement of electrical duct banks.

2. Consistency: Adequate water shall be used to produce the necessary workability for placement. However, the slump determined in accordance with ASTM C 143 shall not exceed the following values unless water-reducing admixtures or other means are used to obtain larger slumps while maintaining water-cement ratios as specified herein:

Vertical wall sections, columns, beams	4 inches
Footings, slabs	3 inches
Plain unreinforced concrete	4 inches

Class 5000LS concrete used for water-retaining structures and as specified below in the Concrete Schedule, shall have a maximum slump of 8 inches when used in walls, and 6 inches when used for slabs. In addition, Class 5000LS concrete shall have a minimum slump of 4 inches when used for walls. Class 4000G concrete shall have a slump of 2 inches to allow it to be placed as shown on the Plans.

3. Aggregate: Aggregates shall meet the requirements of ASTM C33. In the mix design submittal, identify the borrow source of the aggregate to be used in the concrete for this project. Provide State Department of Transportation pit numbers if available. Alkali-reactive aggregates shall be mitigated by such measures as the addition of Type F fly ash. Coarse aggregate having a maximum particle size of 1-1/2 inches (1-1/2-inch minus) may be used in structures where the concrete cover is specified as 2 inches or greater and reinforcing bar spacing's are greater than 2 inches. Other coarse aggregates shall have a maximum particle size of 3/4-inch (3/4-inch minus).

B. Control tests – Characteristics of the concrete shall be controlled as follows:

1. Mix design: Before beginning concrete work, Contractor shall determine proper proportions of materials for each strength and type of concrete. Mix shall consist of the exact proportions of cementitious material, aggregates, water, and admixtures proposed for the particular concrete mix. Admixtures shall be proportions recommended by the manufacturer to achieve results herein noted. Mix design shall be prepared at the Contractor's expense and shall show the expected strength, corresponding slump, air content, and all ingredient weights, and other physical properties necessary to check each design mix. Where more than one grading of coarse aggregate will be used, tests shall be made for the finest gradation to be used. Mix designs and supporting data shall be submitted in accordance with Section 01 33 00 – Submittals Procedure.

2. Shrinkage Testing: Concrete supplier shall perform drying shrinkage tests for the 5000LS trial batches. Fabricate, cure, dry, and measure specimens in accordance with ASTM C175. The maximum concrete shrinkage for specimens cast in the laboratory shall be 0.025 percent. Test specimens with different amounts of a shrinkage reducing admixture (SRA). If trial batch specimens do not meet the shrinkage requirements, adjust the mix design and retest. Use a mix design for construction that has met the trial batch shrinkage requirements.

3. Slump tests: All slump testing is to be done after any water which is going to be added, has been added at the job site. Following addition of any water, slumps exceeding permitted slumps will be cause for rejection of the load.

PART 3 – EXECUTION

3.01 BATCHING AND MIXING

A. Batching: Concrete shall not be batched on the job unless prior approval is obtained from the Engineer.

B. Transit mixed concrete: Ready-mixed concrete shall be used. Transit mixed concrete shall comply with applicable portions of this specification and ASTM C 94. Batch tickets shall be provided with each truckload of concrete in accordance with ASTM C 94 including type and amount of cementitious material, type and amount of admixtures, total water content by producer, and weights of fine and coarse aggregate. Batch ticket shall also state the maximum amount of water that may be added at the job site without violating the maximum allowable water/cement ratio as specified above for each class of concrete. Water may be added at the job site up to the maximum allowed for the water/cement ratio of the class of concrete being delivered, provided the concrete does not exceed the permitted slump. No water may be added at the job site without authorization from the Engineer. In no case shall water be added without adequate means for measuring and recording the amount added. If water is added, the Engineer may require test cylinders to be taken on the load of concrete to which water was added. These test cylinders are in addition to the test cylinders taken under normal conditions.

3.02 CONCRETE FOR PUMPING

A. Special requirements apply when concrete is to be placed by pumping.

1. Standards – The following standards shall govern:

a. ACI 211.1

b. ACI 304.2R

2. Pumping: Type of pump to be used shall be approved by the Engineer.

3. Mix design shall be in accordance with above standards. An average loss of slump of 1/2 to 3/4 inch per 100 feet of pipeline shall be accommodated in the mix design and batching processes.

4. Aggregates: In concrete that is to be pumped, all aggregate shall fall in the middle of ASTM C 33 gradation limits.

5. Admixtures: Any admixtures used to improve pumpability shall strictly follow Paragraph 2.05 Admixtures, and Paragraph 2.15 Mix Design and Control.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. In general, conform to ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete. Conform to the temperature limitations in “Concrete Temperature” in ACI 301, Section 4, “Concrete Mixtures,” and the International Building Code.

B. Particular care shall be taken with concrete mixes with water/cement ratios less than 0.50 to avoid surface drying. In low humidity, or windy conditions, monomolecular film or fogging shall be used to prevent surface drying and consequent cracking.

C. Cold weather concreting shall be in accordance with ACI 306 R, except as modified herein.

1. Cold weather is defined as a period when for more than 3 days the mean daily temperature drops below 40 degrees F. When temperatures above 50 degrees F occur during more than half of any 24-hour period, the concrete should no longer be regarded as cold weather concrete. Low humidity and windy conditions in the winter require evaporation retarders as noted below under Hot Weather Concreting.

2. Concrete temperatures as mixed and as placed shall be maintained within the recommended temperature ranges for the indicated period.

3. When heating of concrete materials is required, apparatus used shall heat the mass uniformly and not create overheated areas or hot spots. Direct heating devices will not be allowed. Any added moisture shall be taken into account in the mix design.

4. No frozen materials or materials containing ice shall be used. Surfaces with which the concrete is to come in contact shall be free of snow, ice, and frost and have a temperature above freezing.

5. Plans for protecting fresh concrete shall be made well in advance of expected freezing temperatures. All necessary materials and equipment shall be on-site before the first frosts are likely to occur.

6. Protective coverings shall quickly follow the concrete placing. If it is necessary to expose the concrete, only small areas shall be exposed at a time and then only for short periods.

7. Choice of curing method shall consider and be compatible with the cold weather protection method. If heaters are used, they shall be vented to the outside. Water curing during cold weather as defined in this section shall not be permitted.

8. All concrete placed in cold weather shall be protected from freezing for a minimum of 7 days following placement.

D. Hot weather concreting shall be in accordance with ACI 305 R, except as modified herein.

1. Hot weather is defined as any combination of high air temperature, low relative humidity, and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal properties.

2. Contractor shall schedule delivery of concrete so it can be placed promptly upon arrival. Formwork shall be ready to receive concrete. Construction joints shall be properly placed and prepared. Concrete shall not be placed faster than it can be properly consolidated and finished by the personnel and equipment at hand.

3. Flatwork shall be protected from excessive drying during finishing operations, by such means as use of a monomolecular film after placing but before finishing, or fogging upwind of the concrete operation. Each finishing operation shall be performed without delay as soon as the concrete is ready for it. Curing shall be applied promptly and continued without interruption.

4. If ice is used in the mixing water, mixing shall continue until ice is thoroughly melted, but not longer than specified elsewhere in this section.

5. No water shall be added to the mix at site except that water may be added sufficient to adjust to within 1 inch below the specified maximum slump, provided such an addition does not exceed the specified maximum water-cement ratio. Any later addition of water must be approved by Engineer.

E. Protection of concrete construction: All surfaces shall be protected against injury. During the first 72 hours after placing concrete, any wheeling, working or walking on concrete shall not be permitted. All slabs subject to wear shall be covered with a layer of sand or other suitable material as soon as concrete has set. Sisal paper or other similarly tough, waterproof paper may also be used, provided all joints between adjacent strips of paper are carefully sealed. This does not alter requirements for proper curing as specified in Paragraph 3.09, Curing Concrete.

1. No concrete slabs or top surfaces of walls shall be placed during rain unless acceptable protective shelter is provided; and during such weather, all concrete placed within the preceding 12 hours shall be protected with waterproof canvas or other suitable coverings. These shall be provided and kept ready at hand.

2. All concrete construction shall be protected from excessive loading. Installation of mechanical and electrical equipment shall be accomplished by employing shores, bearing plates, frames, cranes and temporary beams.

3.04 VAPOR BARRIER

A. Plastic Vapor Barrier: Place underslab vapor barrier directly over subbase when subbase moisture test results taken prior to slab pour don't exceed the requirements of the manufacture. Install, protect and repair vapor barrier according to the manufacturer's written instructions. Comply with ASTM E1643, "Standard Practice for Selection, Design Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs".

1. Lap joints 6 inches and seal with manufacturers recommended tape and seal all penetrations in accordance with manufacturer's written instructions.

3.05 CONSTRUCTION JOINTS

A. General: Concrete in each unit of construction shall be placed continuously. Contractor shall not begin work on any part unless his/her facilities and forces are sufficient to complete the unit without interruption. Before new concrete is deposited on or against concrete which has set, the forms shall be re-tightened and the surface of the set concrete shall be thoroughly cleaned of foreign matter. Concrete surfaces on which concrete is to be deposited shall be wetted, then all free moisture shall be removed. No cold joints are allowed in watertight construction unless a waterstop is used at the joint.

B. Construction: All construction joints shall be formed as described on the Plans. All construction joints in basements and water-retaining structures shall be made watertight.

C. Locations: Construction joint locations shall be shown on shop drawings as required above, and shall be as approved by the Engineer. Construction joints shall be kept to a minimum consistent with sound construction practices.

D. Water-tightness: PVC waterstops shall be provided in construction joints where watertight construction is required. Waterstops shall be held firmly in proper position during concreting operation. Watertight construction will be required as follows:

1. Joints in all parts of structures exposed to ground or water on one side with areas to be occupied by non-submerged equipment or personnel on the other.

2. All joints of tanks and channel walls that are or may be subjected to water pressure.

E. If joint is not watertight after construction, the Engineer may require any of the following:

1. Grouting of the joint by drilling grout holes to the center of the structural unit and forcing epoxy grout into the joint under pressure.

2. Cutting of a bevel groove on the water side of the joint. The groove shall be 1/2 to 3/4 inch in width and depth and shall be filled per manufacturer's instructions with cementitious waterproofing as directed by the Engineer.

3.06 CRACK CONTROL JOINTS

A. Crack control joints shall be formed as described in the Plans by saw-cutting or as otherwise described in the Plans. All saw cutting shall be done within 24hours of the pour.

B. Sidewalks. Sidewalks shall have tooled crack control joints at a spacing equal to the sidewalk width, with a maximum spacing between tooled joints of 10 feet.

3.07 INSERTS AND EMBEDMENTS

A. Inserts: Where pipes, castings, or conduits are to pass through walls, Contractor shall place such pipes or castings in the forms before pouring concrete.

Additional reinforcement shall be provided around such openings as shown on the Plans or directed by Engineer. Pipes, castings, or conduits as specified shall be grouted in place by pouring in grout under a head of at least 4 inches. Grout shall be poured or rammed into place to fill completely the space between pipes, castings, or conduits, and sides of the opening so as to obtain the same water tightness as required for the wall itself.

B. Embedment: Contractor shall set accurately and hold in exact position in the forms all embedded items until concrete is poured and set. Contractor shall furnish and set accurately all inserts and anchor bolts necessary for attaching piping, valves, and equipment.

3.08 PLACING CONCRETE

A. Concrete shall not be placed until forms and reinforcement have been accepted by Engineer. Concrete shall be conveyed from mixer to place of final deposit as rapidly as possible by methods which will prevent separation or loss of ingredients. It shall be deposited in the form as nearly as practicable in its final position so as to maintain a plastic surface approximately horizontal. Concrete shall not be dropped more than 4 feet unless a suitable chute or tube is used. Forms for walls or other sections of considerable height shall be provided with openings, or other devices which will permit the concrete to be placed in a manner which will avoid accumulations of hardened concrete on forms or metal reinforcement. Under no circumstances shall concrete that has partially hardened be deposited in the work. Temporary joints shall not remain exposed for more than 45 minutes before adjacent concrete is placed.

B. Immediately after depositing, concrete shall be thoroughly compacted by means of high-frequency mechanical internal vibrators which shall oscillate at 7,000 cycles per minute minimum.

3.09 PLACING GROUT

A. The substrate on which the grout is to be placed shall be bush hammered to provide a roughened surface. All loose material shall be removed, and the substrate shall be clean. The substrate is to be thoroughly wetted to prevent wicking out of moisture from the grout. If the grout does not contain an adhesive admixture, one shall be applied prior to placing the grout.

B. Grout at the bottom of water-retaining structures is to be finished with Finish FF as specified herein.

C. Grout used for walking surfaces shall be finished with Finish LB, and shall have hardener applied to the surface.

D. Grout is to be cured as required below.

3.10 CURING CONCRETE

A. Immediately following placement, concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury. Materials and methods of curing shall be approved by Engineer. Wet curing shall continue for not less than 7 days.

1. Approved methods include ponding or continuous fog spray, and liquid membrane-forming compounds as described below, except as specified elsewhere in this section. Intermittent wetting of concrete is not permitted. Where wet cure is used, it shall be continuous, and shall prevent the surface from ever drying out for the duration of the 7-day cure period.

   Application of liquid membrane-forming compound shall conform to ASTM C 309. Material shall restrict the loss of water to not more than 0.55 kg/square meter or surface in 72 hours when used at a coverage of 400 square feet per gallon and tested in accordance with ASTM C 156. The curing compound shall be used at a minimum rate of one gallon per 400 square feet.

2. Formed surfaces shall be kept moist prior to stripping forms. Immediately following stripping of forms, concrete shall be cured by the curing compound method.

3. Slabs shall be kept wet for 24 hours. Then cured by the curing compound method, or by wet methods as above. If the temperature drops below freezing, protect the slab as required to prevent freezing for 7 days.

4. Curing compounds shall not be used on surfaces to receive waterproofing membranes.

3.11 REPAIR OF CONCRETE CONSTRUCTION

A. Immediately after removal of forms, all concrete shall be inspected and all porous concrete, rough sections or rock pockets containing loose materials shall be repaired by cutting back to solid concrete and making an opening of such size and shape as will form a 1-inch key for a cement mortar fill. Before the mortar is applied, the surface of the existing concrete shall be coated with an epoxy bonding compound. All form tie holes and imperfections greater than one-fourth cubic inch shall be filled. Fill for small imperfections and form ties shall bond thoroughly to concrete and be of an equivalent quality as the surrounding concrete. Fill shall form a dense plug impervious to water. Where the area or volume of defective concrete is large, it may be repaired by reforming the surface and filling the opening with concrete. For such repairs, the concrete surface shall be coated with an epoxy bonding compound. The exposed surface shall be neatly finished to match the surface and texture of adjacent concrete. All patches shall be cured as approved by Engineer.

3.12 FINISH OF FORMED SURFACES

A. Finishes for surfaces of individual structures and portions of structures is to be as detailed in the Concrete Schedule herein. Any concrete not specifically called out in the Concrete Schedule shall receive Finish B, unless otherwise agreed to by the Engineer.

B. Formed surfaces

1. Finish A: Finish A shall be a Grout-cleaned finish in accordance with ACI 301.

   All fins, ridges and other projecting irregularities shall be ground smooth. All concrete to receive Finish A shall be sandblasted to provide a rough surface for the adherence of the grout, and to remove curing compounds. The surface shall be thoroughly wetted and a bonding agent applied to promote adherence of the slurry mixture to the hardened concrete. All surface imperfections shall be covered with the slurry mixture, leaving a blemish-free finish. The sack-rubbed finish shall be cured by continuous wetting, or by use of curing compound if the curing compound does not cause any blotching or unevenness in the finish.

   Where Finish A is called for, it shall extend to 2 feet below the water surface, or 1 foot below the ground surface, as applicable.

2. Finish B: Hardened concrete shall be blasted with high-pressure (3000 psi or greater) water stream to remove any loose concrete. Surface imperfections greater than 1/4-inch dimension including form tie holes shall be pointed up with cement type grout, flush with the concrete surface.

3. Finish C: Surfaces imperfections greater than 1/2-inch dimension and form tie holes shall be pointed up with cement type grout flush with the concrete surface. Finish C surfaces on buildings and structures with habitable spaces below grade that are to be backfilled are to be coated with asphalt emulsion below finished grade.

4. Top of walls

   a. Strike concrete smooth. Round corners with steel radius tool of 1/2-inch radius or provide chamfer as specified herein.

   b. Float to texture comparable to formed surfaces.

   c. Provide rubbed finish per Finish A wherever adjacent formed surface is scheduled to receive Finish A.

3.13 SLAB FINISHES

A. Slab finishes shall be in accordance with ACI 301, Paragraph 11.7, Finishes. See concrete schedule for types of finish required for each structure.

1. Finish LB. Light broom finish.

2. Finish MB. Medium broom finish. This finish is used for sidewalks and stair landings outdoors.

3. Finish FF. Float finish. Concrete is bull floated, machine floated, and then hand troweled to a smooth finish with a long-handled steel trowel.

4. Finish ST. Burnished steel trowel. Following floating, concrete is troweled in several passes until a ringing sound is heard.

5. Finish RF. Rake Finish. Slabs to receive grout toppings are to be raked to a rough finish with a rake, or rolled with an expanded metal roller that leaves a rough finish on the concrete. Prior to applying the grout topping, surface is to be high-pressure washed as in Finish B, above.

3.14 SURFACE TOLERANCES

A. Finished concrete surfaces shall be true planes within 1/8 inch in 10 feet as determined by a 10-foot straightedge placed anywhere on the slab in any direction. Wall tops shall be level, with a maximum deviation from the elevation shown on the Plans of 1/4-inch.

B. Slopes to drains shall be true to line. All slopes to drains are to have an even slope from the high point to the inlet to the drain, with no changes in slope, such that “birdbaths” do not form. Slope all exterior and interior work including stair landing and individual treads. Stair landings and treads to be sloped 1/8 inch per foot. Minimum slope to drains where not otherwise specified on the Plans is 3/16 inch per foot.

3.15 FIELD TESTING

A. Concrete will be sampled and tested in accordance with ACI 301 and supplements during the progress of concrete work. Slump and air content tests shall accompany all test cylinders for strength. Engineer shall be notified 48 hours ahead of all scheduled pours. Contractor shall notify Engineer 24 hours in advance of any cancellation of pours.

1. When there is a question as to quality of the structure because of cylinder strength test failures, strength tests will be made on specimens taken from the structure, and testing in accordance with ASTM C 42 will be required.

2. Samples of concrete will be obtained in accordance with ASTM C 172 and will be transported to a place on the site where air and slump tests can be made and cylinders stored without being disturbed for the first 24 hours. Cylinders for strength tests will be made in accordance with ASTM C 31 and ASTM C 94.

3. Concrete failing to meet the requirements of these specifications shall be deemed unacceptable and shall be removed from the structure if so required by the Engineer.

B. Cylinders will be made as required by ACI 301, and supplements for strength tests following applicable ASTM standards. Cylinders shall be cured in the laboratory. If a specimen shows evidence of improper sampling, molding or testing, it will be discarded.

C. Slump and air tests shall be made following the procedure in ASTM C 143. Slump tests shall be made for concrete from any batch from which strength tests are made.

1. If the measured slump falls outside limits specified, a check test will be made immediately on another portion of the same sample. In the event of a second failure, concrete will be considered to have failed to meet requirements of the specifications and shall be unacceptable.

D. Air content tests shall be made in accordance with ASTM C 231.

1. If the measured air content falls outside limits specified, a check test will be made immediately on another portion of the same batch. In the event of a second failure, concrete will be considered to have failed to meet requirements of the specifications and shall be unacceptable.

3.16 WATER LEAKAGE TESTS

A. Water-tightness, testing and repair: All water/wastewater/sludge holding structures, concrete tanks and channels which will be subjected to hydrostatic pressure shall be tested for water-tightness in accordance with ACI 350.1. Tests shall be made prior to application of waterproofing or protective coatings. Tests shall be performed after the concrete has been cured and obtained its design strength, and before backfill or other work which cover the concrete surfaces of the walls is begun. Testing will be done to each water-holding cell individually. Testing of water channels will be done individually to test both the water-tightness of the channel, and any gates or other water-controlling mechanisms.

B. Testing shall consist of filling the tank with water or chlorinated plant effluent to the maximum operating water surface. After these structures have been kept full for 48 hours, it will be assumed for the purposes of the test that the absorption of moisture by concrete in the structure is complete. The change in water surface shall then be measured for a 24-hour period. During the test period, all exposed portions of the structure shall be examined for dampness or leaks, and all visible leaks and damp spots shall be marked; such leaks or damp spots shall later be patched or corrected in manner acceptable to the Engineer prior to additional leakage testing. If the drop-in water surface in the 24-hour period exceeds one gallon per thousand gallons of volume of liquid contained in the water holding structure, after accounting for evaporation and precipitation in open basins, or if damp spots or any seepage is present on the walls or other areas exposed to view, the leakage shall be considered excessive and the leakage test will be considered to have failed. Evaporation shall be determined by floating an evaporation pan in the structure during the test period.

C. If the leakage is excessive or if damp spots and observed seepage are present on exposed surfaces, the water-holding structure shall be drained, all leaks and damp spots previously marked shall be repaired to the satisfaction of the Engineer. Cracks shall be “square cut” and sealed with epoxy joint sealer in accordance with manufacturer’s instructions. Any leakage or seepage through the joints shall be repaired to the satisfaction of the Engineer. The Contractor’s method of repair shall be subject to the review and approval of the Engineer.

D. The water-holding structure shall then be refilled and again tested for leakage, and this testing and repair process shall be repeated as many times as necessary until the leakage test passes. This process shall be continued until the drop in water surface in a 24-hour period with the basin full is less than one gallon per thousand gallons of the volume of liquid held in the basin and all damp spots and seepage disappear when the structures are full of water. All repairs of faulty workmanship and materials, and additional tests, shall be made by the Contractor in an acceptable manner, at no additional cost to the Owner. Both the correction for excessive leakage and removal of the damp or wet spots on walls shall be required to pass the leakage test.

E. The purpose of this test is to determine the integrity of the finished concrete and to show that exposed wall surfaces are visually acceptable. Therefore, all other equipment, i.e., stop gates etc., or temporary bulkheads should be made watertight prior to the test.

F. All costs for testing the water-holding structures shall be borne by the Contractor. Water required for the testing shall be provided by the Contractor; or chlorinated plant effluent may be utilized if available. If plant effluent is used the Contractor shall provide all necessary pump(s) and piping. The water shall be disposed of back into the plant treatment system in accordance with the plant supervisor’s instructions. Water shall be disposed of so as not to create a nuisance.

3.17 CONCRETE CLASS AND FINISH SCHEDULE

CONCRETE SCHEDULE				
Structure	**Concrete Class**	**Finish**	**Hardener**	**Comments**
Sidewalks, Outdoor Landings, and Equipment Pads	4000A	MB	Y	
Buildings				
Slab	4000	ST	Y	
Walls	4000A			
both sides, below grade		C	N	
both sides, above grade (exposed)		A	N	
Water-Containing Process Structures				
Slab	5,000LS	FF	N	
Walls	5,000LS			
exterior side, below grade		C	N	
exterior side, above grade (exposed)		A	N	
interior (water) side		B	N	
Grout	4000G	ST	N	

END OF SECTION 03 30 00

SECTION 03 35 11 – CONCRETE HARDENER

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work covered by this section includes all labor, materials, and equipment required for surface preparation and application of concrete hardener as indicated on the Plans and as specified herein.

B. Concrete hardener is to be applied to all concrete floors inside buildings, and as shown on the Concrete Schedule in Section 03 30 00 – Cast-In-Place Concrete. Hardener is not required inside water-retaining structures.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 30 00 – Cast-In-Place Concrete

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. D3278 – Standard Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus.

2. D2369 – Standard Test Method for Volatile Content of Coatings.

3. D4060 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.

4. D1475 – Standard Test Method for Density of Liquid Coatings, Inks and Related Products.

5. D1545 – Standard Test Method for Viscosity of Transparent Liquids by Bubble Time Method.

6. D3960 – Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit the following in accordance with Section 01 33 00 – Submittals Procedure:

1. Technical Data Sheets: For concrete hardener system, Contractor shall submit a technical data sheet from the manufacturer. The technical data sheet shall at minimum provide the material name, manufacturer name, product name and number, material specification, recommended coverage and thickness.

2. Material Safety Data Sheets (MSDS).

3. Copy of warranty to be issued.

PART 2 – PRODUCTS

2.01 CONCRETE HARDENER SUPPLIER

A. This section is based on Eco-Hard-N-Seal™ concrete hardener by Tennant Company, P.O. Box 1452, Minneapolis, MN 55440, (800) 228-4943. Equivalent products are acceptable with Engineer's approval. Also approved for use is Dayton Superior Day-Chem Sure Hard (J-17).

B. The concrete hardeners specified herein may be used as the curing compound on new concrete specified elsewhere in these specifications.

2.02 DELIVERY, STORAGE AND HANDLING

A. Store materials in dry, enclosed area with adequate protection from moisture. Keep temperature of storage area between 65°F (18°C) and 90°F (32°C).

B. Deliver all materials to the job site in original, new, and unopened packages and containers bearing manufacturer's name and label.

1. Provide labels on each container with the following information:

a. Name or title of material.

b. Federal Specification number, if applicable.

c. Manufacturer's stock number.

d. Manufacturer's name.

e. Contents by volume.

f. Thinning instructions, if any.

g. Application instructions.

C. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application in a clean condition, free of foreign materials and residue.

2.03 JOB CONDITIONS

A. Do not apply when conditions are such that dust, dirt, or other deleterious substances which may impair the quality of coats or the finish are present or will be present before the coating is fully cured.

B. Comply with manufacturer's recommended limitations for ambient and surface temperature and humidity. No painting is to be done when the relative humidity exceeds 85 percent.

C. Comply with manufacturer's recommendations for minimum and maximum times between applications.

PART 3 – EXECUTION

3.01 PREPARATION

A. Application can begin after the final concrete trowelling or anytime thereafter.

B. No preparation process is required for newly placed concrete.

C. Remove coating or membranes from existing concrete with one of the following methods:

1. Mechanical – Sand floors.

2. Chemical – Scrub thoroughly with TENNANT 654. Remove curing membranes with TENNANT 530/531/528. Remove paint and coatings with TENNANT 510.

3.02 APPLICATION

A. Apply in accordance with Manufacturer's written specification.

1. Assemble equipment.

2. Mix Eco-Hard-N-Seal™ before using. For new concrete: Spray on the surface with a low-pressure sprayer immediately following the finishing operation. Apply Eco-Hard-N-Seal™ at an average coverage rate of 200 square feet per gallon to the entire surface as soon as the surface is firm enough to walk on and before hairline and temperature cracking begins. Keep the entire surface wet with Eco-Hard-N-Seal™ for 30 minutes by brooming excess material onto the dry spots or by respraying them immediately. After 30 minutes, squeegee or broom all puddled excess of Eco-Hard-N-Seal™ so that any remaining material penetrates into the surface. For old concrete: (Average or Broom Trowelled Concrete) Saturate the surface with Eco-Hard-N-Seal™ at an average coverage rate of 200 square feet per gallon. If dry spots appear, broom all puddled or excess Eco-Hard-N-Seal™ on to them or respray them immediately so that the entire surface is wet for 30 minutes. After approximately 30 minutes, the floor will become slippery. Add more water to the solution, and work it in using a disc machine or automatic scrubber.

3. Scrub and rinse 2-4 hours after application to ensure removal of all residue. White residue upon drying indicates inadequate rinse. Repeat rinse step if necessary. Floor may be open to traffic after it has dried. Apply a second application using the same procedure as before, if there is very little residue remaining after the first application. Check Floor: Texture of floor should feel smooth and appear somewhat glossy. WAIT: Allow to dry 12 hours before trafficking.

4. CAUTION: TENNANT coatings provide a smooth, non-porous surface. Immediately clean liquid spillage or soilage on coated surfaces to avoid a slippery condition. Use TENNANT grit in slip-hazard areas.

3.03 PROTECTION

A. Close job site to traffic for a period of 12 hours after sealing application.

END OF SECTION 03 35 11

DIVISION 05 – METALS

SECTION 05 50 11 – MISCELLANEOUS METALS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, materials and equipment for the fabrication and erection of all metal fabrications shown on the drawings and as specified including metal work associated with electrical and instrumentation installations.

B. Work includes, but is not limited to, embedded and non-embedded metal work including structural steel and aluminum shapes, clip angles, sheet steel, rungs, tubing, rods, guides, inserts, brackets, anchor bolts, bracing and supports, hangers, stair treads, fixed ladders, access doors, and metal workbenches for all related sections.

C. Work of this section also includes supply and installation of fabricated aluminum ladders and appurtenances, as specified and shown on the Plans.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 10 00 – Concrete Forming and Accessories

D. Section 03 20 00 – Concrete Reinforcing

E. Section 03 30 00 – Cast-In-Place Concrete

F. Section 05 52 11 – Aluminum Railings

G. Section 05 53 11 – Aluminum Gratings

H. Section 07 41 11 – Metal Roof and Wall Panels

I. Section 07 62 00 – Sheet Metal Flashing and Trim

J. Section 07 92 00 – Joint Sealants

K. Section 08 11 13 – Hollow Metal Doors and Frame

L. Section 09 90 00 – Painting and Coating

M. Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)

N. Division 26 – Electrical

O. Division 33 - Utilities

P. Division 40 - Process Interconnections

Q. Division 46 – Water and Wastewater Equipment

1.03 REFERENCE STANDARDS

A. American Iron and Steel Institute (AISI)

B. American Society for Testing and Materials (ASTM)

1. A 36 – Structural Steel.

2. A 53 – Pipe, steel, black and hot-dip, zinc-coated, welded and seamless.

3. A 123 – Standard Specification for Zinc (Hot Dip Galvanized) coatings on Iron and Steel Products.

4. A 153 – Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.

5. A 167 – Stainless and heat-resisting chromium-nickel steel plate, sheet and strip.

6. A 386 – Zinc coating (hot dip) on assembled steel products.

7. A 307 – Carbon steel externally threaded standard fasteners.

8. A 366 – Steel, carbon, cold-rolled sheet commercial quality.

9. A 500 – Hot formed welded and seamless carbon steel structural tubing.

10. A 526 – Steel sheet, zinc-coated (galvanized) by the hot-dip process, commercial quality.

11. A 780 – Standard Practice for Repair of Damaged Hot Dip Galvanized Coatings.

12. B 308 – Aluminum alloy standard structural shapes, rolled or extruded.

13. F 468 – Nonferrous bolts, hex cap screws, and studs for general use.

14. Additional ASTM Standards as called for in the Contract Drawings.

C. American Welding Society (AWS)

D. National Association of Architectural Metal Manufacturers (NAAMM).

E. The Society for Protective Coatings (SSPC):

1. SSPC-Guide 14 – Guide for the Repair of Imperfections in Galvanized or Inorganic Zinc Coated Steel Using Organic Zinc Rich Coating.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product data: Submit manufacturer's descriptive literature and installation instructions for the following:

1. Fasteners;

2. Grouts;

3. Galvanizing repair paint;

4. Ladder Rungs

5. Stair Treads

6. Access Doors

C. Shop drawings: Submit shop drawings of metal fabrications in accordance with Section 01 33 00 – Submittals Procedure.

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners and accessories.

2. Include erection drawings, elevations and details where applicable.

3. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths. Include data for welding materials and methods to be used.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver any steel items, other than those to be encased in concrete, which have not received either a galvanized, painted or anodized surface treatment, or are constructed of stainless steel.

B. Store job site metals on blocks above snow, mud, and soil. After erection, remove any weld spatter, oil and grease. Cover items with cover that allows air movement but keeps out moisture.

PART 2 – PRODUCTS

2.01 FABRICATION, GENERAL

A. Verify dimensions on site prior to shop fabrication.

B. Fabricate items with joints neatly fitted and properly secured.

C. Fit and shop assemble in largest practical sections, for delivery to site.

D. Exposed mechanical fastenings shall be flush countersunk screws or bolts, unobtrusively located consistent with design of structure, except where specifically noted otherwise.

E. Make exposed joints flush butt type hair line joints where mechanically fastened.

F. Supply components required for proper anchorage of metal fabrications. Fabricate anchorage and related components of same material and finish as metal fabrication, unless otherwise specified or scheduled herein.

G. Thoroughly clean surfaces of rust, scale, grease and foreign matter prior to prime painting, galvanizing, anodizing or buffing.

H. Do not shop prime surfaces to be embedded in concrete. Primer is part of paint system specified in. Galvanized surfaces to be painted may be shop primed at Contractor's option.

2.02 CORROSION PROTECTION

A. All ferrous metals except stainless steel that are not entirely embedded in concrete shall be hot-dip galvanized after fabrication. All other structural steel and miscellaneous steel items not specifically described elsewhere shall be hot-dip galvanized.

2.03 MATERIALS, GENERAL

A. Steel and Iron

1. Carbon steel shapes ASTM A36. Plates and bars: ASTM A36. Wide flange shapes: ASTM A992, Grade 50.

2. Steel pipe and tubing:

a. Pipe: ASTM A53, Grade B, Type E or S, Schedule 40 unless indicated otherwise.

b. Square or rectangular: ASTM A500, Grade C, welded and seamless.

3. Steel sheet: ASTM A366 if not galvanized, ASTM A526 if galvanized.

4. Finish: All ferrous material not encased in concrete shall be hot-dip galvanized or stainless steel.

B. Aluminum

1. Aluminum: ASTM B308, Type 6061 T6 unless a different type is called for in an individual part of this specification.

2. Finish: AA-C22-A41, Class I unless indicated otherwise.

C. Stainless steel: ASTM A 167 Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

1. Bolts: ASTM F593-95 Alloy AISI Type 316.

2. Nuts: ASTM F594-91 Alloy AISI Type 316.

2.04 FASTENERS

A. General:

1. Wet exposure. All the following are considered a wet exposure and shall be stainless steel:

a. All fasteners which are in contact with water or sewage.

b. Above open channels or tanks containing water or sewage.

c. Attached to a tank containing water or sewage.

2. Unless otherwise specified on the drawings, expansion bolts or drilled-in adhesive anchors may be substituted for cast-in anchor bolts in concrete or masonry base materials.

3. Drilled-in adhesive anchors are to use parallel tubes of resin and hardener, dispensed through a mixing tube which ensures proper mixing and eliminates any possibility of measuring errors. The mixed adhesive is to be injected directly into the hole drilled in the base material. Drill sizes and techniques are to be per manufacturer’s recommendations. No polyester or vinyl ester-based resins are to be used. Drilled holes are to be cleaned out prior to placing the adhesive.

4. An appropriate anti-seize compound, as recommended by the fastener manufacturer, shall be used on all stainless-steel threaded bolt connections to prevent galling during installation.

B. Metal to metal:

1. Steel to steel: Except wet exposure as noted above, use ASTM A325, Grade A, hex head, hot-dip galvanized. All bolts 3/8-inch diameter or larger are to be either hot-dip galvanized or stainless steel. Bolts smaller than 3/8-inch diameter may be zinc plated bolts.

2. Aluminum to aluminum: ASTM F468.

C. Metal to concrete:

1. Anchor bolts: ASTM A307, Grade A, hex head, hot-dip galvanized. All embedded anchor bolts are to be standard bolts with hex head. Do not use “J” bolts.

2. Anchor bolts, for submerged or intermittently submerged applications: Stainless steel; ANSI B 1.1 threads.

3. Expansion bolts: Meet Federal Specification FS FF-S-325, Group II, Type 4, Class 1. Material is to be stainless steel as noted under “General”, above. Manufacturer: Hilti, Kwik Bolt TZ, or equal. Equality to be determined based on allowable loads in the ICBO or ICC report for the proposed substitute.

D. Metal to wood:

1. Bolts: ASTM A307, Grade A, hex head, hot-dip galvanized, except stainless steel where noted on drawings.

2. Lag screws: FS FF-B-561, hot-dip galvanized coated for steel, stainless steel for all other.

E. Metal to hollow construction: Toggle bolts, FS FF-B-588, (hot-dip galvanized).

F. Powder-actuated fasteners: To be used where called for on the drawings. Galvanized for steel; stainless steel for all other.

G. Washers: Provide washers of the same material and finish as the bolt or lag bolt in the following locations:

1. Under all nuts.

2. Under bolt heads except in steel-to-steel connections.

H. Lock washers: Provide spring steel helical lock washers, of the same finish as the bolt, under nuts and bolt heads of connections subject to vibration.

2.05 WELDING

A. Perform welding in accordance with pertinent recommendations of the American Welding Society. Use electrodes and methods recommended by manufacturer of material being welded, or as shown on the drawings. Type, size and spacing of welds in accordance with reviewed shop drawings.

1. Welding shall be done by operators who have been qualified by tests as prescribed in the AWS in “Standard Qualification Procedure” to perform the type of work required. The quality of welding shall conform to AWS “Code for Arc Welding in Building Construction,” Section 4 Workmanship.

B. Welds behind finished surfaces: Use methods to minimize distortion and discoloration of finished surface.

C. Remove flux and slag from both sides of welds.

D. Grind accessible welds smooth.

E. Buff or polish welded surfaces which will be exposed to view in the finished work to match and blend with adjacent parent material.

F. Complete welding before galvanizing, anodizing or painting.

2.06 GALVANIZING REPAIR PAINT

A. High zinc dust content paint, meeting the requirements of SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

B. Surface Treatment – Shop Applied

1. Galvanized surfaces: Galvanize steel surfaces in accordance with ASTM A123, A386 and A526.

2. Steel Surfaces

a. Paint in accordance with paint system in Section 09 90 00 – Painting and Coating.

b. If fabricator uses different primer, it must be compatible with finish coating specified in Section 09 90 00 – Painting and Coating.

C. Surface Treatment – Field Applied

1. Cutting or drilling in the field will not be allowed unless it has been approved by the Engineer.

2. Galvanized surfaces: Items that must be drilled or cut in the field shall be coated with galvanizing repair paint before installation. Field welded items shall be hot-stick galvanized after welding.

3. Painted surfaces: Damaged shop primed surfaces and all field priming and finish painting shall be done as specified in Section 09 90 00 – Painting and Coating.

2.07 HANGER SYSTEMS

A. All hanger systems on this project are to be as manufactured by Unistrut Corporation standard shapes and accessories or approved equal. All such shapes and accessories must conform to the same ASTM specifications as the standard Unistrut items. See drawings for particular configurations and sizes.

B. It is the responsibility of the particular trade using this system as support to determine the appropriate units and attachments and accessories required for the proper completion of their work. Attachment to the building structure, however, shall be limited to that shown on the drawings. Additional ceiling penetrations or other attachment must have prior approval of the Engineer. See Division 07 – Thermal and Moisture Protection for sealant around ceiling penetrations.

C. All channel shapes shall be hot-dipped galvanized in accordance with ASTM A-123 or A-153. All parts, screws and nuts shall be hot dip galvanized or stainless steel.

D. Refer to Division 40 – Process Interconnections and the Plans for pipe support requirements and specifications.

2.08 ALUMINUM LADDERS

A. All ladders shall conform to IBC and OSHA/WISHA standards. See Plans for standard details, types and locations.

B. Submit shop drawings and product data on all ladders prior to fabrication.

C. Manufacturers: UPNOVR Inc./ACL Industries, Model U-505, Aluminum Ship's Ladder Folding Type with rail extension for mezzanine access, or Engineer approved equal.

D. Materials: Folding type aluminum ship's ladder for hatch and mezzanine access shall have the following design features and material properties:

1. Operation: Folding ladder to store against wall with stringers in vertical position. Top of ladder to pivot with sliding hinge assembly with pin to move ladder to inclined position.

2. Stringers (Siderails): Aluminum channel 3-inch X 1-inch, with non-skid rubber feet at bottom of stringers.

3. Treads: Aluminum 1-1/4-inch square tubing double rung with corrugated surfaces, 2-foot-0-inch wide.

4. Top Mounting Bracket: Fabricated from 3-inch x 1/4-inch aluminum plate.

5. Handrail: 1-1/4-inch aluminum pipe.

6. Height: Reference Plans.

7. Angle of Inclination: 75 degrees.

8. Finish: Mill finish aluminum.

E. Fabrication: Ladders shall be completely fabricated ready for installation before shipment to the site. Handrail components are completely fabricated ready for field assembly to the ladder before shipment to the site.

2.09 METAL STAIR TREADS

A. Bar grating stair treads are to be manufactured by McNichols Company, Model GW with Type B checker plate nosing. Equivalent products are acceptable with Engineer's approval.

B. Stair treads are to be pre-manufactured treads designed to support a 300-pound concentrated load or 100 psf.

C. Tread Size:

1. Height: 2 inches.

2. Depth: Nominal 12 inches.

3. Width: See stair details on Plans.

D. Construction:

1. Bearing Bar Thickness: 3/16 inch.

2. Bearing Bar Spacing: 1 3/16 inch.

3. Cross Bar Spacing: 4 inches.

4. Surface Texture: Smooth.

5. Nosing: Checkered.

6. Finish: Mill finish aluminum.

E. Fasten stair treads to carriages with bolts or welds as recommended by the manufacturer to support the loads listed above.

F. All stair treads for the project are to be the same style, and be from the same manufacturer.

PART 3 – EXECUTION

3.01 INSPECTION

A. Installer must examine the areas and conditions under which miscellaneous metal items are to be installed and notify the Contractor in writing of conditions detrimental to the timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner satisfactory to the installer.

3.02 PREPARATION

A. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors which are to be embedded in concrete or masonry. Coordinate delivery of such items to project site.

3.03 ERECTION

A. Obtain Engineer's written permission prior to on-site cutting, welding, or making other adjustments which are not part of scheduled work.

B. Install items square and level, accurately fitted and free from distortion or defects.

C. Make provision for erection stresses by temporary bracing. Keep work in alignment.

D. Replace items damaged in course of installation.

E. Grouting (see Section 03 30 00 – Cast-In-Place Concrete).

F. After installation, touch up scratched and damaged prime painted and galvanized surfaces.

1. Use same primer as used for shop priming of painted surfaces.

2. Use galvanizing repair paint for galvanized surfaces. Use hot-stick galvanizing for field-welded areas, and for damaged areas that are classified as a “wet use” above at Section 2.04 A. 1.

3.04 LADDER INSTALLATION

A. Install ladders in accordance with the manufacturer's instructions and recommendations. Coordinate with installation of roof deck and other substrates to receive accessory units, roof insulation, roofing and flashing, as required, to ensure that each element of the Work performs properly.

B. Clean exposed metal surfaces according to Manufacturer's instructions. Touch up damaged metal coatings.

END OF SECTION 05 50 11

SECTION 05 52 11 – ALUMINUM RAILINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, materials, and equipment for the installation of non-welded aluminum guardrails and handrails.

B. Railings as used in this section shall include handrails at stairways, and guardrails as required by the International Building Code and Washington Industrial Safety and Health Act (WISHA) regulations. All guardrails and handrails shall meet the requirements of the International Building Code (IBC), Section 509, and OSHA. Guardrails and handrails as required by IBC and WISHA shall be furnished and installed at no additional cost whether or not they are explicitly shown on the Plans.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 30 00 – Cast-In-Place Concrete

C. Section 05 50 11 – Miscellaneous Metals

1.03 REFERENCE STANDARDS

A. International Building Code, 2021 Edition.

B. Washington Industrial Safety and Health Act (WISHA).

C. American National Standards Institute (ANSI).

1. A21.1 Safety Requirements for Floor and Wall Openings, Railings and Toe Boards.

D. American Society for Testing and Materials (ASTM).

1. B 221 Specifications for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.

2. B 429 Specifications for Aluminum-Alloy Extruded Structural Pipe and Tube.

E. Aluminum Association (AA).

1. SAA-46 Standards for Anodized Architectural Aluminum.

F. National Association of Architectural Metal Manufacturers (NAAMM).

1. Pipe Railing Manual - ANSI/NAAMM AMP 521-95.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product data:

1. Submit manufacturer’s technical product data, installation instructions. Include highlighted data substantiating that materials comply with requirements.

C. Shop Drawings: Submit drawings for fabrication and installation of aluminum railing system.

1. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.

D. Furnish (1) sample of the following:

1. Extruded aluminum pipe.

2. Extruded aluminum toe board.

E. Test Reports: Specifying that all products comply with performance requirements specified within this section.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Components and installation are to be in compliance with state and local code authorities.

2. Components and installation are to follow current ADA and ANSI guidelines.

B. Single Source: All components and fittings are to be furnished by the same manufacturer or approved by the primary component manufacturer.

1.06 DELIVERY, HANDLING AND STORAGE

A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.

B. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way that will prevent bending.

C. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.

D. Keep handling on-site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of these specifications, products by one of the following manufacturers is acceptable:

1. Golden Railings, Inc., 720 Corporate Circle Suite J, Golden, CO 80401-5626; Phone: (303) 279-5807: Fax: (303) 279-6214: www.goldrail.com.

2. AlumaGuard Corporation, 2250 S Lipan St., Denver, CO 80223; Phone: (303) 935-7245: Fax: (303) 937-0823: www.alumaguard.com.

3. Superior Aluminum Products, Inc., 555 E. Main St., Russia, OH, 45363; Phone: (800) 548-8656; Fax: (937) 526-3904: www.superioraluminum.com.

4. Thompson Fabricating, LLC, 1411 Commerce Place, Tarrant, AL 35217, Phone: (800) 824-6182: Fax: (205) 841-0822: www.tfco.com.

2.02 STRUCTURAL REQUIREMENTS

A. Design handrails and guardrails to withstand a 200-pound concentrated load applied horizontally or vertically at any point along the rail. This concentrated load is to be applied non-concurrently with any other load. Design guardrails to withstand a 20 pound/foot uniformly distributed load applied horizontally at the top rail. Design intermediate rails to withstand a load of 20 pounds per linear foot applied horizontally along the rail and a 50-pound concentrated load applied horizontally at any location along the rail. This concentrated load need not be combined with any other load. Design for the above loads or for the loads specified in the International Building Code, whichever is greater.

2.03 DIMENSIONAL REQUIREMENTS

A. Guardrails shall be 42 inches high, and Handrails shall be 34 inches high as measured from the front top of the stair tread. Guardrails shall have a maximum post spacing of 5 feet; and handrails 5 feet.

B. Each guardrail is to be constructed with intermediate railings such that a 12-inch sphere cannot pass through any opening in the rail assembly, including the opening between the bottom rail and the solid surface to which the rail is attached. This requirement shall also apply to handrails where the height difference between the walking surface of the stair and surfaces below to which a person could fall exceeds 30 inches.

C. A toe board shall be attached continuously to the bottom of the guardrail assembly where shown on the Plans or required by OSHA regulations. The spacing between the toe board and the solid surface beneath shall be 1/4-inch or the minimum required by OSHA regulations, whichever is less.

D. Railings shall be smooth and free from defects or variations in finish which would cause scrapes or injury to persons brushing or sliding along the railing surface.

E. Changes in direction shall be done with a radius corner, not a mitered corner. Radius corners shall fall between a 4-inch minimum and 8-inch maximum, measured from the centerline of the pipe.

F. In long linear runs of railings, an expansion joint shall be provided at least every 50 feet of run to prevent buckling of railings.

G. Adjust railing prior to anchoring to ensure matching alignment at butting joints. All bolts fastening guardrails are to be straight and be placed so that they are perpendicular to the substrate surface.

H. Vertical opening (gaps) between walls, other rails and equipment shall be 1-1/2 inches minimum and 3 inches maximum.

2.04 MATERIALS AND FINISH

A. Aluminum:

1. Extruded Pipe: Alloy 6063-T6 or 6105-T5 meeting with ASTM B 221 or ASTM B 429.

2. Solid Reinforcing Bars: Alloy 6061-T6 meeting ASTM B 221.

3. Extruded Bars and Shapes: Alloy 6063-T6 meeting ASTM B 221.

4. Castings: Almag 35 meeting ASTM B 26.

5. Extruded Toe Board: Alloy 6063-T6 meeting ASTM B 221.

6. Finish: Class I (0.7 mil. minimum), clear anodized (refer to NAAMM Metal Finishes Manual).

2.05 RAILING SYSTEM

A. Material shall conform to 2.02 A, and be finished in accordance with 2.04 A. 6.

B. Railing system shall be permanently anchored except where shown as removable on the Plans.

C. Rails and Posts:

1. Rails: Fabricate from anodized aluminum, 6063-T6 pipe with nominal size of 1-1/2 inches (1.900 inches outside diameter), Schedule 40 (0.145-inch wall, minimum).

2. Posts: Fabricate from anodized aluminum, 6063-T6 or 6105-T5 pipe with nominal size of 1-1/2 inches (1.90 inches outside diameter, 1.50 inside diameter), Schedule 40 (0.145-inch wall, minimum) or 80 (0.20 inch wall, minimum).

a. Provide post reinforcement consisting of solid aluminum reinforcing bar if required to meet structural requirements specified above.

D. Fittings:

1. Fittings shall be of wrought material of aluminum. Tee-fittings and elbows, which are fabricated from more than one piece, shall be of welded construction with no weld marks visible when the fitting is installed.

E. Connector Sleeves:

1. Internal connector sleeves shall be of extruded aluminum.

F. Mounting Flanges:

1. Floor Flanges:

a. One piece cast aluminum.

b. Two (2) 3/8-inch diameter stainless steel set screws.

c. Two (2) minimum holes for attachment.

2. Heavy Duty Floor Flange:

a. One (1) piece cast aluminum with a solid aluminum-reinforcing bar.

b. Two (2) 3/8-inch diameter stainless steel set screws.

c. Four (4) holes for attachment.

3. Side Mount Flanges:

a. Aluminum with a solid aluminum-reinforcing bar.

b. One piece.

c. Two (2) 3/8-inch diameter stainless steel set screws.

d. Four (4) holes for attachment.

4. Wall Flange:

a. One (1) piece cast aluminum.

b. One (1) 3/8-inch diameter stainless steel set screw.

G. Toe Board:

1. Toe Board shall be of extruded aluminum; equal to BLUM No. 6446. Toe boards shall have at least one continuous horizontal stiffening web. Flat bar toe boards will not be accepted.

2.06 FASTENERS

A. Mechanical fasteners are to be provided as required by the manufacturer. All fasteners shall be either aluminum or stainless steel.

1. Machine screws used to mount flanges to stair stringers shall be of stainless steel, 3/8-inch diameter.

B. Adhesive: Scotch-Weld epoxy adhesive, Catalog No 3M EC-2216 B/A Clear Amber, or approved equal.

C. Cement Hydraulic, ASTM C 595, factory prepared with accelerator.

2.07 HANDRAIL BRACKETS

A. Aluminum extruded.

2.08 FABRICATION

A. Form rail-to-end post connections and all changes in rail direction by radius elbows, not a mitered corner. Radius corners shall fall between a 4-inch minimum and an 8-inch maximum, measured from the centerline of the pipe.

B. Cut material square and remove burrs from all exposed edges, with no chamfer.

C. Make exposed joints butt tight and flush.

D. Close exposed ends of pipe by use of appropriate end cap.

E. Locate intermediate rails as shown on the Plans.

F. Verify dimensions on-site prior to shop fabrication.

G. All edges, imperfections and fasteners such as rivets shall be completely flush with tubing surface in order to avoid any edges that could inflict injury on an operator or catch an article of clothing. Any raised portions of fasteners shall be entirely removed and reinstalled properly and edges properly connected.

PART 3 – EXECUTION

3.01 DISSIMILAR METALS

A. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with a heavy coat of a proper primer.

B. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with heavy bodied bituminous paint.

3.02 INSTALLATION

A. Install in accordance with shop drawings and manufacturer's instructions.

B. Erect work square and level, horizontal or parallel to rake of steps or ramp, and free from distortion or defects detrimental to appearance or performance.

C. Expansion joints shall be provided as specified herein to allow for thermal expansion or contraction.

3.03 CLEANING

A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.

B. Do not use acid solution, steel wool or other harsh abrasives.

C. If stain remains after washing, remove finish and restore in accordance with NAAMM Metal Finishes Manual. Finish must be removed from anodized aluminum. Re-anodizing can only be done by removing railing and returning it to the anodizer.

3.04 REPAIR OF DEFECTIVE WORK

A. Remove stained or otherwise defective work and replace with material that meets specification requirements.

END OF SECTION 05 52 11

SECTION 05 53 11 – ALUMINUM GRATINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, materials and equipment for the fabrication and installation of all aluminum gratings, including banding, hold-down clips, shown on the Plans, and specified herein.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 30 00 – Cast-In-Place Concrete

C. Section 05 50 11 – Miscellaneous Metals

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. B 221 Specifications for Aluminum-Alloy Bars, Rods, Wires, Shapes and Tubes.

2. B 429 Specifications for Aluminum-Alloy Extruded Structural Pipe and Tube.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product data:

1. Gratings: Submit materials, sizes, and banding techniques.

2. Hold-down devices. Submit type of hold-down device to be used, and the means of fastening the hold-down devices to the underlying structure.

C. Shop Drawings:

1. Submit shop drawings showing layouts of gratings, provisions for removable gratings where called for in the Plans and as specified herein. Show details of how hold-down devices are to be attached to the gratings and the underlying structure.

D. Informational Data:

1. Design Data: Submit certification that the gratings meet the design requirements shown on the Plans and specified herein.

2. Manufacturer's instructions. Submit copies of manufacturer’s instructions for installation of gratings.

1.05 QUALITY ASSURANCE

A. Single-Source: All aluminum gratings are to be obtained from one manufacturer, and shall be of a single style.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with the requirements of these specifications, products by one of the following manufacturers is acceptable:

1. McNichols Co., P.O. Box 30300, Tampa, FL 33630; Toll Free: (800) 237-3820; www.mcnichols.com.

2. Ohio Gratings, Inc., 5299 Southway SW, Canton, OH 44706; Toll Free: (800) 321-9800; Phone: (330) 477-6707; Fax: (330) 477-7872; www.ohiogratings.com.

3. Alabama Metal Industries Corporation, 3245 Fayette Avenue, Birmingham, AL 35208; Toll Free: (800) 366-2642; Fax: (205) 780-7838; www.amico-grating.com.

2.02 PRODUCT REQUIREMENTS

A. All aluminum gratings are to be swaged rectangular bearing bar gratings or “I” shaped section gratings with cross bars.

B. Bearing bars: Bearing bar spacing shall 1-3/16 inches on center, with a minimum bar thickness of 3/16 inches. See schedule on the Plans for the size to use for a specific grating span. Bearing bars are to bear a minimum of 1 inch on supporting structure.

C. Cross bars: Cross bar spacing shall be 4 inches on center, with a minimum bar thickness of 3/16 inches. Cross bars may be square, round, or rectangular. Cross bar connection to bearing bars may be pressure fit, swaged, or welded, or other means provided the bars are permanently attached and do not loosen with time.

D. All gratings shall be designed to support a minimum uniformly distributed load of 100 psf, or a concentrated load at any point of 300 pounds distributed over 12 inches square. Live load deflection shall be limited to 1/180th of the span when subjected to the concentrated load of 300 pounds placed at mid span.

E. Gratings shall be manufactured to lie flat, forming a continuous flat surface with the surrounding walking surface. Gratings shall not protrude above the surrounding walking surface. Gratings having more than a 1/4-inch warp in 6 feet will be considered unacceptable. Gratings which rock when walked on are unacceptable.

F. Openings to be grated shall be field measured prior to making shop drawings and fabricating gratings.

G. Cut-outs shall be end banded. Bearing bars shall be continuously banded at ends.

H. Banding over support shall be welded to bearing bars with full height 1/8-inch fillet to edge bearing bars. Banding at cut-outs shall be welded with full height 1/8-inch fillet to all bearing bars. All cross bars shall be tack welded to the bearing bars at the edge of each grating panel and to the bearing bars at the edge of cut-outs.

I. All gratings shall be fastened to supporting surfaces with hold-down devices such as saddle clips, or Z clips. All grating hold-down devices are to be Type 316 stainless steel, and be approved by the Engineer.

J. Gratings over operable gates and weirs shall be fabricated in sections small enough to be easily handled by one person (40 pounds or less per section).

K. Long runs of gratings shall be fabricated in sections of a size such that the greatest dimension is 12 feet, 0 inches or less.

L. Gratings shall be provided with corrugated angle nosing at edge facing upcoming stair assemblies.

2.03 MATERIALS

A. Gratings to be fabricated from aluminum bars or aluminum extrusions. Aluminum for bearing bars shall be Alloy 6061 T6, and for cross bars Alloy 6063 T6.

B. Hold-down devices to be 316 stainless steel. Fasteners for hold-down devices to be 316 stainless steel.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances and method of attachment with other work. All work is to be laid out using field determined dimensions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and as specified herein.

3.03 ADJUSTING, CLEANING AND PROTECTION

A. Remove construction debris from project site and legally dispose of debris.

B. Gratings shall be left in a clean, non-stained condition at the end of the project.

END OF SECTION 05 53 11

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

SECTION 07 21 00 – THERMAL INSULATION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish all labor, materials, and equipment for the installation of insulation at building structure exterior walls, ceiling, and foundation walls.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 30 00 – Cast-In-Place Concrete

C. Section 13 34 19 – Pre-Engineered Metal Building System

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. C272 – Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions.

2. C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

3. C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

4. C991 – Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.

5. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

6. D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

7. D4397 – Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.

8. E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

9. E 96 - Standard Test Method for Water Vapor Transmission of Materials in Sheet Form (Procedure A).

B. Federal Specifications (FS)

1. HH-I-521F Insulation Blankets, Thermal (mineral fiber, for ambient temperatures).

C. National Fire Protection Association (NFPA)

1. NFPA 701 – Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories (UL)

1. UH 723 – Test for Surface Burning Characteristics of Building Materials

E. Washington State Energy Code (WESC), 2021

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product Data: Provide manufacturer's technical product data for each of the products specified and/or used on the project including, but not necessarily limited to:

1. Roof installation instructions.
2. Wall installation instructions.
3. Product data sheet.
4. Design considerations guide.

C. Provide shop drawings that indicate the following:

1. Liner fabric layout.
2. Insulation layout and cut list.
3. Customer and project information.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Companies shall be familiar with the installation practices associated with banded liner systems.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Furnish material in manufacturer's packaging, complete with installation instructions.

B. Store products indoors or in dry a dry, covered location. Do not open products until ready to use. Protect products from potential construction site damage. Use care when opening products as pallets may shift during shipment.

C. Banding has sharp edges. Wear cut-proof gloves when handling. Wear safety glasses when unpacking materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with specified requirements, provide insulation provided by one of the following, or approved equal:

Silvercote, LLC
Therm-All, Inc.

2.02 INSULATING MATERIAL

A. Dual Layer Unfaced Mineral Fiber Blanket/Batt Insulation – Pre-Engineered Metal Building:

1. Dual layer blanket insulation shall be used to insulate the pre-engineered metal building, installed between the outside building wall sheeting and the support members (purlins and girts). The nominal size of the innermost layer shall be equal to the height of associated purlins or girts. Length and width shall be suitable for installation in pre-engineered metal buildings per insulation manufacturer's installation instructions.

2. Thermal and acoustical insulation produced by combining glass fibers with thermosetting resins to comply with ASTM C991 for Type I (blankets without membrane facing).

3. Combustion Characteristics: Passes ASTM E136 test.

4. Surface Burning Characteristics: Maximum flame spread and smoke developed values of 25 and 50, respectively. Tested in accordance with NFPA 255, UL 723, and/or ASTM E84.

5. Insulation is to have an integral vapor barrier built-in or Contractor is to provide a separate, continuous vapor barrier of at least 6 mil thickness at all insulated spaces. See part 2.02 VAPOR BARRIERS for further detail.

6. Thermal resistance: Thermal resistance requirements shall comply with the Washington State Energy Code for Commercial Buildings (2021 or latest edition) thermal envelope requirements. Minimum requirements for metal buildings with slab-on-grade floors are as follows unless otherwise shown on the Plans:

   a. Roofs: R-25 + R-22 liner system, plus a R-3.5 thermal block at Purlins and/or a maximum U-factor of 0.031.

   b. Walls: R-13 + R-14 continuous insulation and/or a maximum U-factor of 0.050.

   c. Floors: R-10.

B. Sill Seal Gasket

1. Shall be FoamSealR manufactured by Owens Corning or approved equal.

2. Thickness: 1/4-inch.

3. Width: To suit sill member site(s) indicated.

2.03 VAPOR BARRIERS

A. Polyethylene Vapor Barrier (fabric liner facing) complies with the following

1. ASTM C1136 Type III through VI, minimum 6 mils thick.

2. Perm Rating: Maximum of 0.033 perm when tested in accordance with ASTM E96.

3. Surface Burning Characteristics: Flame Spread Index of 0 and Smoke Developed Index less that 50 when tested in accordance with ASTM E84.

B. Vapor Barrier Adhesive: Application temperature of 0 to 110 degrees F.

C. Double-Sided Vapor Barrier Tape: Pressure-sensitive tape of type recommended by vapor barrier manufacturer for sealing joints and penetrations in vapor barrier.

D. Patch Tape: one-sided adhesive tape, width of three (3) inches. Installation temperature of 0 to 110 degrees F.

E. Metal Banding: Coated steel, width of one (1) inch. Structural steel Grade 50 per ASTM C635, exposed color to match vapor barrier.

2.04 AUXILIARY INSULATING MATERIALS

A. Thermal Spacer Blocks: Extruded or Expanded polystyrene. Width of 3 inches, and thickness of 1/2 inch to 1 inch, with a minimum R value to comply with WSEC.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrate indicated without damaging insulation and substrate.

C. Insulation Fasteners: As required for each application and as recommended by manufacturer for each specific installation.

D. Joint Tape: Closed cell vinyl foam tape for wall applications. Thickness 1/8 to 3/8 inch, and width of 3 inches.

E. Insulation Hangers: Insul-hold insulation hangers or approved equal.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements of section in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Do not install system outside of the temperature, humidity, ventilation, and environmental limits recommended by the manufacturer. Products should be kept covered and dry at temperatures less than 100 degrees Fahrenheit (F) prior to installation. Do not proceed with installation until unsatisfactory conditions are corrected or improved.

3.02 PREPARATION

A. Clean substrate of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or that interfere with insulation attachment.

B. Clean dirt from vapor barrier fabric using a soft cloth with soap and water or non-abrasive household cleaner. Solvent-based cleaners and abrasive pads shall be avoided.

3.03 GENERAL INSTALLATION

A. Install in accordance with manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

C. Extend insulation in thickness indicated to envelope entire area to be installed. Cut and fit tightly around obstruction and fill voids with insulation. Remove projections that interfere with placement.

D. Apply each required layer of insulation to produce thickness indicated.

3.04 INSTALLATION OF PERIMETER/FOUNDATION AND UNDER-SLAB INSULATION

A. On vertical surfaces, set units in adhesive applied according to manufacturer’s written instructions. Use adhesive recommended by insulation manufacturer.

B. Protect top surface of horizontal insulation from damage during concrete work.

3.05 INSTALLATION BLANKET INSULATION

A. Unfaced Thermal and Acoustical Wall Batts: Install by friction-fit method except as otherwise required for support of units. Cut, cope and shape units as required at obstructions to provide most effective wall insulation envelope reasonably achievable.

B. Install all metal building walls to form full closure with roof insulation or roof deck. Place insulation into concealed corners and similar areas while areas are still accessible, whether or not such placement requires special sequencing of work.

C. At roof spaces: Install blanket insulation by placing blankets within cavities parallel to purlins, and perpendicular over the framing members. Butt insulation tightly to adjacent blankets at sides and ends. Consult insulation manufacturer’s installation instructions.

1. Thermal Spacer Blocks: to comply with WSEC for Commercial Buildings, include a thermal spacer block of R-value = 3.5. Install per building manufacturer’s recommendations.

D. At walls: Install blanket insulation by friction-fit method between framing cavities and screwing continuous insulation blankets into framing. Butt insulation tightly to adjacent blankets at sides and ends. Consult insulation manufacturer’s installation instructions.

E. Install insulation in full thickness of purlin or girt space with minimum R-value as shown on the Plans or specified herein.

F. Vapor barrier is to be installed on the warm side of the space insulated

1. Extend insulation in thickness indicated to envelop entire area to be insulated. Remove projections that interfere with placement

3.06 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected for vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than 2 wall studs. Fasten vapor retarders to framing at top, end and bottom edges, at perimeter of wall openings and at lap joints. Space fasteners 16 inches o.c.

C. Seal overlapping joints in vapor retarders with adhesive or vapor-retarder tape according to vapor retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrate.

D. Firmly attach vapor retarders to substrate with mechanical fasteners or adhesives as recommended by vapor retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with vapor-retarder tape or another layer of vapor retarder.

F. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.07 PROTECTION

A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposure, physical abuse and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 41 11 – METAL ROOF AND WALL PANELS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work includes, but is not necessarily limited to, furnishing all labor, materials and equipment for the installation of manufactured metal roof, and wall panels as shown on the Plans.

B. Provide and install pre-formed pre-finished steel roof and wall panels as a part of pre-engineered metal building.

C. This section shall be used as a reference section to ensure minimum standards for materials specified in Section 13 34 19 - Pre-Engineered Metal Building System, and shall not be bid as a separate contract. All roof and wall panels for pre-engineered metal buildings specified in Section 13 34 19 - Pre-Engineered Metal Building System, are to comply with this specification.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 04 22 00 – Concrete Unit Masonry

D. Section 07 62 00 – Sheet Metal Flashing and Trim

E. Section 13 34 19 – Pre-Engineered Metal Building System

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

3. A924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

4. D226 – Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

5. D522 – Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.

6. D968 – Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.

7. D2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.

8. D2247 – Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

9. D4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

10. D4587 – Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product Data: Submit manufacturer's technical product data, installation instructions and recommendations for each type of roofing and siding requirements. Include highlighted data substantiating that materials comply with requirements.

C. Shop Drawings: Submit complete shop drawings detailing roof and wall panel layouts, trim installation, and panel attachments. Shop drawings shall also include details of all perimeter and joint flashings that comply with the manufacturer’s standard recommendations. Describe all proposed details that deviate from what is shown on the plans. Include details to allow for expansion and contraction.

D. Samples:

1. Prior to ordering products, submit manufacturer's standard color samples for Engineer's selection.

2. Prior to starting work, submit the following:

a. Roof and Wall Panels: (2) 12-inch-long panel samples showing shape and the representative color as approved by the Engineer.

E. Informational Data:

1. Test Reports: Specifying that all products comply with performance requirements specified within this section,

2. Certifications specified in the following Quality Assurance article.

3. Qualification Data: Manufacturer's, engineer's and installer's qualification data.

4. Manufacturer's instructions.

F. Submit the following closeout data in accordance with Section 01 78 00 – Operation and Maintenance Manuals:

1. Maintenance Data.

2. Warranty: Submit specified warranties.

1.05 QUALITY ASSURANCE

A. Single-Source: Obtain roof and wall panels from one manufacturer.

B. Installers Qualifications: Installer shall be experienced to perform work and is acceptable to panel manufacturer.

C. Manufacturer Qualifications:

1. Manufacturer shall have a minimum of ten 10 years’ experience supplying metal roof and wall panels to the region where the work is to be done.

2. Capable of providing field service representation during construction, approving acceptable installer and approving application methods.

D. Regulatory Agency Requirements: Comply with UBC and local Building Code requirements if more than those specified.

1.06 PERFORMANCE REQUIREMENTS

A. Materials: All panels shall be formed from steel conforming to ASTM A653 or ASTM A792, with minimum yield strength of 40,000 psi. Panels shall have a 24-gage minimum thickness.

B. Protective Coatings: All panel coating thickness shall conform to ASTM A653, G90 (Galvanized) or ASTM A792, AZ50 (Zincalume).

C. Finish:

1. Primer Coat Material: All panels are to have a factory-applied baked-on corrosion-resistant primer, minimum primer coat dry film thickness: 0.2 mils.

2. Finish Coat Material: All panels are to have a factory-applied baked-on paint system on both sides using polyvinylidene fluoride (PVF2), such as "Kynar 500" or equal, meeting the following requirements.

a. Weathering: No checking, blistering or adhesion loss when tested for 5000 hours in accordance with ASTM D4587.

b. Chalking: Will not chalk greater than #8 rating when tested for 2000 hours in accordance with ASTM D4214.

c. Fading: Color changed will not exceed 5 NBS units when tested for 5000 hours in accordance with ASTM D2244.

d. Humidity: Shall be less than 5 percent of #8 blister when tested for 5000 hours in 100 percent humidity at 100 degrees F in accordance with ASTM D2247.

e. Flexibility: No rupture of coating when subjected to a 180-degree bend around a 1/8-inch mandrel in accordance with ASTM D522.

f. Formability: When subjected to a 180-degree bend over 1/8-inch diameter mandrel in accordance with ASTM D522, exterior coating shall be flexible to the point of metal rupture without separation of coating from substrate.

g. Abrasion Resistance: Coating system shall withstand a minimum of 65 liters of falling sand before appearance of base metal per ASTM D968.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect against damage and discoloration.

B. Handle panels with non-marring slings.

C. Do not bend panels.

D. Protest panels against standing water and condensation between adjacent surfaces.

E. If panels become wet, immediately separate sheets, wipe dry and allow to air dry.

F. Remove and strippable film prior to installation and do not allow to remain on panels in extreme cold, heat or in direct sunlight.

1.08 PROJECT CONDITIONS

A. Examine the conditions and substrate in which metal roof and wall panels are to be installed. Substrate shall be installed level, flat and true to avoid panel stresses.

B. Field measurements shall be taken prior to fabrication of panels.

C. Proceed with panel installation only after satisfactory conditions are met.

1.09 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Product Warranty: Submit a written warranty, for Owner’s acceptance, executed by the manufacturer agreeing to cover failure of the factory-applied exterior finish on metal roof and wall panels within the warranty period

1. Warranty Period: Twenty-five (25) years from Date of Substantial Completion.

C. Manufacturer's Weathertightness Warranty: Submit a written warranty, for Owner’s acceptance, executed by the manufacturer agreeing to cover against leaks in standing seam roof panels, arising out of or caused by ordinary wear and tear under normal weather and atmospheric conditions

1. Warranty Period: Twenty years (20) from Date of Substantial Completion.

D. Contractors Warranty: Warrant panels, flashing, sealant, fasteners, and accessories against defective materials and/or workmanship, to remain watertight and weatherproof with normal usage for two (2) years following project substantial completion date, and to repair or replace without additional cost to the owner, any leaks, and resulting damage to other materials and building contents as may occur.

PART 2 – PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Roof and wall panels products specified within this section are by:

1. Nucor Buildings Group

B. Subject to compliance with requirements, equivalent products by the following manufacturers are acceptable:

1. AEP Span

2. Metal Sales Manufacturing Corporation

3. Metal Building Components, Inc. (MBCI)

4. Taylor Metal Products.

5. Approved equal.

2.02 MATERIALS

A. Roof Panels:

1. Nucor Loc Seam Standing Seam, as manufactured by Nucor Buildings Group or approved equal.

a. Profile: 12-inch wide panel, with subtle striations, 1-3/4” high ribs.

b. 24-gauge minimum thickness.

c. Color: As selected by Engineer from manufacturer's standard colors.

B. Wall Panels:

1. Nucor A-Panel, as manufactured by Nucor Buildings Group or approved equal.

a. Profile: 12-inch wide panel, with subtle striations, 1-3/4” high ribs.

b. 24-gauge minimum thickness.

c. Color: As selected by Engineer from manufacturer's standard colors.

2.03 UNDERLAYMENT MATERIALS

A. Self-adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970.

2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.

2.04 ACCESSORIES

A. General: Except as indicated as work of another specification section, provide components required for a complete roof and wall panel system, including, but is not necessarily limited to, fascias, ridge closures and vents, clips, seam covers, flashing, sealants, gaskets, fillers, closure strips and similar items. Match materials and finishes of panels.

B. Roof Panels:

1. Panel Penetration Flashing: Recommended by panel manufacturer.

a. Color: Match panel color.

2. Flashings: Match panel finishes and material. Do not use lead or copper.

3. Fasteners: Per manufacturer recommendations.

a. Conceal whenever possible. If exposed, use same color of parts as they attach. Include sealing washers.

b. Fasteners shall be coated to provide protection against corrosion.

4. Clips: One-piece fixed to accommodate thermal movement.

5. Closure strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyethylene foam flexible closure strips. Premolded to match configuration of roof panels. Provide closure strips where indicated or necessary to ensure weathertight construction.

6. Bituminous Coating: Cold-applied asphalt mastic, SSPC paint 12, compounded for 15 mil dry film thickness per coat.

C. Wall Panels:

1. Panel Penetration Flashing: Recommended by panel manufacturer.

a. Color: Match panel color.

2. Flashings: Match panel finishes and material. Do not use lead or copper.

3. Fasteners: Per manufacturer recommendations.

a. Conceal whenever possible. If exposed, use same color of parts as they attach. Include sealing washers.

b. Fasteners shall be coated to provide protection against corrosion.

4. Clips: One-piece fixed to accommodate thermal movement.

5. Closure strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross-linked polyethylene foam flexible closure strips. Premolded to match configuration of wall panels. Provide closure strips where indicated or necessary to ensure weathertight construction.

6. Bituminous Coating: Cold-applied asphalt mastic, SSPC paint 12, compounded for 15 mil dry film thickness per coat.

D. Joint Sealant: Refer to Section 07 92 00, and reference contact drawings.

2.05 FABRICATION

A. Roof and Wall, Panels:

1. Unless otherwise shown on drawings or specified herein, fabricate panels in continuous one-piece lengths and fabricate flashings and accessories in longest practical lengths.

2. Panels shall be factory formed. Field formed panels are not acceptable.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with work.

B. Verify dimensions, tolerances and method of attachment with other work.

C. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions. If field measurements differ from contract Plans or shop drawings notify Engineer prior to fabrication.

D. Prior to starting work, notify general contractor about defects requiring correction.

E. Do not start work until conditions are satisfactory.

3.02 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

B. Apply over the entire roof surface.

3.03 METAL PANEL INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Apply bituminous coating or other permanent separation materials on panel surfaces where panels would otherwise be in contact with substrate materials that are non-compatible or could result in electrolytic corrosion or deterioration of either material or finishes. Coat back of metal roof and wall panels with bituminous coating where it will contact wood, ferrous metal or cementitious construction.

C. Roof and Wall Panels:

1. Follow roof panel manufacturer's instructions in conjunction with approved shop drawings.

2. Install panel seams vertically.

3. Lap panels away from prevailing wind directions.

4. Overlap roof panels at least 6 inches.

5. Secure panels without warp or deflection.

6. Maximum Alignment Variation: 1/4 inch in 40 feet.

7. Flashing: Refer to Section 07 62 00 – SHEET METAL FLASHING AND TRIM.

8. Cutting and Fitting:

a. Neat, square and true. Torch cutting is prohibited where cut is exposed to final view.

b. Openings 6 inches and larger in any direction shall be shop fabricated and reinforced to maintain original load capacity.

c. Openings less than 6 inches in largest dimension can be made by trade requiring opening.

d. Where necessary to saw cut panels, debur and treat with galvanic paint.

3.04 PREPARATION

A. Clean and dry surfaces prior to applying sealants.

3.05 ADJUSTING, CLEANING AND PROTECTION

A. Panels or flashings that have severe paint and/or substrate damage shall be replaced as directed by the Engineer or Owner’s representative. Do not use touch-up paint on damaged surfaces.

B. At completion of each day's work and at work completion, sweep panels, flashings and gutters clean. Do not allow fasteners, cuttings, fillings or scraps to accumulate. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 07 41 11

SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes the following categories:

1. Metal flashing.

2. Exposed trim.

3. Exposed fascia.

4. Drain gutter assemblies.

5. Miscellaneous metal fabrication.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 07 92 00 – Joint Sealants

D. Section 13 34 19 – Pre-Engineered Metal Building System

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

3. A924 – Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

4. D4586 – Standard Specification for Asphalt Roof Cement, Asbestos-Free.

5. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

C. Samples of sheet metal flashing, trim and accessory items, in the specified finish.

1. Two (2) 8-inch square samples of specified sheet materials to be exposed as finished surfaces.

D. Informational Data: Submit manufacturer's and installer’s qualification data.

E. Submit the following closeout data in accordance with Section 01 78 00 – Operation and Maintenance Manuals:

1. Maintenance Data

2. Warranty: Submit specified warranty.

1.05 QUALITY ASSURANCE

A. Single-Source: Obtain sheet metal from one manufacturer.

B. Installers Qualifications: Engage an experienced installer who has completed sheet metal flashing and trim work similar in material, design and extent to that indicated for this Project and with a record of successful in-service performance.

1.06 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposed to weather without failing.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect against damage and discoloration.

1.08 PROJECT CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance, durability of work and protection of materials and finishes.

1.09 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. The contractor shall furnish, at no additional cost to the Owner, a guarantee of the watertightness of the flashings. The warranty is limited to repairs due to ordinary wear from the elements and/or due to faulty materials and workmanship.

1. Warranty Period: Five (5) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 METALS

A. Zinc-coated Steel: Commercial quality with 0.20 percent copper. ASTM A653, G90 hot-dip galvanized, mill phosphatized where indicated for painting; not less than 22 gage thickness except as otherwise indicated. The Contractor may, at his/her option, substitute Zincalume or Galvalume, meeting ASTM A792, AZ50 requirements for galvanized finish.

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners: Same metal as flashing/sheet metal or, other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

B. Metal Accessories: Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work; matching or compatible with material being installed; noncorrosive; size and gage required for performance.

C. Zinc Coated Steel Primer: Self-etching type, compatible with paint system specified in Section 09 90 00 – Painting and Coating; shop applied.

D. Mastic Sealant: Polyisobutylene, nonhardening, nonskinning, nondrying and nonmigrating sealant.

E. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Section 07 92 00 – Joint Sealants.

F. Adhesive: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.

G. Paper Slip Sheet: 5-lb/square red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.

H. Gutter Strainer: 1/4-inch hardware cloth installed in sheet metal frames. Fabricate screen and fame of same basic material as gutters and downspouts.

I. Roofing Cement: ASTM D4586, Type I, asbestos free, asphalt based.

2.03 GENERAL FABRICATION

A. Sheet Metal Fabrication Standards: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design dimensions, metal and other characteristics of the item indicated.

B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams and solder.

E. Expansion Provisions: Space movement joints a maximum of 10 feet with no joints allowed within 24 inches of corners or intersection. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weatherproof and water proof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to view.

I. Fabricate cleats and attachments devices form same materials as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.04 SHEET METAL FABRICATION

A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

B. Exposed Trim and Fascia: Fabricate from the following material:

1. Galvanized Steel: 22-gauge.

C. Roof-Penetration Flashing:

1. Galvanized Steel: 22-gauge.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrate and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify dimensions, tolerances and method of attachment with other work.

3.02 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual". Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal work that is without excessive oil canning, buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Expansion Provisions: Space movement joints a maximum of 10 feet with no joints allowed within 24 inches of corners or intersection. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently weatherproof and water proof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with mastic sealant (concealed within joints).

D. Soldered Joints: Do not solder the following materials:

1. Aluminum

2. Coil-coated galvanized sheet.

E. Sealed Joints: Form nonexpanding, but moveable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joints with sealant and form metal to completely conceal sealant.

F. Separation: Separate metal from noncompatible metal or corrosive substrate by coating concealed surfaces, at location of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrate, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.

2. Bed flanges of work in a thick coat of roofing cement where required for waterproof performance.

G. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof.

H. Downspout: Shall be set plum and not less than 0.5 inches from the wall. Leaders shall connect gutters on overhanging eaves to downspouts. Leaders shall be set with a slope not less that 1/8-inch per foot or more than 1/2-inch per foot below the horizontal line. Leaders shall fit over the outlet tube in gutter bottom and shall fit into and be riveted to the downspout. Rivet spacing shall be not more than 2 inches. Strainers shall be set loosely in the eave tube opening in gutter. Downspout shall be one continuous piece from leaders to ground termination. Downspouts terminating in drainage lines shall be neatly fitted into downspout boots and filled. Downspout hangers shall be 16-gauge by 1-inch flat stock of the same material as the downspout.

I. Gutters: Brackets and spacers shall be fastened to roof nailer by screws and shall interlock with or be fastened to the leading edge of gutter. Brackets and spacers shall be alternated at not more than 36 inches on centers.

3.03 ADJUSTING, CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

C. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 07 62 00

SECTION 07 92 00 – JOINT SEALANTS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, materials, and equipment for the complete installation of sealant and caulking as indicated on the Plans and specified herein. Work is primarily at perimeter of hollow metal doorframes, interior and exterior, and windows, and other penetrations in outside walls of buildings.

B. The required applications of sealants include, but is not necessarily limited to, the following general locations:

1. Joints between louvers, window frames, door frames, and other construction.

2. Masonry control joints.

3. Roof penetrations and other required sheet metal/flashing locations.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedures

B. Section 07 62 00 – Sheet Metal Flashing and Trim

C. Section 08 11 13 – Hollow Metal Doors and Frames

D. Section 09 90 00 – Painting and Coating

E. Section 13 34 19 – Pre-Engineered Metal Building System

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit product data.

C. Submit manufacturer's surface preparation and installation instructions.

D. Submit samples of sealant colors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Name and addresses of manufacturers of products specified herein are as follows:

1. Dow Corning Corporation, Midland, Michigan.

2. General Electric Company, Silicone Products Division, Waterford, New York.

3. Mameco International, Cleveland, Ohio.

4. Pecora Corporation, Harleysville, Pennsylvania.

5. Sika Chemical Corporation, Lyndhurst, New Jersey.

6. Sonneborn Building Products Division, Contech, Minneapolis, Minnesota.

7. Tremco, Cleveland, Ohio.

8. Woodmont Products Incorporated, Huntingdon Valley, Pennsylvania.

2.02 SEALANT SYSTEMS

A. Type 1: Vertical joints 1- inch or less in width

1. Silicon rubber (nonsag)

a. Silpruf Sealant: General Electric Company, Silicon Products Div., Waterford, New York.

b. 790 Building Sealant: Dow Corning Corp., Midland, Michigan.

c. 864 Architectural Silicone: Pecora Corp., Harleysville, Pennsylvania.

B. Type 2: Interior nonmoving joints

1. Silicone rubber (at wet interior areas)

a. 786 Mildew-Resistant Silicone Sealant: Dow Corning Corp., Midland, Michigan.

b. Sanitary Sealant: General Electric Company, Silicone Products Div., Waterford, New York.

c. Chem-calk 1200: Woodmont Products, Inc., Huntingdon Valley, Pennsylvania.

2.03 ACCESSORIES

A. Primer: Nonstaining type, recommended by sealant manufacturer to suit application.

B. Joint cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer and compatible with joint substrates.

C. Joint filler: Round, opened or closed-cell, foam rod, as recommended by sealant manufacturer, diameter oversized 30 percent greater than the width of joint to be filled.

D. Bond breaker: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

PART 3 – EXECUTION

3.01 INSPECTION

A. Verify that joint dimensions and physical and environmental conditions are acceptable to receive work of this section.

B. Beginning of installation means acceptance.

3.02 PREPARATION

A. Clean, prepare, and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.

B. Verify that joint substrates and release tapes are compatible with sealant.

C. Examine joint dimensions and size materials to achieve required width/depth ratios.

D. Use joint filler to achieve required joint depths, to allow sealants to perform properly.

E. Where joints are more than 3/4-inch deep, install joint filler to within 1/2-inch of surface.

F. Where joint is more than 1/2-inch deep, install joint filler to within 1/4-inch of surface.

G. Where joint is less than 1/2-inch deep, apply bond breaker tape to bottom of joint to prevent adhesion of sealant to joint bottom.

H. Prime or seal joint surfaces wherever recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.03 INSTALLATION

A. Install sealant in accordance with manufacturer's instructions.

B. Apply sealant within recommended temperature ranges. Consult manufacturer when sealant cannot be applied within recommended temperature ranges.

C. Tool joints: Concave.

D. Joints: Free of air pockets, foreign embedded matter, ridges, and sags.

E. Install sealant before painting only if it is recommended as paintable by the sealant manufacturer, otherwise do all sealing after painting is completed.

3.04 CLEANING

A. Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to the adjoining surfaces of finishes.

END OF SECTION 07 92 00

DIVISION 08 – OPENINGS

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work consists of furnishing all labor, materials, and equipment for the installation of hollow metal doors and frames, and relights, as shown on Plans.

B. Work included:

1. Standard, insulated core steel doors; standard frames, unless otherwise detailed.

2. Prepare doors and frames to receive hardware specified in Section 08 71 00 – Door Hardware.

3. Provide lights in doors where indicated.

4. All steel doors and door frames on this project are to be hot-dip galvanized and factory primed for field finish painting.

5. Certain openings require custom doors and frames, see elsewhere for details.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 08 71 00 – Door Hardware

C. Section 08 80 00 – Glazing

D. Section 09 90 00 – Painting and Coating

E. Division 26 – Electrical

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. C1363 – Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit product data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

C. Shop Drawings: Submit shop drawings for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements and details of joints and connections. Show anchorage and accessory items.

1.05 QUALITY ASSURANCE

A. Provide doors and frames complying with ANSI/SDI 100 “Recommended Specifications for Standard Steel Doors and Frames” as specified.

B. Certification of label construction: For components exceeding Underwriters Laboratories, Inc. (UL), furnish inspection certificate stating that components construction conforms to UL rating requirements only if Engineer is aware of such a limitation and has allowed the non-labeled unit.

C. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a testing agency acceptable to authorities having jurisdiction that doors conform to all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

2. Temperature-Rise Rating: Where required by code, provide doors that have a temperature-rise rating of 450 °F maximum in 30 minutes of fire exposure.

D. Single Source: Provide doors, frames, and builders hardware through one source.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames in cartons or crates to provide protection during transit and storage. Adequately protect factory finished paint surfaces from damage during shipment, storage, construction and installation of door hardware and accessories.

B. Inspect hollow metal work for damage upon delivery and during construction. Field repair of damage(s) will not be allowed. Remove and replace any damaged items as directed by the Engineer.

C. Store doors and frames at the building site under cover. Place units on minimum 4-inch high wood sills or on floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, equivalent products by the following manufacturers are acceptable.

1. Steel Doors and Frames:

a. Ceco Corporation.
b. Curries Company.
c. Republic.
d. Steelcraft.
e. Stiles.

2.02 MATERIALS

A. Steel sheets: All doors and frames shall be constructed of galvanized steel sheets conforming to the requirements of ASTM A653, G90 minimum coating thickness.

B. Paint: All hollow metal doors and frames on this project shall be factory primed and field finish painted with paint as specified in Section 09 90 00 – Painting and Coating. Factory paint and field finish paint shall be spray-applied to achieve a smooth and uniform finish. Brush and roller applied finishes will not be accepted.

2.03 METAL DOOR FABRICATION

A. General: Fabricate doors in accordance with SDI 100-1991, Grade II, Model 2 seamless design, to sizes shown, providing necessary clearances and bevels to permit operation without binding. Door shall be free from warp, wave, buckle and other defects.

B. Door Construction:

1. Thickness: 1-3/4 inches, unless indicated otherwise.

2. Fabricated with face sheets of 18-gauge steel.

3. Both lock edge and hinge rail edge of the door shall be continuous welded and ground smooth the full height of the door.

4. Bevel lock and hinge edges 1/8-inch in 2 inches.

5. Provide with top and bottom inverted 16-gauge steel channels welded within the door to both face sheets.

6. Reinforce, stiffen and sound deaden with self-extinguishing, non-toxic, polystyrene foam core completely filling inside of door and laminated to the inside faces of panels.

7. Closer Reinforcement Channel: 12-gauge reinforcement in doors with closers.

C. Thermal Rated Assemblies: Provide door and frame assemblies tested in accordance with ASTM C1363 at exterior locations. Unless otherwise indicated, maximum apparent U factor for thermal-rated assemblies is 0.39 BTU/hr (ft^2) °F.

D. Preparation for Hardware:

1. Reinforce components for hardware installation in accordance with SDI 107.

2. Door shall be mortised, reinforced, drilled and tapped at the factory for templates for all mortise hardware listed in the hardware schedule.

3. Door shall be reinforced only for surface applied hardware such as closers, checks, escutcheons and kick plates, the drilling and tapping for which is to be done in the field by the door erector.

4. Door shall be provided with reinforcing unit as recommended by lock manufacturer.

5. Hardware Mounting Height and Door Clearances: In accordance with ANSI industry standards.

E. Electric Door Position Switches: Provide cutout and 12-gauge reinforcing tabs for electric door position switches. Location as recommended by position switch manufacturer.

2.04 METAL FRAME FABRICATION

A. General: Pressed, double rabbeted metal frames shall be formed to shapes and sizes shown. Head and jambs are to be notched, mitered, welded and finished to present a smooth surface for painting.

B. Frames shall be fabricated from 16-gauge steel and shall be designed with integral stop and trim. Mitered corners shall be reinforced with 18-gauge channel shaped reinforcements.

C. Jamb Anchors: Frame anchors shall provide stiffness and rigidity to keep frames square, in accurate position without twisting, buckling or warping.

1. Provide minimum of three anchors at jamb end of frames.

2. Wood stud construction: 18-gauge galvanized steel sheet, U-shaped type to engage stud, welded to back of frame. Loose anchors are not acceptable.

3. Concrete masonry: Adjustable galvanized “tee” anchors. Install in course mortar as work progresses.

4. Cast-in-place concrete walls: Use cabinet type frames anchored to concrete as per manufacturers printed recommendations, using expansion bolts.

D. Floor Anchors: For each jamb which extends to floor, provide clip-type anchors formed of not less than 14-gauge galvanized steel sheet, welded to back of frame, with two holes to receive fasteners.

E. Preparation for Hardware: Frame shall be prepared at the factory for all hardware using templates furnished by hardware supplier. Locations of miscellaneous hardware shall conform to the recommendations for the Door and Hardware Institute (DHI). Mortise, reinforce, drill and tap for all mortise type hardware. Reinforce for surface applied hardware, the drilling and tapping for which is to be done in the field by door erector.

1. All hardware cutouts shall have steel plate reinforcements with tapped holes welded to frame. Reinforcement shall include 3/16-inch butt reinforcement; 12-gauge lock strike; 12-gauge for surface applied items.

2. Provide strike stops at frames to receive metal doors with holes for three rubber door silencers. On double doorframes, provide for two silencers per door at head. Omit holes at frames to receive unitized weather stripping.

F. Removable Spreaders: Provide removable metal spreaders for frames to prevent damage during shipment and handling. Removal of spreaders shall be possible without damage to the finished surface.

G. Plaster Guards: Provide 26-gauge steel plaster guards or mortar boxes, welded to frame at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation.

H. Electric Door Position Switches: Door frames shall be provided with cutout, 12-gauge reinforcing tabs, and 16-gauge grout guard cover box/junction box with electrical conduit knockout for electric door position switch. Location as recommended by position switch manufacturer. Coordinate with Electrical.

2.05 ACCESSORIES

A. Cement Grout: Portland cement, sand and water; with minimum compressive strength of 3000 psi at seven days.

B. Bituminous Paint: Coal Tar Epoxy. Factory coat inside of frame profile with bituminous coating to a thickness of 1/16-inch.

C. Vision Frames: Vision frames shall be removal channel type with sloped moldings, 7/16 inches wide by 1-1/4 inches high, constructed of 18-gauge galvanized rolled steel, with mitered and welded corners and counter-sunk mounting holes. Fasteners shall be stainless steel and placed on the interior side of the door. All fire rated vision lights and frames are to be installed in accordance to standards set forth by NFPA 80. All fire rated vision frames shall bear the mark of Underwriters Laboratory (UL), Warnock Hersey, or approved equal, visible without removal of the frame from the door. Glazing of vision lights shall be per Section 08 80 00 – Glazing.

D. Louvers: Door louvers shall be supplied and installed by the door manufacturer. Louvers shall be galvanized 18-gauge steel with 50 percent free area, and integral stainless-steel mesh insect screen, model AFDL as manufactured by Anemostat®, or approved equal. Louvers for fire-rated doors shall be UL rated fusible-link type, constructed of galvanized 18-gauge steel with optional framed attached stainless-steel mesh insect screen, Anemostat® model FLDL-UL, or approved equal. Refer to the door and HVAC schedules on the Plans for sizes and additional requirements.

PART 3 – EXECUTION

3.01 INSTALLATION

A. General: Install steel doors, frames and accessories according to shop drawings, manufacturer's data and as specified.

B. Placing Frames: Comply with provision of SDI 105 “Recommended Erection Instructions for Steel Frames,” unless otherwise indicated. Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders, leaving surfaces smooth and undamaged. Install silencers.

1. In masonry construction, install at least three wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.

2. At existing concrete or masonry construction, install at least three completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.

3. In metal stud partitions, install at least three wall anchors per jamb at hinge and strike levels. In steel stud partitions, attach wall anchors to studs with screws.

4. Grout all frames unless noted otherwise. Coat inside of frames with bituminous paint.

5. Install fire rated frames in accordance with the requirements of NFPA 80.

C. Door Installation: Fit steel doors accurately in frames, within clearances specified in ANSI/SDI 100.

1. Fire-Rated Doors: Install in accordance with requirements of NFPA 80.

D. Install hardware in accordance with Section 08 71 00 – Door Hardware.

E. Install glazing in accordance with Section 08 80 00 – Glazing.

3.02 PROTECTION, ADJUSTING AND CLEANING

A. Protection: Immediately before final inspection, remove protective wrapping from doors and frames.

B. Remove and replace defective work, including doors which are warped, bowed, dented, buckled or otherwise unacceptable.

C. Final Adjustments:

1. Check and readjust operating finish hardware items just prior to final acceptance.

2. Leave work in complete and proper operating condition.

END OF SECTION 08 11 13

SECTION 08 36 13 – SECTIONAL DOORS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes the following:

1. Upward acting sectional steel doors, including, but not limited to, unit sections, brackets, tracks, counterbalance mechanisms, hardware, and electric door operator.

B. Manufacturers offering products to comply with the requirement for insulated steel sectional doors include the following:

1. Overhead Door Corporation.

2. Clopay Building Products.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 05 50 11 – Miscellaneous Metals

D. Section 06 10 00 – Rough Carpentry

E. Division 26 – Electrical

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00 – Submittals Procedure.

B. Product Data: For each type and size of sectional overhead door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions and maintenance information.

C. Shop Drawings:

1. Submit shop drawings for review prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors and accessories. Include relationship with adjacent materials.

D. Color Selection Chart:

1. Manufacturer's standard color selection to be selected by the owner in conjunction with the Architect/Engineer.

E. Installer Certificates:

1. Signed by manufacturer certifying that installers comply with specified requirements.

F. Closeout Data:

1. Operation and Maintenance Data.

2. Warranty: Submit specified warranty.

1.04 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead door capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:

1. Wind Load: Uniform pressure (velocity pressure) of 20 lbs/sq. ft., acting inward and outward.

1.05 QUALITY ASSURANCE

A. Single-Source: Obtain sectional doors, guides, and related primary components from one manufacturer. Provide secondary components from source acceptable to manufacturer of primary components.

B. Installers Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for installation.

C. Regulatory Agency Requirements: Comply with IBC and local Building Code requirements if more than those specified.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled protective packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

1.07 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Product Warranty: Submit a written warranty, for Owners acceptance, executed by the manufacturer agreeing to repair and replace faulty material or workmanship within the specified warranty period.

C. Warranty Period (from the date of installation)

1. Ten (10) years for delamination of door sections.

2. Three (3) years for all other components.

3. Two (2) years for electric operator.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, equivalent products by the following manufacturers are acceptable.

1. Overhead Door Corporation: 2501 South State Highway 121 Bus. Ste. 200 Lewisville, TX 75067; (800) 275-3290; http://www.overheaddoor.com/

2. Clopay Building Products Company: 8585 Duke Boulevard Mason, OH 45040; (800) 225-6729; http://www.clopaydoor.com/

3. Engineer approved equal.

B. Door assemblies shall be heavy-duty commercial products equivalent to Overhead Door 596 series or Clopay Model 3722, subject to compliance with these specifications.

2.02 DOOR ASSEMBLY

A. Sections shall be steel sandwich construction consisting of exterior and interior skins incorporating EPDM thermal break with injected polyurethane foam insulation core with continuous rubber seal between each section joint. Exterior and interior skins to be roll formed from commercial quality hot-dipped galvanized (G-60) steel per ASTM A 924 and A 653. Units shall have the following characteristics:

1. Panel Thickness: 2 inches.

2. Exterior Skin: 20-gauge minimum.

3. Interior Skin: 28-gauge minimum.

4. Interior and Exterior Surface: Flush, textured.

5. Insulation: R-value shall be 17.4 minimum, or as required by the Washington State Energy Code, latest edition.

6. Air Infiltration: Maximum air infiltration rate to be 0.40 cfm/ft^2 per ASTM E 283 at 1.57 psf, or as required by the Washington State Energy Code, latest edition.

B. Insulation: Manufacturer's standard rigid cellular polyurethane-foam-type thermal insulation, foamed in place to completely fill inner core of section, pressure bonded to face sheets to prevent delamination under wind load and with maximum flame-spread and smoke-developed indices of 75 and 450, respectively, according to ASTM E 84. Enclose insulation completely, with no exposed insulation material evident.

C. Fabricate door panels from a single sheet to provide sections not more than 24 inches high. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap or tongue-in-groove weathertight seal.

D. Reinforce bottom section with a continuous channel or angle complying with bottom section profile and allowing installation of astragal.

E. Provide reinforcement for hardware attachment.

F. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist and deformation.

G. Stiles and Hardware Plates: Shall be 16-gauge double end hinge style. Hardware plates to be 20-gauge galvanized steel and shall be located under each hinge location and prepunched for ease of hinge attachment.

H. Finish: Two coats of paint; one primer coat and one polyester (powder coat) finish coat. Color to be selected by Engineer from manufacturer's standard colors.

2.03 TRACKS, SUPPORTS AND ACCESSORIES

A. Tracks: Provide galvanized steel track system, sized for door size and weight, designed for high lift type indicated and clearance shown, and complying with ASTM A 653, for minimum G-60 zinc coating, 16-gauge minimum material thickness. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

1. Type of Tracks: Lift Clearance. Coordinate with roof structure, ductwork and lighting to determine lift clearance dimensions.

2. Track Reinforcement and Support: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

B. Weather-seals: Provide replaceable, adjustable, continuous weather-stripping gaskets.

1. Bottom of door to have continuous flexible rubber or vinyl seal.

2. Jamb Seal: Continuous flexible seal for weather-tight installation.

3. Lintel Seal: Continuous flexible seal for weather-tight installation.

2.04 COUNTERBALANCE MECHANISM

A. Torsion Spring: Operation by torsion-spring counterbalance mechanism, consisting of adjustable-tension, tempered-steel torsion springs mounted on a cross header tube or steel shaft. Connect to door with galvanized aircraft-type lift cables. Provide springs calibrated for 10,000 cycles minimum.

B. Provide cast-aluminum or gray-iron casting cable drums, grooved to received cables. Mount counterbalance mechanism with manufacturer’s standard ball-bearing brackets at each end of shaft. Provide one additional midpoint bracket for shafts up to 16 feet long and two additional brackets at one-third points to support shafts over 16 feet long, unless closer spacing recommended by door manufacturer.

C. Include a spring-loaded, steel or bronze cam mounted to bottom door roller assembly on each side, designed to automatically stop door if either cable breaks.

D. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.05 HARDWARE

A. Hinges: Provide double end, heavy-duty galvanized steel hinges, on not less than 14 gauge at each end stile and at each intermediate stile, per manufacturer’s written recommendations for door size. Attach hinges to door sections through stiles and rails with stainless steel bolts and lock nuts or lock washers and nuts. Use self-tapping fasteners where access to nuts is not possible.

B. Rollers: Provide heavy duty rollers, with steel ball bearings in casehardened steel races, galvanized steel stem with 2-inch casehardened steel tires. Roller to extend through double end hinges.

C. Lock: Provide interior mounted pad lockable slide lock and galvanized steel lift handle.

2.06 WINDOWS

A. Windows: Type and size indicated and in arrangement shown on drawings. Set glazing in vinyl, rubber, or neoprene glazing channel.

B. Size: Manufacturer's standard for type of glazing indicated.

C. Float Glass: 3 mm thick and complying with ASTM C 1036, Type I, Class 1, Quality Q3. Insulated double strength safety glazing.

2.07 ELECTRIC DOOR OPERATORS

A. Electric door operator shall be Overhead Door Model RSX Commercial Operator, Lift Master Model H Industrial Operator, or approved equal, side-mount jack shaft type with electric motor, heavy duty reversing contactor, factory pre-wired motor controls, and solid state microcontroller with built-in surge suppressor.

1. Motor: 3/4 HP, or as recommended by the manufacturer. Motor shall be capable of operating from a 120V single-phase AC power supply.

2. Controls: Provide wall mounted 3-button (open-stop-close) control station and mount control station at location shown on the Plans. Provide one (1) remote transmitter for each door, with dual frequency system in compliance with FCC, 500-foot minimum range.

3. Automatic Reversing Control: Provide automatic safety switch extending the full width of the door bottom, located in neoprene or rubber astragal mounted to bottom door rail. Contact with switch before fully closing will immediately stop downward travel or reverse direction to full-opened position.

2.08 MANUAL DOOR OPERATION

A. Operation shall be manual push-up, requiring maximum exertion of the greater of 5% of the door weight or 25 lbs. force to open. Provide and install lift handle and pull rope as needed for manual operation.

PART 3 – EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrate, supports and other conditions under which this work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General: Install door, track and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacture’s written instructions, and as specified.

B. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track form structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.03 ADJUSTING, CLEANING AND PROTECTION

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

B. Touch-up damaged coatings and finishes and repair minor damage. Clean exposed surfaces using non-abrasive materials and methods recommended by the manufacturer of material and product being cleaned.

C. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 08 36 13

SECTION 08 71 00 – DOOR HARDWARE

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work covered by this section of the specifications consists of furnishing and delivering to the job site for fitting and installation, all finish hardware complete, in accordance with this section and applicable Plans. It is intended that the following list of hardware will cover all finish hardware to complete the project. Omissions and discrepancies shall be brought to the Engineer's attention during the bidding period. Hardware for labeled openings shall meet U.L. requirements.

B. Work included

1. Templates for doors and frames.

2. All required screws, bolts, anchors, and the like, for proper fastening of each item of hardware.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 08 11 13 – Hollow Metal Doors and Frames

D. Division 26 – Electrical

1.03 REFERENCE STANDARDS

A. International Building Code (IBC), latest edition.

B. Washington Industrial Safety and Health Act of 1973.

C. State Building Code Act.

D. Washington State Barrier-Free Regulations (WAC 51-30).

E. ANSI / BHMA A156.1 through A156.24 - Product Standard for Builders Hardware.

F. National Fire Protection Association (NFPA) [www.nfpa.org]80 - Fire Doors and Windows.

G. National Fire Protection Associations (NFPA) 101 - Life Safety Code.

H. Door and Hardware Institute (DHI) [www.dhi.org] - Hardware for Labeled Fire Doors.

I. Door and Hardware Institute (DHI) - Recommended Locations for Architectural Hardware for Standard Hollow Metal Doors and Frames.

J. Door and Hardware Institute (DHI) - Abbreviations and Symbols.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Furnish five (5) typewritten hardware schedules for approval with attached cut sheets. Approval of schedule shall not relieve the contractor of responsibility for errors or omissions therein.

C. Submit schedule in accordance to DHI publication on "Sequence and Format for the Hardware Schedule" and include explanation of all abbreviations, symbols and codes.

D. Include cross-reference to hardware groups in the hardware schedule. Mark openings with the Engineer's numbering and indicate each door and frame.

E. Indicate type, style, function, size, hand, means of fastening and manufacture for each hardware item.

F. Quantities listed are for the Contractor's convenience only and are not guaranteed. Items not specifically mentioned, but necessary to complete the work shall be furnished matching in quality, finish and design those items specified for similar locations.

G. Submit one (1) copy of catalog cuts for each hardware item listed in the schedule. Catalog cuts must be of good reliable quality. Highlight each cut to readily show compliance with project requirements.

H. Provide samples if required by the Engineer. Samples will be returned to be incorporated into the work.

I. Furnish a complete and current set of templates to all other related material suppliers.

J. Keying requirements will be discussed with the owner, finalized and documented for submittal to the owner.

K. At the completion of the project, submit the following in accordance with Section 01 78 00 – Operation and Maintenance Manuals:

1. As-built hardware schedule, including keying information.
2. Operation and maintenance data as specified.
3. Warranty data as specified.

1.05 QUALITY ASSURANCE

A. The "scheduled" manufacture's names and numbers shown in the hardware schedule are for the purpose of establishing quality, design and function. Only approved Manufacturers and model numbers will be accepted. A request for approval, in writing, indicating the "scheduled" manufacture's catalog number and "substitution" manufacture's proposed substitution catalog number must be submitted. In addition, catalog cuts, and physical samples (if requested), clearly labeled, must accompany the request for approval. All physical samples must be left with the Project Manager for whatever time that is required for his evaluation.

B. Single Source: Provide doors, frames and hardware through one source.

C. Only recognized builders' hardware suppliers who have regularly engaged in furnishing hardware in the project vicinity for a minimum of five (5) years will be acceptable. This supplier must have in its employ a locksmith along with a Hardware Consultant currently a member of the American Society of Architectural Hardware Consultants, who is available at reasonable times, during the course of the work for consultation about the projects hardware details, installation or adjustment. Suppliers without certified consultants may be required to furnish a letter of qualification, listing similar projects furnished, including the Architects name, date and year and the project location.

D. Provide hardware for fire rated openings in compliance with NFPA - 80 latest edition.

1.06 DEFINITIONS

A. ANSI American National Standards Institute.

B. BHMA Builders Hardware Manufacturers Association.

C. CABO Council of American Building Officials.

D. DHI Door and Hardware Institute.

E. ICC International Code Council.

F. NFPA National Fire Protection Association.

G. UBC Uniform Building Code.

1.07 DELIVERY, STORAGE AND HANDLING

A. Hardware shall be delivered to the project site in the manufacturer's original packaging, with appropriate markings indicating the location in accordance with the approved hardware schedule.

B. Jointly inventory the hardware upon delivery with the Contractor and or Installer.

C. Store all hardware in a clean, dry and secure room to prevent hardware from damage and loss.

1.08 WARRANTY

A. The following items shall have warranty in excess of Division 01.

1. Door Closers: 10 years.
2. Locks and Latches: 5 years.

B. Warranty period shall begin from the date of substantial completion.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified under this section shall be products of:

1.	Hinges	ST	Stanley
2.	Locksets	SC	Schlage
3.	Deadbolts	SC	Schlage
4.	Cylinders	SC	Schlage
5.	Latch Protection	DJ	Don-Jo
6.	Flush Bolts	IV	Ives
7.	Closers	SA	Sargent
8.	Wall Stops	TR	Trimco
9.	Door Silencers	TR	Trimco
10.	Overhead Stops	SA	Sargent
11.	Thresholds	P	Pemko
12.	Gasketing, Sweeps, Astragals	P	Pemko
13.	Overhead Rain Drip	p	Pemko
14.	Kickplates/Protective Items	TR	Trimco
15.	Door Position Switches (By Electrical)	SE	Sentrol (GE-Interlogix)

2.02 MATERIALS

A. The following products have been selected to establish a level of quality, design and function. Furnish either the designated item or the approved alternate. Plans show the direction of slide, swing and hand of each door. Furnish each item of hardware for proper installations and operation. Check door and frame types to ensure all additional installation accessories are included with the specified item.

B. Related items: All necessary fastenings, brackets, clips, and other items necessary to install the hardware items in the best manner shall be furnished in the same material and finish as the related item and shall be furnished as a part of the project.

2.03 DOOR HANDLES

A. All door handles on the project shall be lever-type. If lock cylinders are called for on the Door Schedule, they shall be in the handle.

2.04 FASTENERS

A. All screws shall be of matching finish to their product and shall be manufacturers standard.

2.05 HINGES AND PIVOTS

A. Doors 1-3/4 inches thick minimum use 4-1/2-inch hinges.

B. Each door shall have three hinges. Doors 7 feet 6 inches in height, and over shall have an additional hinge for each 30 inches of additional height, or fraction thereof.

C. Exterior doors over 3 feet 2 inches wide and/or 7 feet 6 inches high shall have heavy weight hinges. Hinges shall be non-ferrous with non-removable stainless-steel pins.

D. Interior reverse bevel doors with lockable hardware shall have non-removable pin hinges.

E. Hinges shall be sized in width to clear all trim.

2.06 LOCKSETS

A. Locks, cylinders and trim shall be the product of one manufacturer.

B. Functions as shown in hardware sets.

C. Provide 3/4-inch minimum latch throw for mortise locks, 1/2-inch for cylindrical locks and 1-inch throw for deadbolts.

D. Provide locks with standard 6-pin cylinder.

E. Unless otherwise noted, locksets shall have freely rotating locked levers for added security and vandalism protection.

2.07 DOOR CLOSERS

A. Door closers shall be fully adjustable type with complete spring power adjustment, sizes 2-6 and field adjustable according to door size and frequency of use. Closer shall have adjustable back-check.

B. Where closers are indicated to be delayed action, provide units with adjustable delay.

C. Where doors are indicated to be accessible to the physically handicapped, provide units that comply with ANSI A117.1 provision for door opening force and delayed action for closing.

D. Provide all accessories for mounting required by door and frame types.

2.08 DOOR TRIM UNITS

A. Fabricate protection plates not more than 1 inches less than door width on stop side of door and not less than 1 inch less than door width on pull side of door.

B. Metal plates shall be of stainless steel and 0.050 or 18 gauge.

C. Provide manufacturers standard exposed fasteners with through bolting on matched pairs.

2.09 FLUSH BOLTS

A. Provide manual, self-latching or automatic flushbolts where listed in hardware sets. Flushbolts for fire rated doors shall be approved and shall have U.L. label.

B. Provide minimum 1/2-inch diameter rods of brass, bronze or stainless steel with a minimum 3/4-inch throw.

C. Provide 12-inch rods for doors less than 7 feet 0 inches. Provide longer rods as necessary for doors taller than 7 feet 0 inches.

D. Provide dust proof strikes at all locations except where thresholds are shown.

2.10 THRESHOLDS AND WEATHERSTRIP

A. Provide continuous weather-stripping at the edge of every exterior door leaf. Provide non-corrosive fasteners as recommended by manufacturer.

B. Provide thresholds with flat head sleeve anchors on all exterior doors.

C. Provide PemKote™ anti-slip surface on all exterior thresholds.

2.11 ASTRAGALS

A. All double doors shall be provided with a removable astragal. Astragals shall be constructed of galvanized steel, painted to match door finish. Astragal shall be trimmed as recommended by the manufacturer to clear strike lip or other hardware.

B. Astragals for exterior double doors shall be supplied with weather-stripping at edge where doors meet.

2.12 SILENCERS

A. All interior wood and metal doors shall have silencers, unless specified otherwise.

B. Three per single door and two per pair.

2.13 FINISHES

A. The designations used in hardware sets indicate hardware finishes are to be industry recognized standard commercial finishes established by BHMA.

1. Hinges 630

2.	Locks	626
3.	Flushbolts	626
4.	Push/Pull/Kicks	630
5.	Closers	689
6.	Door stops	626

2.14 KEYING

A. Keying Schedule: After receipt of approved finish hardware schedule, hardware supplier shall prepare a keying schedule. Keying schedule shall then be discussed with Engineer and Owner to ensure all locksets are functionally correct and keying fulfills desires of Owner. Copies of proposed keying schedule shall be given to Engineer and/or Owner with all corrections inserted into proposed schedule.

B. Establish system to integrate with existing system.

C. All keyed cylinders shall be subject to existing Masterkey system. The hardware supplier shall be responsible for obtaining all keying information from the Owner.

D. Keys shall be furnished in the following quantities:

0	each	Grandmaster
6	each	Master keys
3	each	Change keys per cylinder
2	each	Control keys
6	each	Construction keys

E. Construction Keying: Furnish all standard cylinder items with construction cores. Following construction, the hardware shall provide permanent cores as part of this contract. The hardware supplier shall insert all permanent cylinder cores into the locks and try each permanent key for operation before turning the permanent keys over directly to the Owner.

2.15 DOOR POSITION SWITCHES

A. Door position switches shall be concealed/flush mount, magnetic type electric contacts, Sentrol (GE-Interlogix) 2757 Series, or Engineer approved equal. Switches shall be UL listed. Prep doors and frames for switches, which will be provided by Electrical. Coordinate installation and wiring with Division 26 – Electrical.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Mount hardware units at heights indicated in “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames,” By DHI. The local Authority having jurisdiction may have specific requirements that may apply.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Whenever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, reinstall each item. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Vision Panels: Mounting is custom. The vision panel is to be located 40 inches maximum above finish floor, governed by ADA regulations.

D. Set all hardware plumb and true to locations specified in the installation instructions.

E. Set thresholds for exterior doors in a bed of butyl-rubber sealant.

F. Upon completion of installation, verify hardware has been installed in accordance with the approved finish hardware schedule. Check hardware for proper placement and operation. Hardware found to be incorrectly installed or damaged, will be repaired or replaced.

3.02 ADJUSTMENT

A. After inspection of the installation and operation by Engineer, the Contractor shall readjust all items of operating hardware as required.

B. Wherever hardware installation is made more than four (4) weeks prior to acceptance or occupancy of a space or area, return to work prior to acceptance of occupancy and make final check and adjustment of all hardware. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of air conditioning and ventilating equipment. Hardware to be found defective shall be repaired or replaced.

C. Instruct Owner's personnel in proper adjustment and maintenance of hardware and finishes during the final adjustment period.

3.03 PROTECTION AND CLEANING

A. After installation, all hardware surfaces shall be cleaned on both interior and exterior of all mortar, plaster, paint and other contaminants. After being cleaned, all work shall be protected against damage.

3.04 SPECIAL TOOLS

A. Provide three (3) sets of any special tools, required for installation and maintenance of hardware to Owner.

3.05 SCHEDULE

A. Refer to the Door Schedule on the Plans to relate the hardware group to specific doors.

Mfr.	Qty.	Description	Model No.
HW 1			
ST	3 EA	HINGES	FBB191 4.5 x 4.5 NRP
SC	1 EA	LOCKSET	ND53PD RHO
N	1 EA	CLOSER	P7500SS
P	1 EA	THRESHOLD	171A
P	1 EA	SWEEP	18062CNB
P	1 SET	WEATHERSTRIP	S88D 17’
IV	1 EA	KICK DOWN DOOR HOLDER	FS452
HW 2			
ST	8 EA	HINGES	FBB191 4.5 x 4.5 NRP
SC	1 EA	LOCKSET	ND53PD RHO
IV	1 PAIR	MANUAL FLUSHBOLTS	FB458
IV	1 EA	DUST PROOF STRIKE	DP2 626
N	1 EA	DOOR CLOSER (ACTIVE LEAF)	P7500SS
P	1 EA	THRESHOLD	171A
P	2 EA	SWEEP	18062CNB
P	1 SET	WEATHERSTRIP	S88D 20’
IV	1 EA	KICK DOWN HOLDER (ACTIVE LEAF)	FS 452
IV	1 EA	MANUAL WALL HOLDER (INACTIVE LEAF)	WS 445

END OF SECTION 08 71 00

SECTION 08 80 00 – GLAZING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Glazing shall be installed where specified in other sections. Provide glazing systems capable of withstanding normal thermal movement, wind loading, and impact loading, without failure including loss or glass breakage attributable to defective manufacture, fabrication, and installation; deterioration of glazing materials; and other defects in construction.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 08 11 13 – Hollow Metal Doors and Frames

D. Section 08 36 13 – Sectional Doors

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product Data: Glazing material indicated.

C. Certificate: From respective manufactures attesting that glass and glazing materials furnished for the project comply with requirements.

D. Test Reports: Sealant-substrate adhesion and sealant compatibility test reports, including glazing sealant manufacturer's findings and recommendations.

E. Submit operation and maintenance and warranty data in accordance with Section 01 78 00– Operation and Maintenance Manuals.

1.04 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this section or referenced standards.

1. GANA Publications: "GANA Glazing Manual"

2. LSGA Publications: "LSGA Design Guide"

3. SIGMA Publications: TM-3000 "Vertical Glazing Guidelines"

B. SafetyGlass: Product complying with ANSI Z97.1 and CPSC 16 CFR-1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least on component lite of units with appropriate certification label of inspecting and testing agency indicated below:

1. Insulating Glass Certification Council (IGCC)

2. Associated Laboratories, Inc. (ALI)

3. National Certified Testing Laboratories (NCTL)

4. Single-Source Responsibility for Glass and Accessories: Obtain glass and glazing accessories from one source for each product and installation method indicated.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect glazing material to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials.

B. Protect glass from edge damage during handling and installation.

1.06 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Warranty Period: Manufacturer's standard but not less than ten (10) years from Date of Substantial Completion.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide the following glass
1. Tempered or Laminated Safety Glass – Interior Door and Relite Glazing:

a. Certified safety glass in accordance with ANSI Z97.1

b. Unless otherwise approved by the building official, provide manufacturer's label on each light, indicating type and thickness of glass.

c. Thickness: 1/4-inch

d. Color: Clear

e. Coatings: Uncoated

2. Laminated Insulated Units – Exterior Doors and Windows (Within 8 feet above ground level): Factory assembled insulated units composed of two glass lights separated by a metal spacer, hermetically sealed and containing a captive dehydrated air space and complying with the following:

a. Exterior Pane: Laminated outboard lite consisting of; 3/16-inch thick, clear float glass, heat-strengthened; 0.060 thick polyvinyl butyral interlayer, clear; 3/16-inch thick, clear float glass, heat-strengthened with PPG Solarban 60 solar control low-e coating on surface 4. Provide exterior pane with obscure glass where indicated on the drawings.

b. Interior Pane: 1/4-inch thick, clear float glass.

c. Air Space: 3/8”, as required to result in specified overall thickness. Argon gas filled.

d. Overall Unit Thickness: 1-inch

3. Insulated Units – Exterior Windows (Over 8 feet above ground level): Factory assembled insulated units composed of two glass lights separated by a metal spacer, hermetically sealed and containing a captive dehydrated air space and complying with the following:

a. PPG/Vitro, Solarban 60 (2) Clear + Clear; SHG 0.38, Shading Coefficient 0.44, Visible Light Transmission 70, U-value Winter 0.29, U-value Summer 0.27, Outdoor Visible Light Reflectance 11, Interior Reflectance 12.4, UV% 18.6, Light to Solar Ratio 1.85.

i. Exterior Pane: 1/4" thick, clear float glass, heat-strengthened with PPG Solarban 60 solar control low-e coating on 2nd surface.

ii. Interior Pane: 1/4" thick, clear float glass, heat-strengthened.

iii. Air Space: 1/2”, as required to result in specified overall thickness. Argon gas filled.

iv. Overall Unit Thickness: One inch (1”).

4. Mirror Glass: 1/4” thick, transparent flat, type I, Class 1 clear, Quality Q2, conforming to FS DD-G-451, with silvering, copper coating and protective organic coating complying with FS DD-M-411. Grind and polish all edges.

B. Provide safety glass units in all doors, where indicated, and where required by authorities having jurisdiction. Refer to International Building Code for safety glazing locations.

2.02 ACCESSORIES

A. Elastomeric Glazing Sealants: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealant and tapes of proven compatibility with other materials they will contact, including glass products, and glazing channel substrate, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with sealant and glass manufacturer’s recommendations for selecting glazing sealants and tape that are suitable for applications indicated and conditions existing at time of installation.

a. Colors: Provide color of exposed joint sealants as selected by Engineer from manufacturer’s full range of standard colors for products of type indicated.

B. Glazing Tapes: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect an air and vapor seal.

C. Miscellaneous Glazing Materials: Provide products of material, size, and shape complying with referenced glazing standards, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

1. Cleaners, Primers and Sealants: Type recommended by sealant or gasket manufacturer.

2. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

3. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

4. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side-walking).

2.03 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.03 INSTALLATION

A. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

B. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by project conditions during installation.

C. Protect glass from edge damage during handling and installation as follows:

1. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

2. Remove damaged glass from project site and legally dispose of offsite. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by pre-construction sealant-substrate testing.

E. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in this course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressure stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:

1. Locate spacers inside, outside and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

I. Set glass lights in each series with uniform pattern, labels, draw, bow and similar characteristics.

J. Mirror Units: Install mirror units full width of the wall, as shown on the drawings. Use Knape & Vogt #277/278 glass clip mounting brackets.

3.04 PROTECTION AND CLEANING

A. Protection: Glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld spatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Remove nonpermanent labels, and clean glass as recommended by manufacturer.

END OF SECTION 08 80 00

DIVISION 09 – FINISHES

SECTION 09 90 00 – PAINTING AND COATING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work covered by this section includes all labor, materials, and equipment required for surface preparation and application of protective coatings as indicated on the Plans and as specified herein.

B. It is the intent that all new interior and exterior metal and submerged metal surfaces be painted, whether specifically mentioned or not.

C. Unless specifically indicated in the Technical Specifications, the following items shall not be painted:

1. Nonferrous and corrosion-resistant alloys such as copper, bronze, monel, aluminum, chromium plate, stainless steel, except where:

a. Required for electrical insulation between dissimilar metals.

b. Aluminum and stainless steel that is embedded in concrete or masonry, or aluminum in contact with concrete or masonry.

c. Color coding of equipment is required.

2. Nonmetallic materials such as glass, PVC, wood, porcelain, and plastic except as required for architectural painting or color coding.

3. Prefinished electrical and architectural items such as motor control centers, switchboards, switchgear, transformers, disconnect switches, acoustical tile, cabinets, elevators, wall panels, except where color coding of equipment is required.

4. Nonsubmerged electrical conduits attached to unpainted concrete surfaces.

5. Cathodic protection anodes.

6. Insulated piping or insulated piping with jacket, except as required for architectural painting or color coding.

7. Moving parts of operating units such as valve and damper operators, linkages, sensing devices, motor and fan shafts, unless otherwise specified.

8. Code required labels, such as Underwriters Laboratories, or any equipment data plates.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 08 11 13 – Hollow Metal Doors and Frames

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Manufacturer’s Certification: Contractor shall submit certification that states that the factory applied coating system meets or exceeds the requirements specified herein.

C. Technical Data Sheets: For each paint system used herein, Contractor shall submit a technical data sheet from each paint manufacturer and paint colors available for each product used in the paint system. The technical data sheet shall at minimum provide the paint material name, manufacturer name, product name and number, material specification, minimum coats of coverage and thickness.

D. Paint Schedule: Contractor shall submit a complete and detailed paint schedule showing, at a minimum, product name and number (including required primer or ty-coat), number of coats, thickness of each coat, colors, and locations each paint system will be used.

E. Contractor Qualifications: Submit coating applicator name and qualifications, including references and manufacturer’s certification as applicable and specified in this section.

F. Maintenance Instructions: Contractor shall submit Manufacturer’s instructions for procedures and products required for re-coating of finish coat. Submit maintenance data in accordance with Section 01 78 00 – Operation and Maintenance Manuals.

1.04 QUALITY ASSURRANCE

A. Contractor Qualifications: All painting specified in this section shall be accomplished by an applicator qualified in the field of protective coatings for a water and wastewater systems, with a minimum of five (5) years of experience, including specific experience in application of the specified product systems. The Contractor shall maintain qualified personnel who have received training by the manufacturer or manufacturer’s representative and shall be certified or licensed by the coating materials manufacturer as a qualified applicator.

1.05 DELIVERY AND STORAGE

A. Deliver all materials to the job site in original, new, and unopened packages and containers bearing manufacturer's name and label.

1. Provide labels on each container with the following information:

a. Name or title of material.

b. Federal Specification number, if applicable.

c. Manufacturer's stock number.

d. Manufacturer's name.

e. Contents by volume, for major pigment and vehicle constituents.

f. Thinning instructions.

g. Application instructions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

1.06 GUARANTEE/WARRANTY

A. The Contractor shall provide a Manufacturer's guarantee as specified in the General Conditions for all labor, materials, and equipment required herein.

1.07 JOB CONDITIONS

A. Do not apply paint when conditions are such that dust, dirt, or other deleterious substances which may impair the quality of coats or the finish are present or will be present before the coating is fully dry.

B. Comply with manufacturer's recommended limitations for ambient and surface temperature and humidity. No painting is to be done when the relative humidity exceeds 85 percent.

C. Comply with manufacturer's recommendations for minimum and maximum times between applications.

PART 2 – PRODUCTS

2.01 PAINT AND COATING SUPPLIERS

A. Specifications for paint of this section are based on products of the Sherwin-Williams Company, unless otherwise specified. Equivalent products are acceptable only with Engineer’s approval.

B. Paint finish coats shall be by the same Manufacturer of the prime coat and shall be compatible. Contractor shall be responsible for verifying compatibility of finish coatings used with shop coating system used by manufacturers of prefinished materials and equipment.

2.02 COLOR REQUIREMENTS

A. Each coat of paint shall be darker than the preceding coat such that the finish coat is the darkest coat.

B. Colors shall be formulated with colorants free of lead and lead compounds.

C. Fiberglass reinforced plastic (FRP) equipment with an integral colored gel coat shall not require painting, provided the color is approved by the Engineer.

D. Colors shall be selected from “deep” pigments.

2.03 PAINT SYSTEM SCHEDULE

A. All colors will be selected by the Owner based on the color charts and samples submitted by the Contractor.

B. The Contractor will be required to prepare and paint the following areas of construction:

1. All ceilings and interior walls (unless otherwise noted).

2. All hollow metal doors and frames (unless otherwise noted).

3. Any miscellaneous metal work which is not galvanized, aluminum or stainless steel, including, but not necessarily limited to, pipe and valve supports, and equipment stands and supports.

C. The following types of paints in the schedule below, as manufactured by the Sherwin-Williams Company, have been used as a basis for the paint schedule:

PAINTING SCHEDULE				
LOCATION	ITEM	TYPE OF COATING	FINISH	PRODUCT SYSTEM
Building, Interior (All Rooms and Buildings)	Ceiling, walls and trim	Latex Enamel	Eggshell	ProMar 200 EG-SHEL Enamel, B20W200 Series, including ProMar 200 Interior Latex primer, B28W02600 Series
Building Interior (Dewatering Building and UV/RAS Building)	D.I., Steel, and PVC pipe, fittings, and valves	Alkyd	Gloss	INDUSTRIAL ENAMEL VOC, B54Z Series, including manufacturer recommended primer/ty-coat
Building Interior and Exterior (All Rooms and Buildings)	Hollow metal doors and frames, misc. steel fabrications	Aliphatic Acrylic Polyurethane	Semi-Gloss	HI-SOLIDS POLYURETHANE, B65-350 Series, including manufacturer recommended primer/ty-coat

D. For all product systems in the above schedule, primer shall be provided that is appropriate for the substrate and compatible with the specified finish coat. If substrate conditions are not appropriate for the primer specified, the manufacturers recommended primer and/or ty-coat shall be provided. The manufacturers recommended (suggested) dry film thickness shall be provided for all product systems.

PART 3 – EXECUTION

3.01 INSPECTION

A. All work performed under this section shall be carefully inspected by the Contractor and Engineer for rejections or flaws to be corrected, and for proper compliance with Plans and Specifications. Owner furnished equipment shall be inspected by Contractor for compliance with this specification. If surface damage to paint system occurs prior to delivery, and if the Engineer determines that the damage cannot be repaired at the job site, the equipment will be returned to the factory for repair and returned to the job site at no cost to the Owner.

B. Visual Inspection: The paint system will be visually inspected by the Engineer and/or Contractor. Show-through of substrate or previous coating will be grounds for rejection.

C. Testing: Dry Film Thickness (DFT) in mils on steel and galvanized substrates will be measured with a calibrated magnetic non-destructive testing apparatus. Holiday testing of concrete primary digester coating systems shall be as specified in paragraph 2.04.

D. Coverage rates for concrete and masonry surfaces will be determined by a count of empty containers. Remove or permanently deface labels of empty containers after counting by the Engineer. Remove empty, counted containers from the job site.

E. All pipe testing shall be done prior to any finish painting.

F. Leak tests and all functional tests shall be completed prior to painting unless permitted otherwise by the Engineer.

G. Starting of painting work will be construed as the installer's acceptance of the surfaces and conditions within any particular area.

H. Factory Finished/Prefinished items:

1. Unless otherwise indicated, do not include painting when factory finishing, or installer finishing is specified for such items as (but not limited to) toilet accessories, partitions, lab equipment, furnishings, cabinetwork, acoustical materials, acoustical ceilings, and metal surfaces of aluminum louvers and similar finished materials.

2. For factory finished items that require additional field painting see painting schedule, Paragraph 2.03.

I. Remove all hardware, hardware accessories, machine surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted or provide surface-applied protection prior to surface preparation and coating operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

3.02 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.

B. Installer must examine the areas and conditions under which painting work is to be applied. Notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

C. Test previously painted or primed surfaces for compatibility with painting systems.

D. Masking: Remove, mask, or otherwise protect surfaces or hardware not specified or intended to be painted or blasted, or surfaces which have received the finish coat.

E. Clean surfaces to be painted before applying coating or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet, newly coated surfaces.

F. Metal Surface Preparation: All workmanship for metal surface preparation shall be in conformance with the current Steel Structures Painting Council (SSPC) specifications as listed in Table 09 90 00-1. All oil, grease, welding fluxes, and other surface contaminants shall be removed prior to blast cleaning. All surfaces shall be cleaned of all dust and residual particles of the blast cleaning operations prior to painting. Surfaces that have started to rust before they are painted shall be re-blasted.

Table 09 90 00-1. SSPC Specification Numbers	
Solvent Cleaning	SP 1
Hand Tool Cleaning	SP 2
Power Tool Cleaning	SP 3
White Metal Blast Cleaning	SP 5
Commercial Blast Cleaning	SP 6
Brush-Off Blast Cleaning	SP 7
Pickling	SP 8
Near-White Blast Cleaning	SP 10

G. Plastic Surface Preparation: All plastic surfaces to be coated shall be hand sanded to provide tooth for the coating system. Larger areas may be power sanded, or brush-off blasted, provided sufficient controls are employed so that the surface is roughened without removing excess material. Wash sanded surfaces with detergent and rinse.

H. Concrete and Masonry Preparation:

1. Prepare surfaces of concrete and masonry to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, through etching, wire brushing, fiber brushing, stoning or scraping to remove glaze.

2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. Do not paint over surfaces where the alkalinity or moisture content exceeds that permitted in the manufacturer's printed directions.

I. Previously primed or painted surfaces. Sand lightly to remove gloss then wash with detergent and rinse.

J. Wood Preparation:

1. Touch up knots, pitch streaks and sappy spots with shellac where finish calls for interior enamel or paint. Sand all surfaces smooth and wipe clean before applying specified primer. Putty or spackle holes, splits, and scratches smooth after primer application.

2. Staining: Clean soiled surfaces, sand smooth and even and vacuum clean where finish calls for stain. Putty all nail holes, cracks, and the like with colored putty matching that of finish, after first coat has been applied. Bring putty flush with adjoining surfaces in neat, workmanlike manner. After "setting", wipe wood-paste filler across open grain wood. Wipe with grain and obtain clean surface.

3. Back prime interior and exterior trim before installation with wood prime paint.

K. Gypsum Wallboards Preparation: Fill narrow, shallow cracks and small holes with spackling compound. Rake deep wide racks and deep holes. Dampen with clear water. Fill with thin layers of drywall joint compound. Allow to dry. Sand smooth. Do not raise nap of paper.

L. Protection from sandblasting: Thoroughly mask and protect from dust all mechanical and electrical equipment in vicinity of sandblasting. Repair all painted surfaces and equipment damaged by sandblasting.

M. Non-ferrous metals shall not be painted, except where directed or called for.

N. Hot-dip galvanized items shall not be painted except where directed or called for. See elsewhere in these specifications for special treatment of hollow metal doors and frames.

3.03 APPLICATION

A. General:

1. Apply paint in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of material being applied. Do not exceed manufacturer's recommended coverage per gallon.

2. Apply additional coats when undercoats, stains, or other conditions show through the finish coating, until the paint film is of uniform finish color and appearance.

3. Apply paint to surfaces behind movable equipment and furniture the same as similar exposed surfaces. Coat surfaces behind permanently fixed equipment or furniture with prime coat and base coat only.

4. See elsewhere in these specifications for special requirements and treatment of hollow metal doors and frames.

B. Back priming: Ungalvanized structural steel, miscellaneous steel and iron work shall be back-primed prior to erection. Galvanized steel surfaces need not be back primed or painted. All ungalvanized metal brackets, angles, mechanical equipment mounting plates and miscellaneous devices mounted against concrete or masonry surfaces shall be back primed before installing.

C. Factory Finished Items (including factory primer):

1. The Contractor shall repair or have repaired all surface damage to factory finished items. The Engineer shall determine if damage can be repaired at job site or if item is to be returned to the factory. Any coating done shall be equal to the original coating in every way and compatible with the shop coats.

2. Where additional coats of paint are required, the factory applied primer shall be from the paint system selected or be compatible with it. This finish coat will be field applied. Coordinate this work with equipment manufacturers. Colors will be selected by the Engineer.

D. Hollow Metal Doors and Frames: All hollow metal doors and frames on this project shall be factory primed and field finish painted as specified in Section 08 11 13 – Hollow Metal Doors and Frames. Factory paint and field finish paint shall be spray-applied to achieve a smooth and uniform finish. Brush and roller applied finishes will not be accepted.

E. Coating inspection: Each coat of material shall be inspected and approved by the Engineer before applying succeeding coats; otherwise no credit for coats applied will be given, and Contractor assumes recoat responsibilities.

3.04 CLEANUP

A. Cleanup: During the progress of the work, remove from the project daily all discarded coating materials, rubbish, cans and rags.

B. Cleaning: Upon completion of painting work, clean all window glass and other spattered surfaces. Clean by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Corrected Work: Correct any damages by cleaning, repairing, or replacing and painting as directed by the Engineer. Provide "Wet Paint" signs as required to protect newly-coated finishes. Remove temporary protection wrappings provided by others for protection of their work, after completion of painting operations.

D. Repair of Defective Work: Where any painted surface exhibits rust through its finished coat, all layers of primer and paint shall be removed down to the bare metal. The metal surface shall be prepared again to receive a completely new paint system. The new system shall be the same as the one removed or as selected by the Engineer.

END OF SECTION 09 90 00

DIVISION 13 – SPECIAL CONSTRUCTION

SECTION 13 34 19 – PRE-ENGINEERED METAL BUILDING SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work includes the manufacture, delivery, and certification of installation of one pre-engineered metal building of the nominal length, width, eave height, and roof pitch as indicated on the drawings that accompany this bid package.

1. Storage Building: 40’ span x 50’ length x 18’ eave height. Bay spacing as shown on the drawings.

a. Provide eave gutters and downspouts full length of each eave. Space gutters as required to handle precipitation. See section 07 62 00 – SHEET METAL FLASING AND TRIM for gutter and downspouts.

B. Roof and wall panels and building framing are to be sized to accommodate a dual-layer insulation system, complying with the Washington State Energy Code (2021) minimum thermal resistance requirements. See section 07 21 00 – THERMAL INSULATION for insulation specifications, and section 07 41 11 – METAL ROOF AND WALL PANELS for building sheet metal panels.

C. Provide standard wall panels for the pre-engineered metal building, to be attached to framing members using exposed fasteners. Wall panels are fastened through the insulation specified in section 07 21 00 – THERMAL INSULATION. See section 07 41 11 – METAL ROOF AND WALL PANELS for building sheet metal panels.

D. Roof system is to consist of standard roof panels with special coatings which will be attached to framing members using exposed fasteners. Roof panels are fastened through the insulation specified in section 07 21 00 – THERMAL INSULATION. See section 07 41 11 – METAL ROOF AND WALL PANELS for building sheet metal panels.

E. All parts of the metal building system envelope shall adhere to Washington State Energy Code for Commercial Building’s latest edition (2021). The metal building shall also comply with Washinton State Building Code’s latest edition (2024).

F. Endwalls are to be post and beam standard endwalls.

G. Building package is to include framed openings for all doors and other openings as shown on the drawings referenced above.

H. Manufacturer’s standard building components and accessories are to be used, provided components and accessories conform to the design indicated and specified requirements.

I. Manufacturer is to include in bid and furnish all fasteners necessary to erect the building except those needed to secure it to the concrete foundation such as anchor bolts, which will be by Contractor. Fasteners included in the bid are to be clearly identified in the bid detail.

J. Payment for all work covered by this section shall be included in the Total Bid Price for this section.

1.02 RELATED WORK

A. Section 01 30 00 – Submittals

B. Section 03 20 00 – Concrete Reinforcing

C. Section 03 30 00 – Cast-in-place Concrete

D. Section 07 21 00 – Thermal Insulation

E. Section 07 41 11 – Metal Roof and Wall Panels for building sheet metal panels

F. Section 07 62 00 – Sheet Metal Flashing and Trim

G. Section 07 92 00 – Joint Sealants

H. Section 08 11 13 – Hollow Metal Doors and Frames

I. Section 08 36 13 – Sectional Doors

1.03 REFFERENCE STANDARDS

A. American Institute of Steel Construction (AISC)
   1. 360, Specification for Structural Steel Members.

B. American Iron and Steel Institute (AISI)
   1. AISI North American Specification for the Design of Cold-Formed Steel Structural Members.

C. American Welding Society (AWS):
   1. AWS D1.1/D1.1M – Structural Welding Code – Steel.
   2. AWS D1.3/D1.3M – Structural Welding Code – Sheet Steel.

D. ASTM International (ASTM):
   1. ASTM A36 – Standard Specification for Carbon Structural Steel.
   2. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
   3. ASTM A475 – Specification for Zinc-Coated Steel Wire Strand.
   4. ASTM A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   5. ASTM A529 – Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
   6. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   7. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   8. ASTM A992 – Standard Specification for Structural Steel Shapes.
   9. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   10. ASTM A1018 – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   11. ASTM A1039 – Specification for Steel, Sheet, Hot Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, Produced by Twin-Roll Casting Process.
   12. ASTM F3125 – Standard Specification for High Strength Structural Bolts.

E. Metal Building Manufacturers Association (MBMA):
   1. MBMA Metal Building Systems Manual.

F. Washington State Energy Code for Commercial Buildings (WSEC), 2021

G. Washington State Building Code, 2021

1.04 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Engineer, design, fabricate and deliver as specified herein the pre-engineered metal building systems to withstand loads from winds, gravity, structural movement including movement thermally induced, and to resist in-service use conditions that the building will experience, including exposure to the weather, without failure.

B. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stressed in that member as prescribed in MBMA's "Design Practices Manual."

C. Design Codes: Structural design for the metal building structural system shall be provided by the metal building system manufacturer for the following design criteria:

1. Governing building code: Washington State Building Code, 2021

2. Occupancy category: U – Utility and Miscellaneous

D. Design Loads: Basic design loads are as follows:

1. Risk Category I

2. Roof load 30 psf (snow)

3. Seismic Zone 2B

4. Wind load of 70 mph, Exposure "C"

5. Live Load is to include weight produced by maintenance activities, rain, erection activities, and other movable or moving loads. Wind, snow, seismic, crane or dead loads do not apply to the live load.

6. Dead Load is to include self weight of all framing members and sheeting plus a collateral load of 5 psf to account for lighting and other miscellaneous loads.

E. Structural Framing and Roof and Siding Panels: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual."

1. Structural Steel: Comply with the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.

2. Light Gage Steel: Comply with the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.

3. Welded Connections: Comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

F. General Serviceability Limits:

1. Deflection Limits shall be in accordance with the applicable provisions of the MBMA, in the latest edition.

2. Vertical deflection limits apply for snow load (50-year mean-recurrence interval) plus collateral load, or the code required live load. The horizontal drift and deflections limits apply for the loads induced by a basic wind speed corresponding to a 10-year mean-recurrence interval.

1.05 SUBMITTALS

A. Submittals shall be provided in accordance with Section 01 33 00.

B. Product Data: Metal building system manufacturer is to submit the following items:

1. Metal building system manufacturer's product information data sheets for all building components and accessories, including trim. Accessories which are part of the bid shall be clearly identified.

2. Preparation instructions and recommendations for each product, component, and accessory to be used.

3. Storage and handling requirements and recommendations.

4. Installation methods to be used.

C. Shop Drawings: Shop drawing submittals shall be complete with one submittal for each building, for the proper identification and assembly of all building components. Submittals shall be in accordance with Section 01 33 00, Paragraph 2.03, SHOP DRAWINGS. Shop drawings shall include the following features:

1. Structural Framing: Furnish complete erection drawings stamped and prepared by or under the supervision of a professional engineer legally authorized to practice in the State of Washington. Include details showing fabrication and assembly of the metal building system. Show anchor bolts settings and sidewall, endwall, and roof framing. Include transverse cross-sections. Provide detailed information about painting of structural members, including surface preparation.

2. Roofing and Siding Panels: Provide layouts of panels on walls and roofs, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details.

3. Piping Connections: Provide details showing how piping may be suspended from purlins and structural steel.

4. Building Accessory Components: Provide details of metal building accessory components to clearly indicate dimensions, and methods of installation.

5. Sheet Metal Accessories: Provide layouts at 1/4-inch scale. Provide details of gutters, downspouts, and other sheet metal accessories at not less than 1-1/2-inch scale showing profiles, methods of joining and anchorages.

6. Calculations prepared and signed by a Professional Engineer, legally authorized to practice in the State of Washington. Engineer shall certify that the structural framing and covering panels meet indicated loading requirements and codes of authorities having jurisdiction. Include reactions for building columns, bracing, and all applicable load cases, and calculations for rigid frames and purlins.

D. Samples: Submit samples for approval in accordance with Section 01 33 00, Paragraph 2.04, SAMPLES. Samples shall also include the following features:

1. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures and patterns available for metal roofing and siding panels with factory-applied finishes.

2. Samples for verification purposes of roofing and siding panels. Provide sample panels 12-inch long by actual panel width, in the profile, style, color and texture indicated. Include clips, battens, fasteners, closures and other panel accessories.

E. Certifications: The following certifications of qualifications shall be submitted:

1. Installation Certificates: Provide installation certificates signed by the metal building manufacturer certifying that the installer complies with requirements included under the “Quality Assurance” Article.

2. Welder’s Certificates: Certification of welder qualifications shall be furnished as specified by the Project Engineer.

F. Bill of Materials: Bill of Materials shall be furnished and shall include item weights.

1. Preventative Maintenance Manual.

1.06 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide pre-engineered metal buildings manufactured by a firm experienced in manufacturing metal buildings systems that are similar to those indicated for this project and have a record of successful in-service performance.

B. Weldments, Welder, and Weld Inspection Qualifications: Welding inspection and welding inspector qualification for structural steel shall be in accordance with AWS D1.1, “Structural Welding Code – Steel”, latest edition. Welding inspection and welding inspector qualification for cold-formed steel shall be in accordance with AWS D1.3, “Structural Welding Code – Sheet Steel”, latest edition.

C. Design Criteria: The drawings indicate sizes, profiles and dimensional requirements of the pre-engineered metal building system. Metal building systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations to not change the design concept or intended performance. The burden of proof for equality is on the proposer.

D. Erector Qualifications: All products listed in this section are to be installed by a single installer who has demonstrated experience in installing products of the same type and scope as specified.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.

B. Store and handle materials in accordance with manufacturer's instructions. Store materials on a flat, level surface, raised above the ground with adequate support to prevent sagging. Protect materials and finish during storage, handling, and installation to prevent damage.

C. Maintain environmental conditions (temperature, humidity, ventilation) within limits recommended by the manufacturer for optimum results. Do not install products under environmental conditions outside of the manufacturer's absolute limits.

1.08 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Building System Warranty: The manufacturer shall warrant the metal building system against failure due to defective material or workmanship for a period of one (1) year from date of shipment.

C. Roof Weathertightness and Roof and Wall Panel Finish Warranty: See Section 07 40 00.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with specified requirements, provide metal building systems provided by one of the following, or approved equal:

1. Butler Manufacturing Co.
2. CECO Building Systems
3. Star Building Systems, H. H. Robertson Co.
4. American Buildings
5. Nucor Building Systems

2.02 MATERIALS

A. Hot-Rolled Structural Steel Shapes: Steel for hot rolled shapes must conform to the requirements of ASTM A36, A572 or A992, with minimum yield of 36 or 50 ksi, respectively.

B. Steel for built-up sections must conform to the requirements of ASTM A1011, A1018, A529, A572 or A36 as applicable, with minimum yield of 36, 50, or 55 ksi as indicated by the design requirements

C. Steel Members Fabricated from Plate or Bar Stock: Provide 50,000 psi minimum yield strength. Comply with ASTM A529, ASTM A1011 or ASTM A572.

D. Square and Rectangular Tube must conform to the requirements of ASTM A500 Grade B with a minimum yield strength of 46 ksi.

E. Steel Members Fabricated by Cold Forming: Comply with ASTM A607, Grade 50, galvanized. Steel for Cold-Formed sections must conform to the requirements of ASTM A1011 or A1039 Grade 55 or ASTM A653 Grade 55 with minimum yield strength of 55 ksi.

F. Bolts for Structural Framing: Comply with ASTM A307 or ASTM F3125 as necessary for design loads and connection details.

G. Shop Primer for Ferrous Metal: Fast-curing, lead-free, abrasion-resistant, rust-inhibitive primer selected by the manufacturer for compatibility with substrates with types of alkyd finish paint systems indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with FS TT-P-86, Types I, II or III.

H. Primary structural steel, including rigid frames and endwalls is to be hot-dip galvanized. Clean surfaces to be galvanized of loose mill scale, rust, dirt, oil, grease and other matter precluding galvanizing bond. Follow procedures of SSPC-SP6 for Commercial Blast Cleaning.

I. Steel used to form purlins, girts, and eave struts must meet the requirements of ASTM A1011 or ASTM A1039 Grade 55 for primed material or ASTM A653 Grade 55 for galvanized material with a minimum yield of 55 ksi. Gauge to be determined by design to meet specified loading conditions. Minimum hot-dip galvanized coating thickness shall be G90.

J. X-bracing will comply with ASTM A529 for rod bracing, ASTM A992 for angle bracing, or ASTM A475 for cable bracing.

2.03 PRIMARY FRAMING

A. Rigid Frames: Fabricated as a welded built-up “I” sections or hot-rolled sections.

1. Frame Design: Symmetrical Gable.
2. Frame Type: Clear-Span.

B. Rigid Frame Columns and Rafters: The frame columns are to be of a uniform depth, and the rafters tapered.

C. End Wall Frames and Roof Beams: End wall columns are to be fabricated of cold-formed sections, mill-rolled sections, or built-up “I” sections, dependent on design requirements. Roof beams are to be fabricated of either mill-rolled sections or built-up “I” sections, depending on design requirements.

D. Finish: Primary framing finish is to be hot-dip galvanized.

E. Field Bolted Connections: All field bolted connections shall be designed and detailed utilizing ASTM F3125 Grades A325 or A490 as required by design.

2.04 SECONDARY FRAMING

A. Purlins and Girts: Purlins and girts shall be cold-formed "Z" sections with stiffened flanges. Flange stiffeners shall be sized to comply with the requirements of the latest edition of AISI S100. Purlins and girts shall be pre-punched at the factory to provide for field bolting to the rigid frames. They shall be simple or continuous span as required by design. Connection bolts will be installed through the purlin or girt webs, not purlin or girt flanges. Purlins and girts shall comply with the following criteria:

1. Purlin Criteria:

a. Depth: 8”
b. Maximum Length: To be determined by design.
c. Finish: Gray Primer

2. Girt Criteria:

a. Depth: 8”
b. Maximum Length: To be determined by design.
c. Finish: Gray Primer

B. Eave Struts: Equal flange, cold-formed “C” sections, with the following criteria:

1. Depth: 8”
2. Maximum Length: To be determined by design.
3. Finish: Gray Primer

C. Base Framing: Base framing shall comprise of a base girt with flashing. Flashing shall comply with Section 07 62 00, SHEET METAL FLASHING AND TRIM.

2.05 ROOF PANELS

A. Roof Assembly Performance Requirements: Provide roof products and assemblies meeting the following requirements:

1. Assemblies meet UL-580, Class 90.
2. Assemblies meet Class A rating in accordance with UL-790 for External Fire.

B. Roof panels comply with Section 07 41 11 – Metal Roof and Wall Panels.

2.06 WALL PANELS

A. Wall panels will comply with Section 07 41 11 – Metal Roof and Wall Panels.

2.07 SHEET METAL ACCESSORIES

A. Provide coated steel sheet metal accessories with coated steel roofing and siding panels.

2.08 ACCESSORIES

A. Walk Doors: Refer to Section 08 11 13, and reference contract drawings.

B. Sectional Doors: Refer to Section 08 36 13, and reference contract drawings.

C. Metal Building Insulation: Refer to Section 07 21 00, and reference contract drawings.

2.09 FABRICATION

A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly. Additional requirements are as follows:

1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged and reassembled with a minimum amount of labor.

2. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams and instruction manuals.

3. Shop Connections: Provide bolted, or welded shop connections.

4. Field Connections: Provide bolted field connections.

B. Structural Framing:

1. Shop-fabricate framing components to indicated size and section with base plates, bearing plates and other plates required for erection, welded in place.

2. Provide holes for anchoring or connections, shop-drilled or punched to template dimensions.

3. Secondary structural connections (purlins and girts) to be ordinary bolted connections, which may include welded clips.

a. Zee Purlins: Fabricate purlins from cold-formed "Z" sections with stiffened flanges. Size flange stiffeners to comply with the requirements of the latest edition of AISI. Connection bolts will install through the webs, not the flanges.

b. Girts: Girts must be simple or continuous span as required by design. Connection bolts will install through the webs, not the flanges.

4. The manufacturer is responsible for all shop welding inspections in accordance with the manufacturer's IAS Accreditation. Special inspections by the buyer or owner may be done in the manufacturer’s facility and must be noted on the contract documents.

5. Non-Destructive Testing (NDT) – NDT shall be performed and documented as required by the governing building code for this project.

C. Bracing:

1. Diagonal Bracing:

a. Longitudinal bracing in the roof and/or walls need not be furnished where it can be shown that the diaphragm strength of the roof and/or wall covering is adequate to resist the applied wind or seismic forces. Diagonal bracing in the roof and sidewalls may be used to resist longitudinal loads (wind, crane, etc.) in the structure if diaphragm action cannot be used.

b. Diagonal bracing will be furnished to length and equipped with hillside washers and nuts at each end. It may consist of rods threaded at each end or galvanized cable with suitable threaded end anchors. If load requirements dictate, bracing may be of structural angle and/or tube, bolted in place.

PART 3 – EXECUTION

1.08 PREPARATION

A. Confirm field dimensions and examine substrates, areas, and conditions within which work is to be performed. Do not proceed with work until unsatisfactory conditions are corrected.

B. Before erection proceeds, survey elevations and locations of concrete and masonry bearing surfaces and locations of anchor rods, bearing plates and other embedment's to receive structural framing, with Erector present, for compliance with requirements and metal building system manufacturer's tolerances.

C. Provide temporary shores, guys, braces, or other supports as necessary during construction to keep structural framing secure and in alignment against temporary construction loads equal in intensity to design loads. Remove temporary supports when permanent structural framing connections and bracing are in place, unless otherwise indicated.

1.09 INSTALLATION

A. The erection of the building system shall be performed by a qualified erector, in accordance with the appropriate erection drawings, erection guides and /or other documents furnished by manufacturer, using proper tools, equipment and safety practices.

B. Erect framing in accordance with MBMA Metal Building Systems Manual, Chapter IV Common Industry Practices.

C. There shall be no field modifications to any primary structural members except as authorized and specified by the building manufacturer.

1.10 PROTECTION AND CLEANING

A. Protect installed components until completion of the project.

B. Touch-up damaged coatings and finishes and repair minor damage. Replace damaged products, if necessary, prior to substantial completion. Clean exposed surfaces using non-abrasive materials and methods recommended by the manufacturer of material and product being cleaned.

C. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 13 34 19

DIVISION 22 – PLUMBING

SECTION 22 00 00 – PLUMBING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work shall consist of all labor, materials, equipment and incidentals necessary to completely furnish, install, test and clean all plumbing systems. The systems shall include, but not be limited to, all piping, fittings, hangers, valves, fixtures and equipment indicated on the Plans and/or specified herein including all appurtenances necessary to make the systems complete and fully operational.

B. Plumbing systems shall be, but not be limited to, the following:

1. Potable water to 5 feet outside of buildings.

2. Non-potable water to 5 feet outside buildings.

3. Drainage, waste, and vents to 5 feet outside of buildings.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 03 30 00 – Cast-In-Place Concrete

C. Division 26 – Electrical

D. Division 33 – Utilities

E. Division 40 – Process Interconnections

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit product data sheets for all plumbing materials and equipment used on the project.

1.04 QUALITY ASSURANCE

A. Comply with the requirements of Section 40 02 11 – Process System Basic Materials and Methods.

B. All work shall be done by people fully qualified and experienced in the work to be performed.

C. Provide the services of a manufacturer's representative to completely inspect and start up the pumps after installation.

1.05 PROJECT CONDITIONS

A. Obtain exact location and mounting heights of fixtures from details on Plans. Do not order any fixtures until casework shop drawings have been reviewed. Coordinate all fixture locations with casework manufacturer.

B. Where trim and rough-in is not specified, furnish as necessary for the completion of job and of same quality as elsewhere specified.

C. All trim chrome plated.

D. Escutcheon plates for all lines through cabinets and walls.

E. All counter top sinks set on bead of clear silicone sealant.

F. Install trim as specified and connect to equipment furnished by others, and equipment furnished by Owner.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Specifications are based on products of the following manufacturers:

American Standard	Nibco-Scott
Josam	BEECO
Epco	Fee & Mason
Bradley	Precision Plumbing Products
Eljer	Kohler
Zurn	

B. Equivalent products by the following manufacturers are acceptable, subject to approval of the Engineer.

Capitol Manufacturing	Watts
American Granby Co.	Neptune
Crane	ITT Grinnell
Unistrut	Wade
Hammond Valve Corp.	Speedstrut
Zurn	Cla-Val
J.R. Smith	

C. Each type of equipment shall be by a single manufacturer, for example, all plumbing fixtures, roof and floor drains, water heaters, etc.

2.02 DRAIN, WASTE, AND VENT PIPE AND FITTINGS, BELOW GROUND

A. Below ground drain pipe and fittings shall be as called out on the Plans, in accordance with Section 40 20 11 – Process Piping, and as specified herein.

B. Below ground drain pipe shall be ductile iron, cast iron, or ABS as indicated on the Plans and specified in Section 40 20 11 – Process Piping.

2.03 DRAIN, WASTE, AND VENT PIPE AND FITTINGS, ABOVE GROUND

A. Above ground pipe and fittings shall be as called out on the Plans, in accordance with Section 40 20 11 – Process Piping, and as specified herein.

B. Above ground pipe and fittings shall be solvent weld DWV PVC, conforming to ASTM D2665 and ASTM D3311.

2.04 WATER PIPING AND FITTINGS, BELOW GROUND

A. Below ground water pipe and fittings shall be as called out on the Plans, in accordance with Section 40 20 11 – Process Piping, and as specified herein.

B. Below ground water pipe shall be PEX or as indicated on the Plans and specified in Section 40 20 11 – Process Piping.

C. Disinfection shall be done in accordance with Section 33 13 00 – Disinfecting of Water Utility Distribution.

2.05 WATER PIPING AND FITTINGS, ABOVE GROUND

A. Above ground water pipe and fittings shall be as called out on the Plans, in accordance with Section 40 21 11 – Process Piping, and as specified herein.

B. Dielectric connections: EPCO Sales, Inc.

1. Unions: 2 inches and smaller, 175 psi minimum working pressure, ends to match connections.

C. Disinfection shall be done in accordance with Section 33 13 00 – Disinfecting of Water Utility Distribution.

2.06 WATER ACCESSORIES

A. Water hammer arrestor: All stainless-steel construction with welded nested bellows, sized and located in accordance with Plumbing and Drainage Institute Standard PDI-WH201. Josam Absorption.

B. Drain valves: 1/2-inch globe valves at low points in cold water and hot water systems.

C. Valves: In accordance with Section 40 21 12 – Process Valves and Gates.

2.07 HANGERS, ANCHORS AND GUIDES

A. Support pipe in accordance with Section 40 02 11 – Process System Basic Materials and Methods.

B. Provide galvanized pipe hangers to support horizontal piping. Secure vertical piping to wall with galvanized offset clamps or other supports as approved by the Engineer.

2.08 FLOOR DRAINS

A. As called out on the Plans; or

1. Zurn Z-551, medium duty cast iron body, outlet size of connected line, heavy duty cast iron slotted grate. Size as shown on the Drawings;

2. Zurn Z-505 heavy duty, cast iron body, outlet size of connected line, heavy duty cast iron slotted grate. Size as shown on the Drawings;

3. Zurn Z-455 drain with integral cleanout. Cast iron body, outlet size of connected line, heavy duty cast iron slotted grate. Size as shown on the Drawings.

B. Provide cast iron floor drain cleanout where indicated on Plans or required by code, Zurn Model Z-1400 or approved equal.

C. Provide acid-resistant epoxy coating where required or indicated on Plans. Coating drains shall be provided wherever corrosive liquids will be present.

D. Prefabricated Trench Drain: Prefabricated trench drain shall be ZURN Model Z-886 HD or approved equal with steel edge rail and ductile iron slotted grate, length and configuration as indicated on the Plans. Provide manufacturers standard end cap and outlet accessories as required for a complete installation.

2.09 ROOF DRAINS

A. Roof drains shall be as called out on the Plans; or

1. Zurn Z-121, 12-inch diameter cast iron roof drain with top-set deck plate, membrane flashing clamp, and low silhouette poly dome. Provide static drain body extension in length as required for the roofing system material thickness specified and shown on the Plans.

2. Provide drain with Zurn model Z-190, or approved equal, cast iron vertical expansion joint at interior connection to drain leader piping.

3. Drain outlet nozzle shall be as shown on the Plans, Zurn model Z-199, or approved equal.

2.10 HOSE BIBBS

A. Hose bibbs shall be as specified in Section 40 20 12 – Process Valves and Gates.

PART 3 – EXECUTION

3.01 GENERAL

A. Install materials and equipment as shown and specified in accordance with governing codes and standards.

B. Rough in work as construction progresses to minimize cuttings, eliminating interferences.

C. Locate equipment requiring service and maintenance in fully accessible positions. Furnish access doors for this purpose if required.

D. Runs and arrangement of piping shall be as shown, subject only to such changes and modifications as may be necessary to suit actual conditions at the building, to avoid interference or conflict with work of other sections. Install piping concealed in floor or in wall construction or excavations to prevent delay to other work and to allow ample time for necessary tests and approvals.

E. Carefully check installations against structural, architectural, and mechanical drawings and note where walls, ceilings, beams, and pipe shafts are furred or enclosed. Piping shall not be furred in or covered before approval by the Engineer.

F. Hang horizontal piping runs from ceilings or construction above, located as closely as possible to structural members or bottom of slabs or beams, to obtain maximum head room. If a condition should arise where clearance below such piping would interfere with finished ceiling or wall surfaces, the Engineer shall be notified, and no work shall be installed until approved.

G. Connections as shown are intended that waste, soil, water, and other services be fully connected to each individual piece of apparatus with required piping, unions, flanges, valves, check valves, and other needed appurtenances.

H. Each branch pipe shall be controlled by a gate valve where it connects to the supply main or riser. Each toilet room, group of fixtures, or isolated fixture shall be separately controlled by valves in an accessible location and provided with access doors where necessary.

I. Install swing joints or expansion loops to allow for pipe expansion where necessary. Securely anchor pipes so expansion can occur at these joints.

J. Make joints between dissimilar piping by dielectric unions or flanges.

K. Use reducing fittings wherever a change in pipe size occurs. The use of bushings will not be permitted.

L. Provide piping with unions to permit alterations and repairs.

3.02 INSTALLATION OF DRAINAGE, WASTE AND VENT SYSTEMS

A. Make connection to the sewer system as required.

B. All underground drainage and waste pipe shall be pitched a minimum of 2 percent slope in the direction of flow, unless otherwise indicated or approved by the Engineer. Make changes in direction of drainage and waste lines with 45 degree wyes, long turn wyes, or sweep bends. Use long turn fittings wherever space permits. Provide waterproofing around all lines penetrating through foundation walls and floor slabs.

C. Check and verify all inverts of lines within and outside the building.

D. Install traps on fixtures and equipment requiring connection to the sanitary system. Traps shall be of same size as the pipe on which they occur. Provide cleanouts for all traps. Vent traps as shown.

E. Cleanouts: Provide as shown, at the base of each stack, each change in direction, and on a minimum of 50 foot centers on horizontal runs. Cleaning screws, deckplates and other plugs shall be made up with graphite and oil only, use no grease or cement.

F. Pitch vent lines to allow for condensation drainage.

G. Where vent piping is run concealed in partitions, obtain exact dimensions and locations of partitions and use special care to assure that lines are maintained in their proper locations.

H. Joints

1. Joints for hub and spigot pipe shall be ASTM C 564 rubber gasket or "No-Hub".

2. Cast iron “No-Hub” joints shall be made up with neoprene sleeve, stainless steel shield and clamps sized to fit “No-Hub” fittings used. Application as recommended by the manufacturer, precalibrated torque wrench shall be used to tighten clamps.

3. Copper tubing and fittings: Assembled with 50/50 tin-antimony solder. Cut copper tubing square; ream, butt, and size; clean tube ends and fittings well; apply heat, solder. Remove excess solder.

I. Flashing: Flash vents as shown on drawings penetrating the roof structure with roofing manufacture standard.

3.03 INSTALLATION OF COLD WATER SYSTEMS (POTABLE AND NONPOTABLE)

A. Install cold water system as shown. Piping shall traverse the building at the locations shown, or as required to service fixtures requiring cold water, and with the pipe sizes shown or specified. The service shall be valved at the point shown. Locate underground service a minimum of 30 inches below grade. Fit pipe connections to mechanical equipment with unions for ease of dismantling.

B. Conceal cold water piping in finished areas.

3.04 INSTALLATION OF HOT WATER SYSTEMS (POTABLE AND NONPOTABLE)

A. Begin the installation of the hot water piping system at the water heater and traverse the building at the locations shown, or as required to service fixtures requiring hot water, and with the pipe sizes indicated. Fit piping around the heater and equipment with sufficient number of unions to assure easy dismantling for maintenance.

B. Conceal hot water piping in finished areas.

3.05 HANGERS, ANCHORS, GUIDES

A. Support piping to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place. Provide for expansion and contraction.

B. The spacing of hangers shall be not greater than 10 feet on center for pipe larger than 1 inch; 8 feet for 1-inch pipe; 6 feet for pipe 3/4 inch and smaller.

C. Support vertical lines at bases by an approved hanger placed in the horizontal line near the riser.

D. Do not hang piping from the ductwork or piping of other trades. A common trapeze, properly supported and pitched, may be used.

E. Make pipe sleeves watertight with caulked lead joints on both sides of a foundation wall. Pipe and hangers of dissimilar material shall have a plastic sleeve heat shrunk on pipe in contact with hanger.

3.06 INSTALLATION OF PLUMBING FIXTURES

A. Protect fixtures and equipment during construction. Replace if damaged.

B. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations. Exact location and mounting height of plumbing fixtures shall be obtained from the architectural drawings.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Set fixtures level and square, in accordance with fixture manufacturer’s written instructions, with relation to interior finish, floor, and wall lines and pertinent codes and regulations. Space toilet room fixtures equidistant and at the same height from floor as shown.

E. Install stop valve in an accessible location in the water connection to each fixture.

F. Seal fixtures to walls and floors using clear silicone sealant.

G. When installed, cover metal fixture trimmings with noncorrosive grease or approved protective tape and maintain until construction work is complete. Upon completion, remove labels, clean and polish fixtures and trimmings.

3.07 TESTS AND ADJUSTMENTS

A. Test piping in accordance with Section 40 01 11 – Process System Testing in the presence of the Engineer.

1. Correct leaks in joints or evidence of defective pipe or fittings by replacing defective parts with new joints and materials.

2. Adjust apparatus to function as specified

3. Apply water test to all parts of the drainage waste and vent system before pipes are concealed or fixtures are set in place. Test may be applied in sections. Close openings of each system to be tested except the highest openings on the finished system. Fill system with water to the highest opening plus 6 feet. Water shall remain in the system for at least 24 hours, after which time no leaks at any joint or lowering of the water level at the overflow shall be visible.

4. Hydrostatically test cold and hot, potable and nonpotable water supply systems in accordance with Section 40 01 11 – Process System Testing.

B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

C. Adjust water pressure at faucets, shower valves, and flush valves to provide proper flow and stream.

3.08 PAINTING AND MARKING

A. Painting shall be in accordance with Section 09 90 00 – Painting and Coating.

B. Marking shall be in accordance with Section 40 03 11 – Process System Coding and Identification.

END OF SECTION 22 00 00

DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

SECTION 23 00 00 – HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work included: Provide heating, ventilation, and air conditioning systems where shown on the Plans, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:

1. Heating and cooling units.

2. Heating and cooling controls.

3. Ductwork, registers and grilles.

4. Exhaust Systems.

5. Permits.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 05 50 11 – Miscellaneous Metals

E. Section 07 62 00 – Sheet Metal Flashing and Trim

F. Section 08 11 13 – Hollow Metal Doors and Frames

G. Division 26 – Electrical

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit the following product data:

1. Manufacturer’s catalogs, samples, and other items needed to fully demonstrate the quality of the proposed materials and equipment.

C. Record Drawings:

1. Comply with provisions of Division 01.

2. Include a copy of the record drawings in each copy of the operation and maintenance manual described below.

D. Upon completion of this portion of the work, and as a condition of its acceptance, deliver to the Engineer six copies of an Operation and Maintenance Manual compiled in accordance with the provisions of Section 01 78 00 – Operation and Maintenance Manuals.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. Codes and regulations:

1. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies having jurisdiction.

2. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern when so directed by the Engineer.

C. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

D. The material specified shall be furnished by reputable manufacturers, qualified and experienced in the manufacture of such equipment. All equipment specified shall be designed, constructed, and tested in accordance with the best practices and methods of the trades involved.

E. Electrical wiring and equipment with electrical connections, including the motors, and control and safety devices, shall be Recognized Electrical Testing Laboratory (RETL) listed and labeled, or the Contractor shall obtain approval from the Washington State Department of Labor and Industries for the electrical portions of the equipment.

1.05 PRODUCT HANDLING

A. Comply with provisions of Division 01 and manufacturer's recommendations.

PART 2 – PRODUCTS

2.01 DUCTWORK – LOW VELOCITY

A. Material: Galvanized steel or aluminum sheet; steel of following gauges when longest dimension of duct cross section is stated:

Under 12 inches	26 ga.
13 inches to 30 inches	24 ga.
31inches to 60 inches	22 ga.

B. Hangers and Joints

1. Rectangular Ducts: Longitudinal joints at corners Pittsburgh Lock or double seam, longitudinal joints in flat surface double break.

2. Over 15 Inches: Sides, top, bottom diamond break stiffening.

3. Up to 24 Inches: Transverse joints in wide surface 1-1/4 inches standing seam or button punched every 6 inches or "S" cleat, seams not over 36 inches apart; transverse joints on narrow surface same as wide surface except drive cleats instead of "S" cleats; hanger 1-inch x 1/8-inch strap iron screwed to duct or saddle type hanger of 1-inch x 1-inch x 1/8-inch angle with 3/16-inch rods.

4. Plenum Changers: Joints, seams and stiffening same as ductwork of equivalent dimensions.

5. Ductwork: Made as airtight as possible.

C. Mitered elbows shall have turning vanes as manufactured by Barber-Colman Co. or equal.

2.02 DUCT SEAMS

A. Seal all duct seams, transverse and longitudinal, air tight with 6-ounce canvas secured in place with “EC8OO” or equal duct sealing compound, an approved lagging adhesive, or duct tape.

2.03 FLEXIBLE CONNECTION TO EQUIPMENT

A. All types of fan units, unless specifically detailed otherwise, shall be isolated from the ductwork with flexible connections. Connections shall have at least 4 inches of flexible material between the metal parts being isolated and shall be installed with approximately 1 inch of slack flexible material. Flexible connectors shall be of canvas cloth and carry the UL label and be approved by the State of Washington Fire Marshal with a copy of the approval enclosed with submittal.

2.04 VIBRATION ISOLATION AND FLEXIBLE CONNECTIONS

A. At duct connection to equipment, provide vent-fabric, approved by the governmental agencies having jurisdiction, flexible connections with a minimum of 6 inches full length. Vent-fabric, Duro Dyne or equal.

B. Support all compressors or other motor bearing equipment via vibration isolation pads, unless noted otherwise. Place pads under equipment in accordance with manufacturer’s recommendations. Amber/Book “Ampad” type NR pad or equal.

C. Provide additional sound isolation as required to limit the noise level in conditioned space to a maximum of NC-40.

D. Mount larger vibrating equipment when so noted on “ThyCurb Vibrocurbs” with a minimum static deflection of 1 inch.

E. Isolate piping from the structure in a manner to prevent transmission of vibration.

2.05 PREFABRICATED ROOF CURBS

A. Prefabricated roof curbs shall be constructed of 18-gauge galvanized steel or 0.063-inch thick aluminum formed on three sides with only one welded seam to ensure a strong square curb. Wood nailers for attaching fan and/or vent hood shall have notched and lapped joints to ensure strength and durability. A rubber seal shall be provided between the curb and fan/vent hood housing to ensure proper performance of the fan, prevent insects and moisture from entering, and to reduce vibration transmission to the ductwork. Curbs shall have 1-inch minimum thick fiberglass insulation, securely attached at top and bottom with an insulation tray. An optional liner shall be provided to protect the insulation from the airstream. Roof curbs shall also be provided with an optional damper tray.

B. Prefabricated roof curbs shall be as manufactured by Greenheck Fan Corporation, Schofield Wisconsin, or Engineer approved equal. Roof curbs shall be of a model, size and configuration as called out on the Plans, or recommended by the manufacturer. Roof curb configuration and height shall be suitable for the type of roof being installed on. An optional raised cant shall be provided at insulated flat roofs, or where indicated on the Plans.

2.06 INSULATION

A. General:

1. Provide materials complying with NFPA Bulletin 90-A, as determined by UL method NFPA-ASTM E84, and complying with the governing code, with flame spread rating under 25 and smoke developed rating under 50.

2. Where vapor barriers are used, provide intact and continuous throughout.

3. Acceptable manufacturers:

a. Owens/Corning Fiberglass.

b. Johns-Manville

c. Certainteed

B. Application:

1. Provide duct insulation as required per table 5-11 of Washington State Energy Code, latest revision.

2.07 BALANCING DAMPERS

A. Provide balancing dampers, splitter dampers, or adjustable turning vanes as indicated on the Plans.

2.08 FIRE DAMPERS

A. Provide fire dampers as indicated on the Plans. Provide UL rated static fire dampers, Greenheck model FD-150X with integral sleeve or engineer approved equal.

2.09 BACKDRAFT DAMPERS

A. Backdraft dampers shall be suitable for mounting inside fabricated wall collar or damper tray, or for direct mounting in wall with louver assembly.

B. Exhaust dampers shall be Greenheck Model WD-300 series for sidewall fans and WD-100 series for roof mounted fans.

C. Supply dampers shall by Greenheck Model VCD-23 series low-leakage dampers with 115-volt motor packs. Motor pack torque and model selection shall be based on the damper size. Unless otherwise specified or shown on the Plans, damper motors shall operate on a power open and spring return principle to assure damper closure in the event of an electrical failure.

D. Materials:

1. Frame: 16-gauge galvanized steel.

2. Blades: 16-gauge galvanized steel with TPE seals.

3. Axles: 1/2-inch Type 304 stainless steel with synthetic bushings.

4. Linkage: Type 304 stainless steel.

2.10 AIR OUTLETS

A. Ceiling Diffusers: Unless otherwise specified or called out on the Plans, ceiling diffusers shall be adjustable curved blade four-way diffuser, with 0.055-inch minimum T6 extruded aluminum, Shoemaker CB40 Series, or approved equal. Color: White. Provide square to round duct adapter as required. See Plans for required sizes. Provide optional adjustable apposed-blade damper where indicated on the Plans.

B. Supply Diffusers/Registers: Supply diffusers shall be double-deflection type, constructed of heavy gauge aluminum with individually adjustable airfoil blades, 3/4-inch maximum blade spacing, vertical front blades, and nylon blade bushings, Shoemaker 904 Series, Titus model 300FS, or approved equal. Color: White. Provide square to round duct adapter as required. See Plans for required sizes. Provide optional adjustable apposed-blade damper where indicated on the Plans.

C. Return Air Grilles: Unless otherwise specified or called out on the Plans, return air grilles shall be 1/2-inch x 1/2-inch x 1-inch aluminum lattice (egg crate) with 20-gauge minimum extruded aluminum frame, 90 percent free area, Shoemaker 600 Series, Titus model 50F, or approved equal. Color: White. See Plans for required sizes.

D. Provide factory-applied or site-applied black coating on the inside of all air outlets and connecting plenums.

2.11 EXTERIOR LOUVERS

A. Exterior wall louvers shall be extruded aluminum stationary louvers, Greenheck Model ESD-435.

B. Materials:

1. Frame: Heavy gauge 6063T5 extruded aluminum, 4-inch x 0.081-inch nominal.

2. Blades: J style, 6063T5 extruded aluminum, 0.081-inch nominal thickness, positioned at 45-degree angle, 4-inch centers.

3. Birdscreen: 1/2-inch x 0.063-inch aluminum square mesh wire.

4. Louvers shall be installed flush to exterior wall surface with internal clip angles, or other means of attachment to wall. Exterior perimeter flanges will not be allowed.

5. Finish: Kynar 70% (2 coat), color as selected by the Engineer from manufacturer’s standard colors.

C. Performance:

1. Static Pressure Drop, Intake: 0.04-inch WC at 530 fpm free area velocity.

2. Static Pressure Drop, Exhaust: 0.04-inch WC at 500 fpm free area velocity.

3. Water Penetration: 0.02 ounce per square foot at 705 fpm free area velocity.

D. Door louvers shall be as specified in Section 08 11 13 - Hollow Metal Doors and Frames and as called out on the Plans.

2.12 SUPPLY AND EXHAUST FANS

A. General:

1. All supply and exhaust fans and accessories shall be as manufactured by Greenheck Fan Corporation, Schofield Wisconsin, or Engineer approved equal.

2. All fans shall bear the AMCA certified ratings seal for air and sound performance and shall be UL listed.

3. Fans installed in hazardous locations shall be constructed entirely of spark-resistant materials and shall be provided with explosion proof motors and disconnect switches.

4. Belt drive fans shall be supplied with an auto belt tensioner.

5. Provide OSHA compliant motor-side guard on fans where indicated on the Plans or required by code.

6. Spare Parts:

   a. Belt drive fans shall be supplied with and one spare set of all drive belts.

   b. Fans with filters or filter boxes shall be supplied with one spare set of all filters.

   c. Spare parts shall be packaged with protective coverings for storage and identified with labels describing the contents.

B. Centrifugal Inline Fans:

1. Centrifugal inline fans shall be backward inclined direct drive units, as called out on the Plans. Inline fans shall be supplied with fan housing, housing supports, and dampers, as called out on the Plans. Discharge configuration shall be as shown on the Plans.

2. Fan Wheel: The fan wheel shall be a non-overloading, backward inclined centrifugal wheel constructed of aluminum. The wheel cone and fan inlet shall be matched and have precise running tolerances for maximum performance and operating efficiency. Single thickness blades shall be securely riveted or welded to a heavy gauge back plate and wheel cone. Fan wheel shaft shall be constructed of stainless steel. Fan rub ring and motor cover shall be constructed of aluminum. All fasteners shall be stainless steel.

3. Fan Housing: The fan housing shall be square design, constructed of heavy gauge aluminum and provided with duct mounting collars. The housing shall be insulated with 1-inch fiberglass duct liner for noise reduction. The housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly. Housing supports shall be constructed of structural steel with formed flanges. The drive frame shall be constructed of welded steel and support the motor. Adequate access panels shall be provided to permit easy access to internal fan components. All fasteners shall be stainless steel. Provide neoprene mounts/hangers for vibration isolation. The Contractor shall provide inlet and outlet flexible duct connections as specified and shown on the Plans.

4. Dampers: Back draft dampers shall be as specified and may be factory-mounted to the fan or field-installed within the duct.

5. Fans shall be statically and dynamically balance in accordance with AMCA Standard 204-05 and bear the AMCA certified ratings seal for specified air and sound performance.

C. Fan Motors:

1. Fan motors for direct-drive supply and exhaust fans shall be an electronic commutation (EC) type specifically designed for fan applications, Greenheck Vari-Green, or approved equal. AC induction type motors are not acceptable. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and prewired to the specific voltage and phase. Internal motor circuitry shall convert 120V, single phase, 60 Hz AC power supply to DC power to operate the motor. Motor shall be speed controllable down to 20 percent of full speed (80 percent turndown). Speed shall be controlled by a potentiometer dial mounted on the motor, or a remote dial where indicated on the Plans. Motor shall be a minimum of 85 percent efficient at all speeds.

2. Fan motors on belt drive supply and exhaust fans shall be squirrel cage induction type motors suitable for use on a 120V single-phase or 480V three-phase (as indicated on the Plans), 60 Hz AC power supply. Motors 1 HP and greater in size shall be NEMA Premium® efficient.

3. Fans located in hazardous locations, or where required by code, shall be provided with explosion-proof motors, suitable for use in Class 1, Group D, Division I or Division II classified locations.

4. All motors shall be mounted on vibration isolators and be out of the air stream.

2.13 ELECTRIC UNIT HEATERS

A. Electric unit heaters shall be of the capacity shown on the Plans, 480 VAC, 3-phase, wall mounted unit heater with two-stage internal thermostat control, integral power disconnect, internal control power transformer, and wall mounting brackets, Q-Mark MUH Series or approved equal.

2.14 FAN-FORCED WALL HEATERS

A. Fan-forced electric wall heaters shall be as follows:

1. Model: Broan model 170 or as shown on the Plans.

2. Voltage: 120-volt, 1 phase.

3. Watts: 1000, or as shown on Plans.

4. Capacity, BtuH: 3,413, or as shown on Plans.

5. Thermostat: Built-in snap action, 40° F to 125° F.

B. Heater shall have a black epoxy coated steel housing. Grill shall be white, 20-gauge steel, one-piece construction with no sharp edges. Heaters shall be supplied with Model 84 surface-mounting kit.

C. Heater shall include a thermal overload protector with manual reset.

2.15 DUCT-FREE SPLIT AIR CONDITIONER SYSTEMS

A. Duct free split air conditioner systems shall be provided at the locations shown on the Plans and shall provide combination cooling and reverse cycle heating (heat pump). System shall be as manufactured by Mitsubishi, or Engineer approved equal, model number and nominal capacity as called out on the Plans. All system units shall be constructed in accordance with ANSI/ASHRAE standards, latest edition, and shall be AHRI certified, listed, and rated in accordance with Standard 210/240. Minimum system energy efficiency rating shall be 13 SEER, or as required by the Washington State Energy Code, latest edition.

B. The indoor fan coil unit shall be a wall-mounted design, complete the cooling/heating coil, fan, fan motor, electrical controls, integral temperature sensing, and microprocessor-based controls. The indoor unit shall be powered by the outdoor unit. Connecting refrigerant lines shall be insulated as recommended by the manufacturer. A condensate pump shall be supplied where required. Drain location to be determined in the field. The microprocessor-based control system shall control space temperature, determine optimum fan speed, and run self-diagnostics, for a temperature control range of 62 °F to 84 °F. The control settings and system operation modes shall be changeable with a factory-supplied wireless remote thermostat.

C. The outdoor condensing unit shall be air-cooled, horizontal discharge, split system compressor, suitable for installation on the ground, rooftop, or wall hung, as shown on the Plans. The unit shall consist of a rotary compressor, air-cooled coil, propeller-type draw-through outdoor fan, reversing valve, accumulator, metering device(s), and control box. The outdoor unit shall be suitable for operation on a single-phase, 60 Hz AC power supply at 120V or 208/230 V, as indicated on the Plans. The unit power supply shall be a single point connection and control voltage to the indoor fan coil shall be 24 VDC.

D. Duct-free split systems shall be supplied with optional low-ambient kit and controls to regulate fan-motor cycles in response to saturated condensing temperature of the unit. The control shall be capable of maintaining a condensing temperature of 100 °F ± 10 °F with outdoor temperatures to -20 °F. The system shall also be supplied with an optional crankcase heater and wind baffle.

2.16 THERMOSTATS

A. Thermostats shall be provided where shown on the Plans and as specified in this Section.

B. Thermostats for ventilation fans (cooling only) shall be SPST line voltage type, rated for 16.0 FLA and 96.0 LRA at 120 VAC, Dayton model 1UHH4, or approved equal. The temperature control range shall be 30˚F to 110˚F.

C. Thermostats for unit heaters shall be integral to the unit.

PART 3 – EXECUTION

3.01 GENERAL

A. All equipment shall be installed in strict accordance with the manufacturer's specifications.

B. Openings required in building construction for heating and ventilation work shall be provided by the General Contractor. Locations of all openings shall be as shown on the Plans and required for the installation of the equipment and systems and verified by this Contractor.

3.02 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

3.03 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this section.

B. Coordinate installation of factory assembled fan and air handling units and accessories with louver, damper and duct installations. The contractor shall provide all additional materials required for a complete installation as specified and shown on the Plans.

C. Louvers, wall collars, dampers and wall openings shall be coordinated with the requirements for fan installation.

D. Provide sufficient wall collar length to meet minimum distance recommended between damper and fan.

3.04 EQUIPMENT INTERFACE

A. For electrically operated equipment, verify the electrical characteristics actually available for the work of this section and provide equipment meeting those characteristics.

3.05 EQUIPMENT

A. The exhaust fans shall be mounted and flashed as shown on the Plans. Care shall be taken to ensure a watertight installation. Backdraft dampers shall be installed so there is free movement and air does not leak back in the wrong direction.

3.06 PAINTING

A. Touchup scratches and abrasions to be invisible to the unaided eye from a distance of 5 feet 0 inches.

3.07 INSULATION

A. Wrap insulation firmly around all ductwork, covering all surfaces including seams, and with all joints lapped at least 2 inches.

B. Securely fasten the insulation in place with 16-gauge soft annealed black or galvanized wire, spaced approximately 12 inches on center for straight runs and 3 inches on center for elbows and fittings.

C. Take special care to avoid excessive stretching and compressing, and to achieve securing at lapped sections where possible.

3.08 TESTING AND ADJUSTING

A. Test and adjust each piece of equipment and each system as required to assure proper balance and operation.

1. Test and regulate ventilation systems to conform to the air volumes shown on the Plans or specified herein.

2. Make tests and adjustments in apparatus and ducts as required to provide proper volume and face distribution of air for each grille and ceiling outlet.

3. Where required, at no additional cost to the Owner, provide pulleys, belts etc. as required to set fan drives at the speed needed to give the indicated volume.

4. For each system, record the following data in tabulated form that is applicable to equipment and systems installed on this project:

    a. Air volumes at all supply, return, outside air inlets, and exhaust outlets.

    b. Total CFM supplied.

    c. Total CFM returned.

    d. Total CFM exhausted.

    e. Total static air pressure across fan.

    f. Motor speed, fan speed, and input ampere load for each fan motor.

    g. Air/water temperature entering and leaving for heating and cooling cycles.

    h. Compressor ampere loading.

    i. Temperature/pressure readings across any heat exchangers, including any that may be located in packaged equipment.

B. Submit test and balance reports to the Engineer for review in accordance with Section 01 33 00 – Submittals Procedure.

C. Eliminate noise and vibration, and assure proper function of all controls, maintenance of temperature, and operation in accordance with the approved design.

D. Secure required approval from governmental agencies having jurisdiction.

END OF SECTION 23 00 00

DIVISION 26 – ELECTRICAL

SECTION 26 05 01

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 0 – Contract Requirements.
3. Division 1 - General Requirements.
4. Division 3 - Concrete.
5. Division 23 – HVAC.
6. Division 33 - Utilities.
7. Division 40 – Process Integration.
8. Division 46 - Water and Wastewater Equipment

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-volt, 208Y/120-volt, and/or 240/120-volt power distribution systems including raceways, wiring, and power supply to equipment:

B. Provide complete interior lighting system including all lighting equipment, raceways, wiring, and switching/control equipment.

C. 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.

D. 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.

E. 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. The following shall be considered Corrosive Locations:

1. Areas outdoors
2. Headworks
3. Oxidation Ditches
4. Aerobic Digester
5. Solids Handling Building (except Electrical Room)
6. Primary Clarifiers
7. Sludge Holding Tanks
8. Areas below grade in vaults, structures, manholes, pullholes, junction boxes etc.
1. Corrosive areas may also be considered hazardous.

D. Process Areas:

1. Headworks
2. Blower Room
3. Solids Handling Areas
4. RAS/WAS Pump Room
5. UV Room
6. Chlorine Room

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. The following shall be considered Finished Areas:

1. Lab Building

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 01 33 00.

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 26. Do not split submittals having a common bill of materials. Group Division 26 submittals with other Division 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. Submit Electrical System Study Report (ESSR) with or before the submittal information for switchboards, motor control centers, panelboards, variable frequency drives and circuit breakers and similar items that may affect or be affected by each study. Equipment that is submitted prior to ESSR will not be reviewed and will be returned as “Not Reviewed”. Equipment shall not be ordered until the ESSR has been reviewed and approved.

E. 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.

F. 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 26 sections for specific additional requirements.
2. Prior to submittal, coordinate the electrical equipment (particularly switchgear, 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 01 33 00 , 1.1 SCOPE and Section 01 33 00 , 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.

G. 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.

H. 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 26.
    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 supplier's 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 megohmeter 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 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. 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. Switchgear
h. Motor Control Centers
i. Panelboards
j. Safety Disconnect Switches
k. Circuit Protective Devices showing catalog number, serial number and adjustable trip settings.
l. 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 via cloud storage shared folder (OneDrive, Google Drive, etc.) or by another method prior approved by the Engineer.

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 01 66 00 .

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 26 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 01 33 00

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.

2.3 ELECTRICAL SYSTEM STUDY REPORT (ESSR)

A. The short circuit calculation and withstand evaluation report, circuit protective device coordination studies, harmonic analysis studies, and arc flash studies shall comprise the Electrical System Study Report (ESSR).

B. Create reports for existing, new and modified electrical distribution equipment including the Utility Point of Service and submit reports of equipment submittals for approval. Distribution equipment shall include switchboards, panelboards, motor control centers, dry type transformers, etc.

C. Short circuit calculation and withstand evaluation report, circuit protective device coordination studies, harmonic analysis studies, and arc flash studies shall be stamped and signed by an electrical engineer registered in the State of Washington.

D. Short circuit calculation and withstand evaluation report, circuit protective device coordination studies, harmonic analysis studies, or arc flash studies shall be submitted with or before the distribution and control equipment being provided on the project (switchboards, motor control centers, variable frequency drives, panelboards, etc.). It is not acceptable to submit the ESSR after the distribution equipment has been submitted. As a minimum, include the following in the report:

1. Utility source information including primary system & service transformer impedance, X/R ratio, symmetrical and asymmetrical fault currents for 3 phase, line-to-line and line-to-neutral faults.
2. Equipment manufacturer’s information used to prepare the study.

3. Assumptions made during the study.
4. Short circuit calculations listing short circuit levels at each bus.
5. Evaluation of the electrical power system and the model numbers and settings of the protective devices associated with the system.
6. Time-current curves including the instrument transformer ratios, model numbers of the protective relays or trip devices, and the relay or trip device settings associated with each breaker.
7. Comparison of short circuit duties of each bus to the bracing and interrupting capacity of the equipment connected to that bus.

E. Elements of short circuit calculation and withstand evaluation report

1. One-line Diagram:

    a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
    b. Type designation, current rating, range or adjustment manufacturer's style and catalog transformers.
    c. Power, voltage ratings, impedance, primary and secondary connections of all transformers.
    d. Nameplate ratings of all motors and generator with their subtransient reactances.
    e. Transient reactances of generator and synchronous reactances of generator.
    f. Sources of short circuit elements such as utility ties, generators, and induction motors.
    g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc.
    h. Standby as well as normal switching conditions.

2. Impedance Diagram

    a. Available MVA or impedance from the utility company.
    b. Bus impedance.
    c. Transformer and/or reactor impedances.
    d. Cable impedances.
    e. Equipment impedances.
    f. System voltages.
    g. Grounding scheme (solid grounding, resistance grounding, or no grounding).

3. Calculations:

    a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
    b. Calculate the maximum and minimum ground-fault currents.

F. Circuit Protective Device Coordination Study

1. Provide the model numbers and recommended settings of the protective devices associated with the system to achieve full circuit coordination. Unless noted otherwise, full circuit coordination shall include amperages up to the maximum instantaneous fault current available from the standby power source (e.g., engine generator) from 0.1 seconds and longer.

    a. Zone Selective Interlocking is acceptable for circuit breaker coordination for circuit breakers located within the same electrical or adjacent enclosures where each breaker is provided by the same manufacturer.
    b. Full coordination is not required for circuit breakers during the timeframe a reduced (electric arc flash) energy level maintenance bypass switch is activated.
    c. Series rating of equipment is not acceptable.

2. As a minimum, include the following on 5-cycle, log-log graph paper:

    a. Time-current curve for each protective relay or fuse showing graphically that the settings will allow protection and selectively within Industry standards. Identify each curve and specify the tap and time dial setting.
    b. Time-current curves for each device to be positioned for maximum selectivity to minimize system disturbances during fault clearing. Where selectivity cannot be achieved, notify the Project Representative as to the cause.
    c. Time-current curves and points for cable and equipment damage.
    d. Time-current curves and points for standby power generation equipment (e.g., engine generator) protective relays
    e. Circuit interrupting device operating and interrupting times.
    f. Indicate maximum fault values on the graph.
    g. Sketch of bus and breaker arrangement.

3. The circuit breaker sizes shown on the contract drawings are for a basis of design power distribution system from a single Manufacturer. The Contractor is free to select breakers and enclosures that achieve selective coordination, have sufficient fault current interrupting capacity from any generator or utility services, and all the required breakers are enclosed in distribution equipment of the same size or smaller in each dimension than shown on the Contract Drawings.

G. Harmonic Analysis

1. Prepare a report summarizing the power system total harmonic distortion at the Utility Service Point (Meter, Switchboard or Panelboard) and at each Motor Control Center or Building Main Disconnect if not within a Motor Control Center.

2. For each building equipment or location, evaluate total harmonic distortion assuming the IEEE 519 point of common coupling is at the normal service entrance disconnect equipment. Analyze the effect of the line reactors and 18 pulse front ends supplied with the VFDs at each location and the effect of the active harmonic filter (if provided).

H. Arc Flash Study

1. Prepare a report summarizing the arc flash study and conclusions or recommendations which may affect the integrity of the electric power distribution system.
2. Determine the incident energy, arc flash boundary, and minimum PPE requirements for locations throughout the studied portions of the power system. Arc flash warning labels are to be produced and attached to the electrical equipment. These labels must indicate approach boundaries, incident energy level, and the minimum PPE that is required when servicing the equipment within the arc flash boundary.
3. As a minimum, include the following in the report:

    a. Assumptions made during the study.

        1) Estimated available fault current for each bus.
        2) Estimated arc fault current for each bus.
        3) Trip settings for all circuit protective devices (protective relays, circuit breaker and fuses) upstream of any bus evaluated.
        4) Material, quantity, size, and length of each conductor of feeder and raceway material of each feeder.

    b. Reduced copy of the one-line drawing.
    c. Arc flash evaluations summary spreadsheet

        1) Bus name.
        2) Upstream protective device name, type, settings.
        3) Bus line to line voltage.
        4) Bus bolted fault.
        5) Protective device bolted fault current.
        6) Arcing fault current.
        7) Protective device trip/delay time.
        8) Breaker opening time.
        9) Solidly grounded column.
        10) Equipment type.
        11) Gap.
        12) Arc flash boundary.
        13) Working distance.
        14) Incident energy.
        15) Suggested electric arc rated PPE rating.

d. Arc flash warning labels printed in color on adhesive backed labels.

4. Provide the arc flash warning labels containing information suggested by NFPA 70E and affix warning labels to each piece of electrical equipment evaluated in the Arc Flash Study. In addition to the information suggested by NFPA 70E, the arc flash warning labels shall also indicate the report date and date of circuit protective device testing (as of the time of the arc flash study). Arc Flash Warning labels shall be installed prior to the Contractor energizing the equipment. The third-party testing agency shall confirm the circuit protective devices (protective relays, circuit breakers and fuses) match as recommended in the arc flash study prior to equipment energization.
5. The Contractor shall provide four hours (minimum) of arc flash training to the Owner at an Owner's designated facility prior to the Contractor energizing the electrical equipment. Arc Flash training shall include consultation with facility manager regarding plant safety plan based on NFPA 70E, Handbook for Electrical Safety in the Workplace.
    a. Arc Flash training shall be based on the latest edition of NFPA 70E, Handbook for Electrical Safety in the Workplace.
    b. Training shall include site specific features, such as arc flash mitigation procedures, electrically safe procedures, Owner provided personal protective equipment (PPE) use and care procedures.

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 Division 1.

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 26 05 02

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 26 05 01 and Division 1 Specification Sections.

B. Product Data: For each type of material specified.

1. In addition to the requirements of 26 05 01 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 26 05 01 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. Standoff 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 09 09 91 00. 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 megohmeter 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 26 05 01 .

END OF SECTION

SECTION 26 05 19

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 26 05 01 and Division 1 Specification Sections.

B. Product Data: For each type of conductor or cable specified.

1. In addition to the requirements of 26 05 01 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 26 05 01 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:

1. Flexible
2. 3 Conductor Tinned Copper
3. Symmetrical Segmented Bare Copper Stranded Ground
4. XLPE Insulation
5. Overall 100% shield
6. Black PVC outer jacket
7. 600V rated
8. TC-ER 90C Dry/Wet rated
9. For single runs:

    a. Belden 29521C through 29532C for smaller than 4/0
    b. Belden 29534 for 350 kcmil
    c. Belden 29535 for 500 kcmil

10. For parallel runs:

    a. Upsize grounding conductors to meet NEC requirements for equipment grounding conductors in parallel circuits.

b. Belden 29528 for through 29532.

11. Or approved equivalent.

C. Category 6 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) Commscope

b) Berk-Tek

c) Approved Equal.

D. Category 6 OSP Cable: Provide Category 6 Outside Plant cable as shown on drawings. Cable shall be rated for indoor / outdoor use and rated for extended exposure to water. Cable shall be rated CM or CMX per NEC.

1. Berk-Tek
2. Approved Equal.

E. Fiber Cable: Indoor/outdoor riser rated, all dielectric, OM3 grade multimode, 850 nm, laser optimized, plenum rated, water blocking fillers encased in a buffer tube surrounded by water blocking strength members, meeting or exceeding ANSI/TIA/EIA standards for 10 Gigabit Ethernet for at least 300 meters and a nominal outside diameter of 0.3 inches or less. Cables, terminations and fanout kits shall be manufactured by the same manufacturer as the cable. Provide 6 strands with duplex LC-terminations unless otherwise indicated on the Plans.

1. Berk-Tek

2. Approved equal.

F. Pre-Terminated Cables: Where indicated on the plans, supply the quantity and type of cables terminated in a pulling sock kit to protect the ends while pulling.

1. Fiber Pre-Terminated Cable: Provide cables with ends terminated and tested at the factory. It is acceptable to use a TPO connector and TPO to LC (or other connectors if shown on the Plans) module or breakout kit. Provide 6 strands unless shown otherwise on the Plans.

G.

H. 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- 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-volt, 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 26 05 26 .

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 26 05 02 .

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 26 05 02 "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 equipment to devices shall be labeled with the device tag (motor controller terminal #)(device terminal number) – for example, 05SV01(8)(3) - would reference a wire to solenoid valve 05SV01 landed on terminal 8 in the motor controller 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 controllers to control panels shall be labeled with Equipment tag ID (motor control terminal #) (CP terminal #) – for example, 16NPP01(8) (0301) - would reference a wire for pump 16NPP01 landed on terminal 8 in the motor controller 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-conductor 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.

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 6 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. Test fiber optic cable on the reel upon delivery to the job site, again prior to installation, and again after installation.

1. Test all strands using a bi-directional end-to-end Optical Transmission Loss Test Instrument (OTDR) trace performed per ANSI/TIA/EIA 455-61 or a bi-directional end-to-end power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-B.
2. Test at both 850 and 1300nm.
3. Test results shall conform to:

    1) The criteria specified in ANSI/TIA/EIA-568-B
    2) The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)

E. 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 26 05 26

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 26 05 19 for grounding conductor requirements.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. Product Data: For each type of component specified.

1. In addition to the requirements of 26 05 01 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 26 05 01 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 26 05 19 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: ¾ inch diameter, 10 foot long, copper clad steel.

E. Bentonite

F. XIT

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 26 05 33

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.

B. Section 16740 includes specific requirements related to the installation of raceways and boxes.

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.
i. Surface raceways.

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 26 05 33 for raceway and box supports.
2. Section 26 05 19 for conductors installed in raceways and boxes.
3. Section 26 27 26 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 26 05 01 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):

1. Minimum 40 mil exterior PVC coating, and 2 mil interior urethane coating.
2. Conduit: PVC Coated Conduit meeting ANSI C80.1, NEMA RN-1 and UL 6.
3. Fittings: PVC Coated Conduit Bodies meeting UL 514B, IEC IP69 and UL Type 4X.
4. Hazardous Location Fittings: PVC Coated Hazardous Location Fittings (GUA outlet boxes, Sealing Fittings, Unions, and EC Series Couplings) meeting UL 1203 after coating is applied.
5. 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 1-1/2" conduit 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 (Cable provided under Specification Section 16740): 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"
1-¾"	6"	20"	3"	3"
1-½"	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 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 before exiting and a minimum of 3" beyond the exiting point:

        1) PRMC
        2) RMC taped with a half lapped wrap of Scotchrap No. 51 plastic tape (40 mil total thickness) down to the elbow (It is not permissible to provide a rigid steel elbow. All elbows shall be PRMC).

    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 before exiting and 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) down to the elbow (It is not permissible to provide a rigid steel elbow. All elbows shall be PRMC).

    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. For conduit connections to hubless enclosures, cabinets, and boxes:

1. Connect to enclosures, boxes and devices from below in exposed outdoors, below grade, or wet locations. 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.
2. Connection methodology shall be determined by area classification and shall follow the most stringent applicable method from:
    a. In exposed outdoors, below grade, wet locations, or exposed in indoor locations in process areas which are not hazardous use Myers hubs or O-Z/Gedney rain tight conduit hubs.
    b. In corrosive locations areas, use PVC coated conduit hubs.
    c. In exposed dry locations which are not hazardous or are not in process areas, connect with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts.

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 prior to terminating conduit. Clean threads of cutting oil before applying thread compound.
3. PRMC: Use only fittings approved for use with that material. Use a manufacturer approved touch-up compound or repair kit on 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 Myers hubs or O-Z/Gedney rain tight conduit hubs. In "corrosive" areas, use PVC coated 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 or (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. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.

BB. 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.

CC. 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.

DD. Install wall or surface mounted enclosures and cabinets plumb. Support at each corner.

EE. 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 26 22 13

DRY TYPE TRANSFORMERS

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 dry-type distribution and specialty transformers rated 1000 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. Submit transformer information with or after the Electrical System Study Report (ESSR) as specified under Section 16010. Equipment submitted prior to submission of the ESSR will be returned as "Not Reviewed". Transformer equipment shall not be approved or ordered until the ESSR has been reviewed and approved.

C. Product Data: Submit the following:

1. Nameplate ratings
2. Mounting methods
3. Dimensioned plans, sections, elevation views and minimum clearances. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
4. Lug configuration showing quantities and sizes of conductors the transformer can accept. Lugs or connections for transformers which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.

D. Wiring Diagrams: Submit manufacturer's wiring diagrams and clearly identify terminals for tap changing and connecting field-installed wiring.

E. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.3 for further information)

F. Operation and Maintenance Manual: Shall include the following:

1. Maintenance Manuals (specified in Division 1).
2. Electrical System Study Report
3. Field Test Reports

4. Wiring Diagrams
5. Product Data

1.4 QUALITY ASSURANCE

A. Refer to Section 26 05 01 paragraph 1.7.

B. Comply with NFPA 70.

C. Comply with UL 1561 “Standard for Dry-Type General Purpose and Power Transformers”.

D. Comply with 10 CFR 429 for labeling and certification to federal standards.

E. Product Selection for Restricted Space: Space for installation of transformers is limited. Contract Document plan drawings indicate typical physical sizes or dimensions for equipment, including clearances between transformers and adjacent surfaces and items. Transformers 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 equipment with larger dimensions. The Contractor shall coordinate the size of the transformers with the available space and shall verify that the proposed equipment is capable of being installed in the available space prior to making a submittal. Equipment of dimensions larger than the available space shall not be submitted, and if submitted, will be rejected. The decision of the Engineer as to the acceptability of equipment with larger dimensions than as shown on the Contract Document plan drawings 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.

F. 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 transformer 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 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.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit

throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide transformers by one the following:

1. Cutler-Hammer/Eaton Corp.
2. GE Electrical Distribution & Control.
3. Siemens Energy & Automation, Inc.
4. Square D; Groupe Schneider.
5. Tierney Electrical Manufacturing Company

2.2 TRANSFORMERS, GENERAL

A. Description: Factory-assembled and -tested, air-cooled units of types and sizes specified, designed for 60-Hz service.

B. Cores: Grain-oriented, nonaging silicon steel.

C. Coils: Continuous copper windings without splices, except for taps.

D. Internal Coil Connections: Brazed or pressure type.

E. Enclosure: Complies with Section 16050 and NEMA 250 for the environment in which installed. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

F. Lugs or connections for transformers shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

A. Comply with Federal Law 10 CFR Part 431 (DOE 2016), NEMA ST 20 (latest edition) and list and label as complying with 10 CFR 429.

B. Cores: One leg per phase.

C. Windings: One coil per phase in primary and secondary.

D. Insulation Class: 220 deg C class for transformers larger than 15 kVA.

E. Rated Temperature Rise: 80 deg C maximum rise above 40 deg C.

F. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:

1. Taps, 3 through 25 kVA: Two 5-percent taps below rated high voltage.
2. Taps, 25 through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.

G. Wall-Mounting Brackets: Manufacturer's standard brackets for transformers up to 75 kVA.

H. Outdoor transformers shall have epoxy encapsulated windings.

2.4 FINISHES

A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.

B. Outdoor Units: Comply with ANSI C57.12.28.

1. Provide stainless steel enclosure and accessories.

2.5 CONTROL AND SIGNAL TRANSFORMERS

A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506, “Standard for Specialty Transformers”.

B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.

C. Description: Self-cooled, 2 windings.

2.6 SOURCE QUALITY CONTROL

A. Factory Tests: Design and routine tests comply with referenced standards.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Arrange equipment to provide adequate spacing for access and for circulation of cooling air per manufacturer’s recommendations.

B. 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, “Wire Connectors”.

3.2 GROUNDING

A. Comply with Section 26 05 01 and NEC for materials and installation requirements.

3.3 FIELD QUALITY CONTROL

A. Test to ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.

B. Report: Submit a written report of observations and tests. Report defective materials and installation.

C. Tests: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.2.1.1 for transformers. Certify compliance with test parameters.

1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B, “Wire Connectors”.
3. Insulation Resistance: Perform winding to winding and winding to ground megohmmeter tests of each primary and secondary winding.

D. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.4 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

B. Adjust buck-boost transformer connections to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

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 power distribution switchboards and associated auxiliary equipment rated 600 V and less.

B. Switchboards provided or modified under this Section include:

1. "11MDS" Main Distribution Switchboard in Dewatering Building
2. "11GDS" Generator Switchboard in Dewatering Building
3. "06MDS" Main Distribution Switchboard in Aeration Building
4. "05HB" Distribution Switchboard in Aeration Building

C. Related Sections include the following:

1. Section 26 05 20 for additional materials and installation information.
2. Section 26 28 16 for circuit breakers installed in Switchboards.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. Submit switchboard information with or after Electrical System Study Report (ESSR) as specified under Section 26 05 01 . Equipment submitted prior to submission of the ESSR will be returned as "Not Reviewed". Switchboard equipment shall not be approved or ordered until the ESSR has been reviewed and approved.

C. Product Data: For each type of switchboard, accessory item, and component specified.

D. Shop Drawings:

1. Shop Drawings shall include, but not be limited to, the following:

a. Dimensioned plans, sections, and elevations.
b. Tabulations of installed devices, major features, and voltage rating.
c. Enclosure type and mounting. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
d. Bus configuration and current ratings.

e. Short-circuit current rating of switchboard.
f. Circuit breaker quantities, types and layout.
g. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
h. Time current curves for each circuit breaker installed in the switchboard.
i. Metering Equipment information.
j. Lugs or connections for switchboards which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.

E. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.5 for further information)

F. Operation and Maintenance Manual: Shall include the following:

1. Maintenance Manuals (specified in Division 1). Include manufacturer's written instructions for testing and adjusting circuit breakers.
2. Electrical System Study Report
3. Field Acceptance Test Reports
4. Product Data

1.4 QUALITY ASSURANCE

A. Refer to Section 26 05 01 paragraph 1.7.

B. Comply with NEMA PB 2.

C. Comply with UL 891, "Switchboards".

D. Switchboards, and the equipment contained within them, shall be factory assembled and wired as complete units by the manufacturer at the manufacturer's factory, except where shipping splits are required for shipping of the units. This requirement pertains to control wiring, metering equipment and wiring, and similar items and wiring located within the switchboard.

E. Product Selection for Restricted Space: Space for installation of equipment is limited. Contract Document plan drawings indicate typical physical sizes or dimensions for switchboards, including clearances between switchboards and adjacent surfaces and items. Switchboards 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 centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the switchboards with the available space and shall verify that the proposed switchboard is capable of being installed in the available space prior to making a submittal. Switchboards of dimensions larger than the available space shall not be submitted and, if submitted, will be rejected. The decision of the Engineer as

to the acceptability of switchboards with larger dimensions than as shown on the Contract Document plan drawings 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.

F. Where equipment is noted in these specifications to be installed in existing buildings, the equipment shall be able to be tipped over. laid down or placed on its side in order to permit access through existing doors. Equipment that cannot be tipped or laid down to permit entry into existing buildings will be rejected.

G. 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 switchboard 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.

H. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report in Section 16010, equipment that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.E 'Product Selection for Restricted Space'.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store equipment per requirements of Section 26 05 01 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 requirements, provide products by the following:

1. Eaton Corp.; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Div.
3. Siemens Energy & Automation, Inc.
4. Square D Co.

2.2 FABRICATION

A. Enclosures: Floor mounted, free standing, steel, self-supporting, front access, deadfront, NEMA PB 2, Type 1.

1. Each section fabricated to be plumb, square and aligned with adjacent sections without twisting, shimming or otherwise stressing the structure.
2. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.
3. Entire structure finished as a unit with phosphate inhibitor, zinc chromate primer and baked gray enamel finish.
4. Provide complete channel base on all sides.
5. Access plates shall have rolled edges and be screw or ¼ turn fastener attached.
6. Wiring gutters are hinged with ¼ turn fasteners.
7. Each section has a nameplate giving:

    a. ampere rating of phase and neutral bussing
    b. short circuit current rating
    c. voltage rating
    d. system type (3 phase 3 wire, or 3 phase 4 wire)
    e. manufacturer's shipping order and/or serial number with date manufactured.

B. Bus: Hard drawn copper of 98 percent conductivity. Insulated, bondable, full size neutral bus unless otherwise indicated.

C. Main, Neutral, and Subfeed Lugs: Indent compression type, suitable for copper conductors. Lugs or connections for switchboard equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

D. Equipment Ground Bus: ¼" x 2" copper with (minimum) 2 lugs for connections at each end. Bonded to enclosure.

E. Service Equipment Approval: Listed for use as service equipment where indicated or required by Code.

F. Future Devices: Equip for future installation of devices with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated.

G. Special Features: Where shown on the Contract Documents include the following features:

1. Surge protective equipment, mounted in a dedicated compartment, with circuit breaker short circuit/overload protection.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers: NEMA AB 1, handle lockable, meeting requirements of Section 26 28 16 .

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity equal or greater than the switchboard rating.
2. Lugs: Compression lugs and power-distribution connectors for copper conductors of number and size indicated.
3. Coordinate circuit breaker trip sizes with equipment submittals for process, HVAC etc. equipment specified under Divisions 11 through 15 as described in Section 26 28 16 .

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install switchboards and accessory items according to NEMA PB 2.

1. Install switchboard plumb, level, and aligned across all sections; level concrete base by grinding or with grout or imbed channels if not flat and level with manufacturer's tolerance or 1/8" in 3' whichever is more restrictive.
2. Setup, adjust and fasten in interiors, breakers, covers and trim.

B. Do not remove knockouts or access plates for breaker, meter, switch or similar equipment or device positions unless equipment or a device is to be installed.

C. Provision for Future Circuits: Install switchboards and conduit connections in such a manner as to leave access to the enclosure for future circuit additions. Place conduit in rear of enclosure or entry space where possible.

D. Wiring in Switchboard Gutters: Run neatly parallel and perpendicular to enclosure. Arrange conductors into groups, and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Section 26 05 02 .

B. Switchboard Nameplates: Label each switchboard with engraved nameplates as specified in Section 26 05 02 .

3.3 GROUNDING

A. Connect equipment grounding conductors to ground bus.

B. Ground the switchboard per the requirements of the National Electrical Code and as indicated on the Plans.

3.4 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.

3.5 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test the equipment and electrical circuits for proper connection, continuity, and absence of undesirable shorts and grounds. Check for continuity, visual damage, marking, and proper phase sequence before performing insulation testing.
2. Make insulation-resistance tests of each bus, component, and connecting supply, feeder, and control circuits. Megger bus work, breakers 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.
3. Test operation, calibration, and settings of the meters, relays and indicating devices.
4. Test all operating controls for proper operation.
5. Test auxiliary equipment, i.e., heaters, thermostats, lights, and illuminated indicating devices and lamps, and audible alarm devices which are an integral part of equipment to verify that they function properly.
6. Check fuses with an ohmmeter; Ring out wiring and busing; Check operation of control and safety interlocks; Check grounding of potential transformers, current transformers, lightning and surge arresters; Check control connections at terminal blocks, relays, meters, switches, etc.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

B. Acceptance Testing: After installing switchboards and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Provide services of a qualified independent testing agency as described in Section 26 05 02 to perform specified testing for switchboards and circuit breakers.
2. Testing shall not commence until Electrical System Study Report has been reviewed and approved.
3. Procedures:

a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.1 for switchboard assemblies. Certify compliance with test parameters.
b. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6.1.1 for molded-case circuit breakers. Certify compliance with test parameters.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.
5. Take load readings on each feeder circuit connected to switchboard after loads are connected. Record these measurements to give the maximum reading for each phase and neutral obtained with lighting, appliances, motors, and other loads, connected to the switchboards in service.

3.6 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trips as required for selective coordination and adjust, if required to accommodate actual operation of equipment.

1. Where circuit breakers are included in the Electrical System Study Report, set the trip initially as recommended in the Electrical System Study Report.
2. Adjust settings after initial settings have been made when requested by Owner.

3.7 CLEANING

A. On completion of installation, inspect interior and exterior of switchboards. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

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 lighting and power panelboards and associated auxiliary equipment rated 600 V and less.

B. Section Includes:

1. Panelboards specified under this Section include:

   a. Panelboard “08LA” – UV/RAS Building
   b. Panel “11HA” – Dewatering Building
   c. Panel “11LA” – Dewatering Building
   d. Panel “12LA” – Storage Building

C. Storage Building 12LARelated Sections include the following:

1. Section 26 05 02 for additional materials and installation information.
2. Section 26 28 16 for circuit breakers installed in panelboards.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. Submit panelboard information with or after the Electrical System Study Report (ESSR) as specified under Section 26 05 01 . Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Panelboard equipment shall not be ordered until the ESSR has been reviewed and approved.

C. Product Data: For each type of panelboard, accessory item, and component specified in this Section.

D. Shop Drawings:

1. Shop Drawings shall include, but not be limited to, the following:

   a. Enclosure (including front, door, etc.) type and mounting.
   b. Bus configuration, voltage and current ratings.
   c. Short-circuit current rating.
   d. Circuit breaker quantities, types and layout.

e. 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.

f. Lug configuration showing quantities and sizes of conductors the panelboard can accept. Lugs or connections panelboards which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.

E. Panelboard Schedules: Submit circuit breaker layout as scheduled on the "Panelboard Circuit Schedule" located on the drawings.

F. Operations and Maintenance Manual: Shall include the following:

1. Testing Results (must be approved prior to energization of the system) (see Section 3.4 for further information).
2. Maintenance Data: Include manufacturer's written instructions for testing circuit breakers.
3. Panelboard Schedules: Include approved final versions of panel schedules only.
4. Electrical System Study Report
5. Shop Drawings
6. Product Data

1.4 QUALITY ASSURANCE

A. Refer to Section 26 05 01 paragraph 1.7.

B. Comply with NEMA PB 1.

C. Comply with UL 67, “Standard for Panelboards”.

D. Product Selection for Restricted Space: Space for installation of panelboards is limited. Contract Document plan drawings indicate typical physical sizes or dimensions for equipment, including clearances between panelboards and adjacent surfaces and items. Panelboards 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 equipment with larger dimensions. The Contractor shall coordinate the size of the panelboards with the available space and shall verify that the proposed equipment is capable of being installed in the available space prior to making a submittal. Equipment of dimensions larger than the available space shall not be submitted, and if submitted, will be rejected. The decision of the Engineer as to the acceptability of equipment with larger dimensions than as shown on the Contract Document plan drawings 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.

E. 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 panelboard 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.

F. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report 26 05 01 , equipment that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.D 'Product Selection for Restricted Space'.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store equipment per requirements of Section 26 05 01 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.

1.6 EXTRA MATERIALS

A. Keys: Provide 3 spares of each type for panelboard cabinet lock.

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. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Eaton Corp.; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Div.
3. Siemens Energy & Automation, Inc.
4. ABB Group
5. Square D Co.

2.2 PANELBOARD FABRICATION

A. Enclosures: Flush- or surface-mounted enclosures as indicated on the Plans. NEMA PB 1, 20" minimum width of NEMA type complying with Section 16050 for the location installed.

B. Front: Secured to enclosure with concealed trim clamps or screws. Front for surface-mounted panelboards shall be same dimensions as enclosure. Fronts for flush panelboards shall overlap enclosure, unless otherwise indicated. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

C. Directory Frame: Metal, mounted inside each panelboard door.

D. Bus: Hard drawn copper of 98 percent conductivity. Insulated, bondable, full size neutral bus unless otherwise indicated.

E. Main and Neutral Lugs: Compression type. Lugs or connections for panelboard equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

F. Main Breaker: Vertically mounted.

G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to enclosure.

H. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

I. Special Features: Include the following features for panelboards:

1. Provide same size enclosures for multi-section panelboards.
2. Feed-through Lugs: Sized to accommodate feeders indicated.
3. For panelboards with NEMA 1 enclosures, panel fronts shall be stretcher leveled steel with piano hinged door-to-box construction. The entire panel front shall be hinged to allow access to the interior of the panelboard enclosure when opened (the second door allows access to the circuit breakers only). Door-to-box construction shall not increase the width of the panelboard to a dimension greater than what is shown on the Contract Drawings.
4. Provide skirts for surface mounted panelboards located in building or structures.

J. Future Devices and Circuit Breakers: Equip for future installation of devices and circuit breakers with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated.

K. Series Rating: Series rating is not permitted.

2.3 OVERCURRENT PROTECTIVE DEVICES

A. In accordance with Section 26 28 16 , except as modified herein. Coordinate circuit breaker trip sizes with equipment submittals for process, HVAC etc. equipment specified under Divisions 11 through 15 as described in Section 26 28 16 .

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessory items according to NEMA PB 1.1.

1. Setup, adjust and fasten in place flush trim and interiors.
2. Install circuit breakers as shown on the "Circuit Schedule" for each panelboard except where deviations are necessary to accommodate changes in loads or equipment served.

B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish. Mount surface panelboards with spacers of neoprene or fiberglass to shim out from irregular surfaces or from damp surfaces.

D. Circuit Directory: Prepare panelboards directories neatly typewritten in the same pole sequence as the panelboard stamping. Send a copy to the Owner for his records. Prior to typing the final directories, verify room and equipment names and numbers with the Owner and modify circuit descriptions of areas/spaces to conform with the Owner's desires. Obtain approval before installing. Record all circuit breaker installation deviations from the "Circuit Schedule" and show on the Record Drawings the actual size and pole position of all circuit breakers installed.

E. Do not remove knockouts for breaker positions unless a breaker is to be installed. Where twistouts or knockouts are removed in error, provide a circuit breaker (one pole, twenty ampere) to fill each position removed.

F. Provision for Future Circuits: Install panelboards in such a manner as to leave access to the box, building chases, knockouts, etc. for future circuit additions.

3.2 IDENTIFICATION

A. Panelboard Nameplates: Label each panelboard with engraved nameplates per the requirements of Section 26 05 02 paragraph 3.3.

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. Prepare for acceptance tests as follows:

1. Test panelboards 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 panelboard bus, component, and connecting supply or feeder circuit. Megger bus work, breakers 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 panelboards and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements:

1. Provide services of a qualified independent testing agency as described in Section 26 05 01 to perform specified testing for circuit breakers.
2. Testing shall not commence until the short circuit and coordination study has been reviewed and approved.
3. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6.1.1 for molded-case circuit breakers. Testing of circuit breakers shall only be required for circuit breakers 200 amperes and larger. Certify compliance with test parameters.
4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

C. Take load readings on each panelboard after loads are connected and panel has been energized. Record these measurements to give the maximum reading for each phase and neutral obtained with lighting, appliances, motors, and other loads, connected to the panels in service.

3.5 ADJUSTING

A. Set field-adjustable circuit-breaker trip ranges as indicated, or requested by the Owner.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 26 24 19

MOTOR CONTROL CENTERS

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 motor control centers rated 600 V and less.

B. Motor control centers provided or modified under this Section include:

1. “04 MCC D” – Aqua Building
2. “08 MCC A” – UV/RAS Building
3. “08 MCC B” – UV/RAS Building
4. “11 MCC A” - Dewatering Building Motor Control Center
5. “11 MCC B” - Dewatering Building Motor Control Center

C. Motor control centers modified under this Section include:

1. “02 MCC A” – Primary Clarifier Building
2. “04 MCC A” – Aqua Building
3. “04 MCC B” – Aqua Building
4. “04 MCC C” – Aqua Building

D. Related Sections include the following:

1. Section 26 05 00 for additional materials and installation information.
2. Section 26 28 16 for switches and circuit breakers located in motor control centers.
3. Section 26 29 13 for motor controllers located in motor control centers.
4. Section 26 24 16 for panelboards contained in motor control centers.
5. Section 26 22 13 for transformers contained in motor control centers.
6. Section 40 63 43 for PLC equipment located in the motor control center.
7. Division 41 for Material Processing and Handling.
8. Division 43 for Process Gas and Liquid Handling Equipment.
9. Division 46 for Water and Wastewater Equipment.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.

B. Submit motor control center information with or after the Electrical System Study Report (ESSR) as specified under Section 16010. Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Motor control center equipment shall not be approved or ordered until the ESSR has been reviewed and approved.

C. Product Data: For each type of motor control center, accessory item, and component specified.

D. Shop Drawings:

1. Shop Drawings shall include, but not be limited to, the following:

a. Enclosure type and mounting.

b. Wiring Type.

c. Bus configuration, voltage and current ratings.

d. Short-circuit current ratings.

e. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.

f. Wiring diagrams for power circuits and each type of control circuit.

g. Nameplates.

h. Tabulations (bill of materials) of installed devices, major features and voltage rating.

i. 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.

j. Lug configuration showing quantities and sizes of conductors the equipment can accept. Lugs or connections for motor control center equipment which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.

E. Field Test Reports: Indicate and interpret test results for compliance with manufacturer’s published standards and performance requirements. (see Section 3.6 for further information)

F. List of motor characteristics needed to properly set protective devices such as motor load current, service factor, code letter, enclosure type, speed, location (relative to overcurrent devices) and MCP (Motor Circuit Protector) and overload relay settings: Compile after motors have been selected and provided documentation for the MCP and overload settings. Provide list with shop drawings based upon approved or submitted mechanical equipment.

G. VFD and soft starter configuration parameter list: See Section 16422. These parameters include IP addresses, subnet masks, default gateways, master controller IP address, unit identifier, parameters listed in a fieldbus control register, etc.

H. Shop testing notification materials: These include the materials indicated in subsection 3.2.

I. Operation and Maintenance Manual: Unless noted otherwise, submit O&M, including final testing reports, before equipment startup. Operation and Maintenance Manual: Shall include the following:

1. Component Maintenance Manuals (specified in Division 1).

2. Electrical System Study Report

3. Field Test Reports

4. Final as-constructed Wiring Diagrams Reports (see section 3.6 for further information)

5. Product Data

6. List of motor characteristics

7. VFD and Soft Starter configuration parameter list.

1.4 QUALITY ASSURANCE

A. Refer to Section 26 00 00 paragraph 1.7.

B. Comply with UL 845, “Motor Control Centers”.

C. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.

D. Product Selection for Restricted Space: Space for installation of equipment is limited. The Plans indicate typical physical sizes or dimensions for equipment, including clearances between equipment and adjacent surfaces and items. Equipment 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 centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the motor control centers with the available space and shall verify that the proposed motor control center is capable of being installed in the available space prior to making a submittal. Motor control centers of dimensions larger than the available space shall not be submitted, and if submitted, will be rejected. The decision of the Owner as to the acceptability of motor control centers 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.

E. The number of sections in each center and the unit arrangement within the structure is indicated on the Contract Documents and is specific to this project. Arrangement of units shall not be changed from that shown on the Contract Documents unless size requirements of the units necessitate changing the

arrangement, and the proposed change is acceptable to the Owner. In the event that the unit arrangement is changed, the Contractor shall be responsible for coordinating and providing for conduit relocations to allow conduits to enter the section from which the conductors they contain are routed.

F. Motor control centers, and the equipment contained within them, shall be factory engineered, manufactured, assembled and wired as complete units by one of the specified manufacturers at the manufacturer's factory or at a location designated by the manufacturer. This requirement pertains to control wiring, VFD installation and wiring and similar items and wiring located within the MCC. Provide necessary means (terminal blocks, bus splices) to connect adjacent sections where shipping splits are provided.

G. 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 control center 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.

H. Product Selection for Electrical System Selective Coordination: In accordance with 26 00 00 2.3.E 'Coordination Study', equipment that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.D 'Product Selection for Restricted Space'.

I. Shop testing of the motor control centers is required. Refer to the "Shop Testing" section below for shop test information.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store equipment per requirements of Section 26 00 00 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. Square D Co.
3. Eaton Corp.; Cutler-Hammer Products.

B. The motor control centers shall be of the same manufacturer as the motor control center mounted VFDs and shall be of the same manufacturer as the motor control center mounted PLCs and remote I/O.

2.2 MOTOR CONTROL CENTER FABRICATION

A. Ratings: 480 volts, 3 phase, 3 or 4 wire as indicated, 60 hertz.

B. Wiring: NEMA ICS 3, Class I, Type B.

1. Class C stranded, single copper conductor; No. 14 AWG minimum size for control wiring, No. 12 AWG minimum size for power wiring.

2. 600 volt rated MTW thermoplastic insulation. Insulation color as follows:

a. red for control circuits internally energized

b. yellow for control circuits externally energized

c. black for power wiring

d. white for all grounded conductors

e. blue for d-c conductors.

C. Enclosures: free-standing, front-accessible, metal-clad structure sections nominally 20" wide by 20" deep by 90" high, bolted together to form a continuous assembly.

1. Suitable for mounting against a wall and does not require rear or side access.

2. Formed of sheet steel to enclose a vertical bus, hold slide-in units and provide horizontal and vertical wireways and a horizontal busway.

3. Designed to easily extend at either end with similar vertical structures.

4. NEMA type per location as stated in Section 26 05 00.

5. Channel sills for attaching enclosure to floor, housekeeping pad, or other supporting structure.

6. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

D. Wireways: continuous both vertically and horizontally.

1. Accessible from the front of the center.

2. Completely isolated from bus compartments and adjacent sections.

3. Vertical wireways adjacent to the slide-in units in each section, but accessible through a separate hinged door running the full height of each section between horizontal wireways.

4. Horizontal wireways at both top and bottom, each intersecting the vertical wireways of every section.

E. Busing: Copper

1. Horizontal busing at the top or the center continuous, without splices except where shipping splits are required. Provide splice bars and

hardware for shipping splits. Access to the horizontal bus is by removable coverplates.

2. Vertical busing continuous from the top of the section to the lowest unit opening possible in the section.

3. Copper ground bus at the bottom of the center, mechanically and electrically connected to each vertical structure.

4. Lug connections to the bus bolted. Lugs or connections for motor control center equipment shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

5. Bracing designed to avoid accumulation of dirt, lint, etc. on supports between phases.

6. Supports are moisture-resistant, non-carbonizing and non-tracking.

7. Busing rated as indicated on the Plans, but not less than as follows:

   a. Vertical busing - 300 amperes RMS minimum.

   b. Horizontal busing - 600 amperes RMS minimum.

   c. Ground bus - 1/4 inch x 2 inch minimum.

8. Insulated horizontal and vertical bus barriers and insulated bottom barriers or bus caps to completely protect the conduit entry areas from energized bussing.

F. Section units.

1. Units consist of protective/disconnect devices, magnetic starters, control power transformers, control units, pilot lights, relays, terminal blocks and associated wiring mounted on a metal slide-in structure of a modular size.

2. Units of equal rating are interchangeable within the center structure and from center to center.

3. Unit components do not protrude into or restrict wireways.

4. Unit barriers isolate each unit from adjacent units, vertical bus and horizontal bus.

5. Pushbuttons, selector switches, and pilot lights are mounted on the draw-out compartment; but they are visible and operable externally through gasketed, die-cut openings in the unit door. Provide an external reset mechanism for overload relays on the unit door.

6. Plug-in contacts for bus connection of the units are silver plated, free-floating but captive in an insulating block and easily replaceable. The unit plug-in arrangement is completely self-aligning and fail-safe against accidental short or ground. Each plug-in control unit is retained in the structure.

7. Short-circuit protective devices in combination starters and branch circuit protective devices have an external operator. This operator is

interlocked with the door so that the circuit must be de-energized before the door can be opened and the device cannot be closed with the door open. Provide a semi-concealed interlock defeat mechanism.

8. The lugs compartment does interfere with routing of control or power wiring nor interrupt the vertical wireway in the vertical section where it is installed.

G. Identification

1. Provide each motor control center with engraved nameplates per the requirements of Section 26 05 00 paragraph 3.3 and as follows:

a. Nameplate is Lamacoid or equal plastic laminate or engraved metal plate. Lettering is white; backgrounds are black. No abbreviations are permitted unless approved by the Owner. Engraving is subject to the Owner's approval.

b. Provide a main nameplate for each center, 2"x10" minimum size with 1/2" engraved letters.

c. Main Lugs compartment is identified by a 1"x4" nameplate engraved "MAIN LUGS COMPARTMENT" with 3/8" letters.

d. Main Circuit Breaker compartment is identified by a 1"x4" nameplate engraved "MAIN CIRCUIT BREAKER COMPARTMENT" with 3/8" letters.

e. Each unit door and each slide-in unit shall have a permanently attached, engraved nameplate: 3/8" letter unless otherwise shown.

f. Provide nameplates for all relays, timers, transformers, fuses, terminal blocks, and switches mounted internally to the unit. Nameplates are Lamacoid sized to the scale of device to which they refer. Engrave as indicated for the device on the elementary wiring diagrams.

2. Provide legend plates for all cover-mounted control devices, including pilot lights, selector switches and pushbuttons. Engraving is subject to the Owner's approval.

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.

a. The manufacturer's standard internal wiring may be numbered per NEMA or manufacturer's standard.

b. Wire markers shall be readable from the front of the unit.

H. Special Features: Where shown on the Contract Documents include the following features:

1. Provide digital metering information which shall be made remotely available via Ethernet/IP.

a. The metering unit shall be capable of monitoring the following data:

1) Instantaneous value of phase, neutral and ground current

2) Instantaneous value of line-to-line voltage

3) Minimum and maximum current values

4) Frequency in hertz

5) Watts, vars, VA, watthours, varhours and VA hours

6) Energy-monitoring parameter values (peak demand, present demand, and energy consumption).

7) Power quality values: crest factor, power factor, percent total harmonic distortion, and harmonic values of all phases through the 31st harmonic.

b. Communications

1) Provide the ability to retrieve the data remotely using the Ethernet/IP. All data shall be available via ethernet.

a) Include the following information from metering equipment:

i. amps (per phase)

ii. amps demand (per phase)

iii. volts (per phase)

iv. Total Harmonic Distortion

v. Harmonic content (per phase) at least through the 13th Harmonic

vi. kilowatts

vii. kVARs

viii. kilowatt-hours

ix. kVAR-hours

x. kW and kVAR demand

c. Storage

1) Provide the ability to store five full days of recorded data in onboard memory.

I. Finish: Ferrous parts are cleaned, rustproofed and finished with baked enamel, light gray on the exterior, white on the interior. Manufacturer's standard gray colors or accents are acceptable.

2.3 PROTECTIVE AND CONTROL DEVICES

A. Circuit breakers must meet the requirements of Section 26 27 27, Enclosed Switches and Circuit Breakers. Coordinate circuit breaker trip sizes with equipment submittals for process, HVAC etc. equipment specified under other Divisions as described in Section 26 28 16.

B. Motor Controllers must meet the requirements of Section 26 29 13, Motor Controllers.

C. Miscellaneous Protection and Control Devices:

1. Fuses: Power fuses, Class RK-5 silver element. Control fuses, Bussman FNQ or equal.

2. Voltage Relays: Allen-Bradley Bulletin 813S or equal.

3. Pilot devices (control units and stations): Allen-Bradley, Cutler-Hammer, or Square D; heavy duty, oil-tight type per NEMA ICS-1; pilot lights shall be push-to-test transformer type.

4. Control relays:

a. Electro-mechanical machine tool, heavy-duty type per NEMA ICS Standard. IEC rated relays are not permitted.

b. 120 volt alternating current coils and double-break contacts rated B-300 by NEMA standards, unless otherwise indicated.

1) Allen-Bradley 700 N

2) Siemens Class 46

3) Square D Company Class 8501, Type G

4) or equal

c. Time delay relays shall be octal DIN-rail mount electronic relays. Finder or equal.

d. Relays shall be equipped with surge suppressers.

5. Running time meters: Eagle Signal six digit non-reset.

6. Ammeters: +/-2% accuracy, 3-1/2 to 4 inch size, GE "Big Look" or equal, Simpson, Weston, or Crompton.

7. Current transformers: 1% accuracy at burden and lead length as installed. G.E., Midwest, or Westinghouse.

8. Control power transformers: as required for devices such as power meters, with primary and secondary fuses.

9. Communications with motor controllers, such as motor starter overload relays, I/O modules and VFDs, within MCC shall use one of the following protocols over Ethernet using IP and TCP or UDP protocols:

a. Rockwell Automation (ODVA) Ethernet/IP, CIP encapsulation with assembly objects.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install motor control centers and accessory items according to NEMA ICS.

B. Mounting: Level, plumb and rigid without distortion of enclosure.

1. Install motor control center plumb, level, and aligned across all sections; level concrete base by grinding or with grout or imbed channels if not flat and level with manufacturer’s tolerance or 1/8” in 3’ whichever is more restrictive.

2. Shim with stainless steel shims where necessary.

3. Bolt units to the floor with 3/8" stainless steel expansion anchors and bolts or weld to embedded steel channels.

4. Grout or caulk enclosure to floor or pad.

C. Conduit connections:

1. Provide bushings on conduits entering from above or at the sides.

2. Provide metallic, insulating grounding bushings bonded to the ground bus or pad on conduits entering from below.

D. Wiring in wireways: Arrange conductors into groups, and bundle and wrap with tie wire.

E. Prior to energization, remove bracing, packing materials, tape on movable parts, etc. as necessary. Check for damage to enclosure, cracked porcelain, chipped bushings, etc.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Section 26 05 00.

3.3 GROUNDING

A. Connect equipment grounding conductors to ground bus, except for circuits requiring isolated grounding.

B. Provide ground continuity to facility electrical ground system as indicated.

3.4 CONNECTIONS

A. Clean splice plates with Stoddard solvent or mineral spirits before assembling.

B. Assemble all shipping splits.

C. Tighten bus splices, 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.

D. Check factory connections for proper torque.

3.5 SHOP TESTING

A. Shop test motor control centers with control panel, network switches, external motor controller (VFDs and motor overloads), instruments and PLC in the presence of the Owner prior to shipment to project site. Notify the Owner at least ten working days before testing. Testing shall be performed at the motor control center fabricator's or control panel integrator's shop. The Contractor shall conduct a rehearsal of the shop test prior to the arrival of the Owner and shall verbally certify that they believe there are no readily apparent obstacles to performance of the test.

1. Provide a test plan at time of notification of testing. Coordinate the time of testing of the motor control centers with the Construction Schedule.

2. Each assembled motor control center shall be meggered and tested to be free from grounds and shorts before the shop test.

B. Required elements of the Shop Test

1. The Manufacturer of the MCC, motor controllers, PLC, control panel, etc. shall perform their standard tests which the Owner observes.

2. In addition to the Manufacturer's standard tests, the following are also required to be observed by the Owner:

a. Before the portion of the test where line power is required, the MCC, control panel, external motor starters shall be put into an electrically safe condition so the Owner may verify wiring. Remove wire way and raceway covers and open all units to allow the Owner to observe wire labels and routing.

b. Upon energization of the equipment, the Contractor shall perform a network communications test. Connect networking equipment and patch cords, as needed, to allow the Owner to remain outside of a restricted approach or arc flash boundary but be able to observe the Contractor performing the test. The network communications test shall demonstrate that all of the devices on the communications network are properly configured with IP addresses, subnet masks, default gateways, Master Controller IP addresses (as required), fieldbus registers, control places, etc. Web pages, for those devices so equipped, may be used to demonstrate the IP address is configured correctly.

c. The Contractor shall demonstrate the equipment is able to function in "Hand" or manual control mode prior to any attempt using PLC or Communications methods.

d. The Contractor shall configure the equipment to allow the Owner to demonstrate the ability to call equipment using bus controls (even if bus control is not the primary method of control)

e. Motor controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly before the motor control center is shipped.

f. Variable frequency drives and PLC equipment mounted in the motor control centers shall be tested. Testing shall verify proper

functioning of communications between PLC equipment and the remote I/O equipment and between the PLC equipment and the VFDs. Testing of VFDs shall utilize the actual field mounted control devices such as control stations and potentiometers, or the same make and model as the actual field devices. Shorting of field connection terminals is not acceptable, except for motor winding temperature device connections and disconnect switch auxiliary contact connections. Provide resistors or instrument testing devices to simulate the required signals or measurements to allow the equipment to operate.

g. Each device and control loop shall be tested and demonstrated to function properly in each mode (such as “hand”, “local”, “automatic”). Discrete input signals shall be tested in both the “on” and “off” state. Analog signals (4-20 milliamp, or similar type) shall each be tested at not less than three values (4.08 mA or 0.5%, 12 mA or 50%, and 19.92 mA or 99.5%). Test results shall be documented. Test discrete outputs by forcing the output on and off via the programming software. Measure the resistance (for relay outputs) or voltage (for active outputs) between the output terminals. Document proper operation of each output.

h. Test analog inputs by applying voltage or current to the input at not less than three values, including at or just above minimum range, at or just below maximum range, and midrange. Document actual register values for each applied input value at each input.

i. Provide signal generators, multimeters, and other test equipment as required to verify proper operation of the assembled motor control centers. Simulate input signals, both discrete and analog, to verify operation of control and monitoring circuits.

3. Demonstrate that:

a. PLCs and remote I/O are fully operational. The Owner will provide the PLC testing program to the motor control center Fabricator within five working days of notification of the shop test. The motor control center Fabricator shall load the PLC programs into the respective PLC and demonstrate proper operation of the PLC. In no case shall testing be performed without an operating program functioning in the unit under test. Test discrete inputs by shorting across the input terminals. Document that each input performs properly.

b. Each I/O module is recognized by the base unit and is fully functional.

c. Communications ports on the base unit are fully functional.

d. VFDs are fully operational.

4. Correct, replace, or repair motor control center wiring, and/or components until testing demonstrates proper operation. Do not ship motor control centers to the site until testing has demonstrated satisfactory operation of the motor control centers.

5. Provide updated and complete ‘as shipped’ drawings at the time of final testing. The Owner will review the drawings against the motor control center construction at the time of final testing. Drawings which do not reflect the actual construction of the motor control center will need to be revised and reviewed again by the Owner against the actual construction prior to shipment of the motor control center to the job site. ‘As shipped’ drawings which require revisions shall be submitted to the Owner for review at testing notification, prior to the actual field review of these drawings against the motor control center construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the motor control center at the time of shipment. If more than three reviews are required, then the Contractor shall be required to reimburse the Owner for the Owner’s costs for the fourth and each subsequent review. Do not ship motor control centers to the site until the ‘as-shipped’ drawings are updated, complete, and reflect the actual ‘as-shipped’ status of the motor control center.

6. Attention of the Contractor is directed to the fact that more than one shop test and/or review of the motor control center wiring/drawings may be required. If the first shop test is not satisfactory, or results in the need to make revisions to the panel and/or ‘as-shipped’ drawings that cannot be effected during the course of the shop test, then a repeat shop test and/or review of the drawings against the construction will be required. The presence of the Owner at up to two shop tests/reviews will be without cost to the Contractor. If more than two shop tests/reviews are required, then the Contractor shall be required to reimburse the Owner for the Owner’s costs for the third and each subsequent shop test/review.

7. Submit the results of the test in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test

8. After each motor control center has been installed at the jobsite conduct a field test as described in Field Quality Control

3.6 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

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. Make insulation-resistance tests of each bus, component, and connecting supply, feeder, and control circuits. Megger bus work, breakers 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.

3. Test operation, calibration, and settings of the meters, relays and indicating devices.

4. Test all operating controls for proper operation.

5. Test auxiliary equipment, i.e., heaters, thermostats, lights, and illuminated indicating devices and lamps, and audible alarm devices which are an integral part of equipment to verify that they function properly.

6. Check fuses with an ohmmeter; Ring out wiring and busing; Check operation of control and safety interlocks; Check grounding of potential transformers, current transformers, lightning and surge arresters; Check control connections at terminal blocks, relays, meters, switches, etc. Make insulation-resistance tests of each motor control center bus, component, and connecting supply, feeder, branch and control circuits.

7. Make continuity tests of each circuit.

8. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

B. Acceptance Testing: After installing motor control centers and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Provide services of a qualified independent testing agency as described in Section 26 00 00 to perform specified testing for motor control centers and circuit breakers.

2. Testing shall not commence until the short circuit and coordination study has been reviewed and approved.

3. Procedures:

a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.16.2.1 for motor control centers. Certify compliance with test parameters.

b. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6 for molded-case circuit breakers. Primary current injection testing is not required for circuit breakers less than 400 amps. Certify compliance with test parameters. Mechanical and visual checks are required for every breaker unless otherwise noted.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

5. Take load readings on each motor control center after loads are connected. Record these measurements to give the maximum reading for each phase and neutral obtained with lighting, appliances, motors, and other loads, connected to the motor control centers in service.

C. Prepare and submit final wiring diagrams after all field modifications are completed. Include final wiring diagrams in the O&M Manual.

D. Provide the services of a qualified factory-trained employee of the motor control center manufacturer to assist the Contractor in installation and start-up of the

motor control center for a minimum period of 2 days per assembly. The manufacturer's employee shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connection and adjustments, and testing of the assembly and components contained therein.

3.7 ADJUSTING

A. Tighten all structural connections, barriers, racking mechanisms, etc.

B. Check alignment of plug-in devices with stationary parts.

C. Check operating mechanisms for binding, lubrication, etc.

D. Set field-adjustable overload relays and circuit-breaker trip ranges as indicated in Electrical System Study Report, or if not included in the Electrical System Study Report, to the minimum required value (within code limitations) to permit starting and operation of the equipment.

E. Check continuity and phase uniformity from unit to unit and for all control or metering circuits.

F. Provide overload heaters, or set overloads, in motor controllers to protect the actual motor installed.

G. Set, program and/or adjust motor controller parameters (for example, in VFDs and electronic overload relays) to properly control the driven equipment. See also Section 26 29 13, Enclosed Controllers.

3.8 CLEANING

A. Vacuum equipment clean after installation; remove metal cuttings with a magnet or suitable means before assembling equipment; wipe insulating supports, bushings, etc. with a clean lint-free cloth; clean debris, shavings, etc. from breakers, bus, switches, relays, and similar components before start-up.

B. On completion of installation, inspect interior and exterior of motor control centers. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION 26 24 19

SECTION 26 27 26

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 26 05 01 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 26 05 01 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 26 05 01 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. Multi-Outlet Assemblies:

a. Wiremold Co.

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. Photocells:

1. Three wire devices with adjustable aperture or lighting level operation where directly controlling lighting fixtures or interfacing to 120 VAC circuits. They shall be designed for conduit box mounting. They shall have outputs rated 120 volt, 20 amps. Tork, Crouse-Hinds, or equal.
2. Four wire devices operating at 120 VAC and with dry contacts rated 2 amps where interfacing to other than 120 VAC circuits, such as to 24 VDC PLC inputs.

L. Lighting Contactors: electrically operated with 120 volt coils. Contacts shall be silver-cadmium oxide double break type rated 20 amperes, and shall be field convertible to either normally open or normally closed. Square-D Type L, or equal.

M. 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.

N. 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.

O. Device Box Covers: Cast iron to match box to which installed.

P. Wall mounted occupancy sensors shall be passive infrared, with integral switch. Sensor shall have a minimum five year factory warranty. Wattstopper PW-100 or equal.

Q. Ceiling mounted low voltage occupancy sensors shall be passive infrared/ultrasonic dual technology, temperature controlled detectors. They shall be equipped with four individual, dual element, passive infrared sensors with overlapping detection patterns. They shall have automatic sensitivity gain, and two LED walk test indicators. The sensor enclosure and circuitry shall be designed to prevent radio and EMF interference. The sensor shall have an adjustable timing delay of 6-15 minutes, with a shunt provision to enable bypass of the sensor in the event of failure. Sensor shall have a minimum five year factory warranty. Sensor shall be Wattstopper or equal.

R. Line voltage occupancy sensors shall be ceiling mounted, passive infrared, temperature controlled detectors. The sensor shall have an adjustable timing delay of 6-15 minutes, with a shunt provision to enable bypass of the sensor in the event of failure. Sensor shall have a minimum five year factory warranty. Sensor shall be Wattstopper CI-355 or equal.

S. Door Security Switch

1. Magnetic door switch (for intrusion at building doors): GE model number 1078 or equal.

T. Wall mounted temperature transmitter shall provide a 0-5 VDC output signal for temperatures from zero to one hundred thirty five degrees Fahrenheit. Transmitter shall be Omega EWS-TX or equal.

U. Smoke detectors shall be 120 volt, independent units. Alarm contacts shall be rated for use with 24 volt circuits. Smoke detectors shall detect smoke using a photoelectric detector. Smoke detectors shall have a test and silence feature.

Each smoke detector shall have form C contacts that operate when that detector detects smoke. Smoke detectors shall have battery backup in each detector. Smoke detector shall be General Electric ESL 350CC or equal.

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 26 05 33 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 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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 switches and circuit breakers, whether individually mounted or group mounted in switchboards, motor control centers, panelboards, and similar equipment.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 26 27 26 for attachment plugs and receptacles, and snap switches used for disconnect switches.
2. Section 26 24 16 for panelboards containing circuit breakers.
3. Section 26 24 13 for switchboards containing circuit breakers.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. Submit circuit breaker information with or after the Electrical System Study Report (ESSR) as specified under Section 26 05 01 . Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Circuit breaker equipment shall not be approved or ordered until the ESSR has been reviewed and approved.

C. Product Data: For disconnect switches, circuit breakers and accessories specified in this 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. nameplate ratings
3. mounting methods
4. For units which are stand-alone mounted include dimensioned plans (showing available conduit entry locations), sections, and elevations.
5. Enclosures which will not accept the quantities and sizes of conduits as shown on the Contract Plans will be rejected.
6. Lug configuration showing quantities and sizes of conductors equipment can accept. Lugs or connections for switches and circuit breakers 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 performance requirements. (See Section 3.2 for further information)

E. Operation and Maintenance Manual: Shall include the following:

1. Maintenance Manuals (specified in Division 1).
2. Electrical System Study Report
3. Field Test Reports (see Section 3.2 for further information)
4. Product Data

1.4 QUALITY ASSURANCE

A. Refer to Section 26 05 01 paragraph 1.7.

B. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.

C. Comply with NEC for components and installation.

D. Comply with UL 98, “Enclosed and Dead-Front Switches” for safety switches.

E. Comply with UL 1066 “Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures” for low voltage power circuit breakers.

F. Comply with UL 489, “Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures” for molded case circuit breakers.

G. Product Selection for Restricted Space: Space for installation of switches and circuit breakers is limited. The Plans indicate typical physical sizes or dimensions for switches and circuit breakers, including clearances between switches and circuit breakers and adjacent surfaces and items. Switches and circuit breakers 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 centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the switches and circuit breakers with the available space and shall verify that the proposed switches and circuit breakers are capable of being installed in the available space prior to making a submittal. Switches and circuit breakers of dimensions larger than the available space shall not be submitted, and if is submitted, shall be rejected. The decision of the Owner as to the acceptability of switches and circuit breakers 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.

H. 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 switch and circuit breaker 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.

I. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report 26 05 01 , equipment with frame sizes or trip settings other than as specified or shown on the plans that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.H 'Product Selection for Restricted Space'.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:

1. Disconnect switches, safety switches and circuit breakers:

    a. Eaton Corp.; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution and Control Division.
    c. Siemens Energy & Automation, Inc.
    d. Square D Co.

2.2 SWITCHES

A. Enclosed, non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits.

B. Enclosed, Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, Class R rejection fuse clips, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position. Switch horsepower rated where used in motor circuits.

C. Enclosure: NEMA KS 1, with enclosure types as described in Section 16050, unless indicated otherwise in the Contract Documents. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans. Enclosure shall use spring loaded latches to ensure environmental protection in any position of the switch; the use of

screw or bolt type securing is not acceptable for NEMA 1, 3, 3R, 4, 4X or 12 rated enclosures.

D. Lugs or connections shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans.

E. Accessories:

1. Provide at least two auxiliary contacts for each switch. Where no auxiliary contacts are shown on plans, provide two normally open auxiliary contacts. Where one auxiliary contact is shown on the plans, provide indicated auxiliary contact and one additional normally open auxiliary contact. If two or more auxiliary contacts are shown on the plans, provide auxiliary contacts as shown.

2.3 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.

B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated with interrupting rating to meet available fault current.

1. Main circuit breakers and branch circuit breakers 200 amps and larger in switchboards, motor control centers, panelboards and individual enclosed circuit breakers shall have electronic trip units, with field-adjustable, short- and long-time trip units, each separately and individually adjustable for time and pickup. Where indicated, the electronic trip units shall be suitable for monitoring with a network. Circuit breakers greater than 800 amps shall have long term settings adjustable in 5-percent increments and shall have removable and sealable covers for the settings.
2. Feeder circuit breakers and main circuit breakers under 200 amps shall be molded case breakers with thermal magnetic trip unless otherwise noted.
3. Motor circuit breakers shall be magnetic only trip with adjustable trip setting.
4. Branch circuit breakers shall be molded case, thermal-magnetic trip, trip-free with non-interchangeable, non-adjustable trip unless otherwise noted.
5. All circuit breakers capable of being set to 1200 Amps or greater, including 1200 AMP frame circuit breakers with smaller trip plugs installed or lower adjustable settings, shall be provided with ground fault protection and reduced energy let through technology.

C. Application Listing: Appropriate for application, including switching lighting loads (SWD) or heating, air-conditioning, and refrigerating equipment (HACR).

D. Coordinate circuit breaker trip sizes with equipment submittals for process, HVAC etc. equipment specified under Divisions 11 through 15 and adjust the rating/trip size as needed to conform with the manufacturer’s requirements

for the trip rating. Revise the Electrical System Study Report as required to coordinate with circuit breaker requirements for equipment submittals for process, HVAC etc. equipment.

E. Molded-Case Switch: Where indicated, molded-case circuit breaker without trip units.

F. Enclosure: per application, as described in Section 26 05 02 , unless otherwise specified or required to meet environmental conditions of installed location. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

G. Lugs: Compression lugs, mechanical lugs and power-distribution connectors suitable for conductors of the material, number and size provided. Lugs or connectors shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans. Provide compression lugs for circuit breakers for the following:

1. Circuit breakers installed in switchboards and motor control centers.
2. Main circuit breakers installed in distribution and branch circuit panelboards.
3. Branch circuit breakers larger than 200 amps in distribution or branch circuit panelboards.

H. Series Rating: Series rating of circuit breakers is not permitted.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install equipment enclosures level and plumb in locations as indicated, according to manufacturer's written instructions.

B. For wall mounted equipment enclosures located at walls, bolt units to wall or mount on structural–steel channels bolted to wall. For enclosures not located at walls, provide structural stanchion supports conforming to Section 26 05 02 .

C. Install wiring between switches, circuit breakers, control, and indication devices.

D. Connect switches and circuit breakers and components to wiring system and to ground as indicated and as instructed by manufacturer.

1. Tighten electrical connectors and terminals 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.

E. Identify each switch and circuit breaker according to requirements specified in Section 26 05 02.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: After installing switches and circuit breakers and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Provide services of a qualified independent testing agency as described in Section 26 05 01 to perform specified testing for circuit breakers.
2. Third party testing shall not commence until the Electrical System Study Report has been reviewed and approved.
3. Procedures:

    a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5.1.1 for switches. Certify compliance with test parameters.
    b. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.6.1.1 for molded-case circuit breakers. Certify compliance with test parameters.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 ADJUSTING

A. Set field-adjustable circuit-breaker trip setting ranges as indicated.

1. Where circuit breakers are included in the Electrical System Study Report, set the trip as recommended in the report.

B. Provide fuses for fused disconnect switches to coordinate with manufacturer's listed maximum fuse size for equipment supplied by the disconnect switch.

3.4 CLEANING

A. After completing system installation, including 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 26 29 23

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 equipment specified under other sections.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 26 05 01 for general materials and installation methods.
2. Section 26 24 19 for centers housing motor control devices.
3. Section 40 67 16 for Shop Testing requirements.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 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 standalone mounted include dimensioned plans (showing available conduit entry locations), sections, and elevations.
3. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.
4. 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 40 67 16 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 and soft starter configuration parameters summary: Document the settings of configuration parameters and switch settings for each VFD or electronic soft start. 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 26 05 01 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 centers 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.

E. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report 26 05 01 , equipment with frame sizes or trip settings other than as specified or shown on the plans that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.C 'Product Selection for Restricted Space'.

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.

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, but are not limited to, the following:

1. Allen–Bradley
2. Eaton Electrical (Cutler Hammer)
3. Square D Co.
4. ABB Group

B. Motor Controllers shall not be “integrator assembled”. Motor Controllers shall be, unless otherwise expressly noted on Contract Documents, fully manufactured and assembled at the Factory. This includes components internal to the Motor Controller enclosure, i.e. associated circuit breakers, filters, terminal strips, power supplies, fuses.

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.

3. All overload protection units within motor control centers shall be networked. Overload protection units in standalone (individually enclosed) shall be networked if so indicated on the Contract Drawings.

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 use an 18-pulse rectifier or have an active front end capable of harmonic reduction comparable to 18 pulse rectifier technology.
4. The VFD shall maintain the line side displacement power factor at no less than 0.95 regardless of speed and load.
5. 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.
6. 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.
7. The VFD shall include an 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.
8. 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.
9. 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 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

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 Cat6 Ethernet.
2. The protocol shall be Ethernet/IP CIP and shall allow full control of the VFD via VFD manufacturer provided Add-On Profiles or Add-On Instruction Blocks in a 5380 series CompactLogix PLC.

E. VFD Programming Software

1. Provide and license to the Owner one copy of the manufacturer's software application for uploading and downloading drive parameter programming, and for reading of electronic files containing parameter dumps.

2. If programming cannot be done via the Ethernet network used for drive communications, provide any adapters and drivers required to allow communications via a USB port on a Windows 11 computer.

F. 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. VFDs shall meet all requirements as outlined in IEEE 519 for each individual and total harmonic current & voltage distortion and as indicated in this specification. As per IEEE 519, individual or simultaneous operation of the VFDs shall not add more than 3% total harmonic voltage distortion while operating at full load and speed from the utility source, or more than 5% while operating from standby generator. A harmonic analysis must be submitted with the VFD product data submittal. The analysis shall include all voltage and current harmonics up to the 30th.

3. 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 Pacific Power.
    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 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 or phase shifting transformers, as required to meet this specification.

4. The variable frequency drive(s) when installed and operating at the Owner's facility, shall not cause the generator set (provided by the Contractor) 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.

G. 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.

H. 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 all configuration/programming parameters as programmed in the drive at the time of project acceptance.

1. Parameters marked as "Default" without providing actual values as well are not acceptable.
2. Lists of only modified parameters which omit unmodified default parameter values are not acceptable.

I. 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.

J. 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 26 05 02 .

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 26 05 01.

D. Install freestanding equipment on concrete housekeeping bases conforming to Division 3.

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 26 05 02 .

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between motor–control devices according to Section 26 05 19 .

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 2 full days on site start-up services. These days shall be coordinated with the start-up of the facility. Travel time or unsuccessful trips due to Contractor unpreparedness shall not be counted towards the 2 full days of services.

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, protocol settings, IP address, etc.
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 26 05 01 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 26 32 13

GENERATOR ASSEMBLIES

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 packaged engine generator set(s) sized as shown on the oneline diagrams. The generator as shown on the Contract Drawings is the minimum size that is to be provided on this project. The engine generator shall be sized to successfully run the connected loads and start the largest load with other loads connected and operating as described in the System Description in this specification. If the project requires a larger generator than what is specified to meet the starting requirements for the loads, the Contractor shall provide a generator sized to meet the starting requirements (including any changes to circuit breaker, equipment sizes, conduit and conductor sizes) at no additional cost to the Owner.

B. Each engine generator set shall have the following features and accessories unless otherwise noted:

1. Air-intake filter silencer.
2. Battery charger.
3. Starting battery.
4. Block heater.
5. Output circuit breaker(s). Provide number of breakers indicated on the one line diagram. Each breaker shall be provided with either a tap block or lugs capable of accepting quantity of conductors as shown on the one line diagram. Each circuit breaker on the generator shall have a normally open auxiliary contact that closes when the circuit breaker is closed and opens when the circuit breaker is open or tripped.
6. Set-mounted Control Panel.
7. Muffler.
8. Sound Attenuated Weatherproof Enclosure.
9. Sub-base fuel tank.

C. Related Sections include the following:

1. Division 26 Section "Enclosed Switches and Circuit Breakers" for circuit breakers used to protect the engine generators.
2. Division 26 Section "Transfer Switches" for transfer switches, including sensors and relays to initiate automatic-starting and -stopping signals for engine generator set.
3. Division 26 Section “Control Panels” for wiring in the set mounted control panel.

4. Division 13 Section “Diesel Fuel System” for external fuel tank and fuel lines.

1.3 DEFINITIONS

A. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of a power outage.

B. Power Output Rating: Gross electrical power output of generator set minus total power requirements of electric motor-driven cooling fan and pump, and other auxiliary loads related to generator set operation.

C. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hz or cycles per second.

1.4 SYSTEM DESCRIPTION

A. Unit rated at 0.8 power factor and 277Y/480 volts, 3 phase, 60 Hz while operating at sea level to 500 feet in an ambient temperature range of 0 degrees F. to l04 degrees F.

B. Starting capability suitable for each of the following conditions with a voltage dip resulting in a supplied voltage of not less than eighty percent of nominal, or the voltage required by the control equipment supplied by the Contractor, whichever is higher:

1. One 200 HP motor on a VFD with 15 kVA of miscellaneous load on before starting.
2. One 100 HP motor on a VFD with one 200 HP motor (on a VFD) and 15 kVA of miscellaneous load on before starting.
3. One 200 HP motor on a VFD with one 100 HP motor (on a VFD) and one 15 kVA of miscellaneous load on before starting.

C. Steady State Voltage Regulation: 4 percent of rated output voltage from no load to full load.

D. Steady-State Voltage Modulation Frequency: Less than one Hz.

E. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within 2 seconds.

F. Steady-State Frequency Regulation: 0.5 percent of rated frequency from no load to full load.

G. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.

H. Transient Frequency Performance: Less than 2-Hz variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within 3 seconds.

I. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single

harmonics. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.

J. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at the system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.

K. Temperature Rise of Generator: Within limits permitted by NEMA MG 1 when operating continuously at full-rated load.

L. Starting Time: Maximum total time period for a cold start, with ambient temperature at the low end of the specified range, is 10 seconds. Time period includes output voltage and frequency settlement within specified steady-state bands.

1.5 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections..

B. Product Data: For each generator set and component.

1. Include data on features, components, ratings, and performance, including , but not limited to:

a. Overall dimensions of system.
b. Make of engine.
c. Number of cylinders.
d. Bore, in inches.
e. Stroke, in inches.
f. Piston displacement, in cubic inches.
g. Number and type of crankshaft bearings.
h. Lubrication oil consumption.
i. Catalog data for governor.
j. Rating and catalog data for jacket water heater.
k. Engine horsepower at rated load.
l. Fuel consumption at ¼, ½, ¾ and full load.
m. Make and type of generator.
n. Generator electrical rating (kVA, reactances, time constants, temperature rise, etc.)
o. Exciter type and drive.
p. Voltage regulator type, make, model and wiring diagram.
q. Output fault current based on transient and sub-transient reactance for selective coordination of overcurrent devices.

2. Include dimensioned outline plan and elevation drawings of engine generator set and other system components.
3. Foundation requirements for the set.
4. Tabulations (bill of materials) of components and recommended spare parts.
5. Vibration isolator drawings and seismic certification from manufacturer for IBC seismic zone (per paragraph 1.8 B of this section).

6. Provide description of Network Interface Mode monitoring system including listing of registers available to SCADA. Show the IP address, subnet mask, default gateway and Modus Unit ID. At a minimum, the listing for each data point shall include:

   a. Register Address (e.g., Modbus Register)
   b. Description
   c. Engineering Units
   d. Minimum and Maximum Range in Engineering Units

C. Shop Drawings: Include the following:

1. Contractor prepared installation plan drawing (similar to Contract Document drawings in scale and scope) showing the position of the unit on the site and the placement of connections, penetrations, and attachments to the unit (such as vibration isolators, exhaust, fuel and water connections, exhaust stack, power and control connections.
2. Interconnecting and wiring diagrams.

D. Factory Test Reports. Provide certified copies of factory tests on the engine and the generator. Show fuel flow, horsepower, exhaust temperature, and other pertinent information on the test results. Include ratings such as winding resistance, impedance, temperature rise, etc., on the test report.

E. 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)

F. Operation and Maintenance Manual: Shall include the following:

1. Component Maintenance Manuals (specified in Division 1).
2. Spare Parts List
3. Shop Drawings
4. Factory Test Reports
5. Field Test Reports
6. Product Data
7. Control Panel Programming Manual

1.6 QUALITY ASSURANCE

A. Refer to Section 26 05 01 Basic Electrical Requirements 1.7 Quality Assurance.

B. Source Limitations: Obtain engine generator set and auxiliary components from a single manufacturer with responsibility for entire system. Furnish a representative product built from components that have proven reliable and compatible with each other and are coordinated to operate as a unit as evidenced by records of prototype testing.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for generator assemblies, including clearances between generator assemblies and adjacent surfaces and items. The Contractor shall coordinate the size of the generator assembly with the available space and shall verify

that the proposed generator assembly is capable of being installed in the available space prior to making a submittal. Generator assemblies of dimensions larger than the available space shall not be submitted and, if submitted, will be rejected.

E. Comply with UL 2200 (Standard for Safety – Stationary Engine Generator Assemblies). Generator shall be UL 2200 listed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver engine generator set and system components 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.

1.8 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Engine generator system is designed, engineered, and rated to withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: 0° C to 45° C.
2. Relative Humidity: 0 to 95 percent.
3. Altitude: Sea level to 1500 feet.

B. Unusual Service Conditions: Engine generator equipment and installation is required to operate in the following conditions:

1. Applicable seismic risk zone location as defined in the International Building Code. The generator shall be rated to operate after a seismic event.

1.9 MAINTENANCE

A. Extra Materials

1. Furnish extra materials for each generator as described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

a. Manufacturer's recommended spare parts plus:

1) Fuses: 1 for every 10 of each type and rating, but not less than 1 of each type and rating.
2) Indicator Lamps: 2 for every 6 of each type used, but not less than 2 of each.
3) Filters: One set each of lubricating oil, fuel, and combustion air filters.
4) One complete replacement set of belts.
5) One complete set of special tools for engine and generator.
6) Touch-up paint, one quart minimum in aerosol spray cans.

b. Provide spare parts in a suitably boxed moisture-proof containers and stored in a sturdy painted wooden chest marked "STANDBY GENERATOR SPARES", and deliver to the Owner. Include in the chest the supplier's / manufacturer's name and the model number of the generator set.
c. Spare parts shall be provided at the time the generator and associated equipment arrives on site. It is not acceptable to provide spare parts after the equipment is on site.

B. Maintenance Service: Beginning at Substantial Completion, provide 24 months' full maintenance by skilled employees of the manufacturer's designated service organization. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Include quarterly inspection and exercising to check for defects and for proper starting, load transfer, and running under load. Include annual load bank test equal to acceptance testing. Provide parts and supplies as used in the manufacture and installation of original equipment, to complete all service to support all factory warranty requirements with written reports to the Owner upon completion of each visit.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

1. Caterpillar
2. Onan (Cummins)
3. Generac
4. MTU

2.2 ENGINE

A. Features:

1. Four-stroke cycle diesel engine of either vertical in-line or V-type suitable for operation on #2 diesel fuel.
2. Maximum continuous power output capacity of the engine shall not be less than 1.5 bhp/kW of generator set rating at 1800 (synchronous) rpm, at the job site altitude and with all accessory loads or losses as operating at the job site deducted from the rating, including alternator, water pump, exhaust system, etc.
3. Engine speed governed by a full hydraulic or isochronous electronic governor
    a. Maintain governed speed within 1.8 cycles of 60 cycles per second from no-load to full-load generator output
    b. Maintain frequency at any constant load, including no-load, within a steady-state band width of plus or minus 0.25 percent of rated frequency.

c. Frequency modulation (defined as the number of times that the frequency varies from the average frequency in cyclic manner) does not exceed one cycle per second.

B. Components

1. Fuel pump: sufficient to meet full fuel flow requirements of engine generator set while pumping fuel from a remote fuel tank. The fuel pump shall be capable of meeting these requirements including suction lift as required for the actual elevation of the generator set and remote fuel tank and dynamic flow losses in the fuel supply line.
2. Oil pump: gear-type lubricating oil pump for supplying oil under pressure to main bearings, crankpin bearings, pistons, piston pins, timing gears, camshaft bearings, and valve rocker mechanism.
3. Oil filters: Full flow oil filters conveniently located for servicing, and equipped with a spring-loaded bypass valve to insure oil circulation if filters are clogged.
4. Cylinder Liners: removable, wet or dry type cylinder liners of close-grained alloy iron.
5. Air Cleaner: one or more dry type air cleaners.
6. Electric starter sufficient to start the engine within ten seconds of call to start
7. Cooling System: sufficient to cool the engine when the generator set is delivering full-rated load in an ambient temperature of 104 degrees Fahrenheit.
    a. Engine-driven, centrifugal-type water circulating pump
    b. Thermostatic valve
    c. Heat exchanger (radiator)
8. Block Heater: engine-mounted, thermostatically controlled immersion-type engine coolant heater to ensure a minimum coolant temperature of 120 degrees Fahrenheit at ambient room temperature of 32 degrees Fahrenheit. The block heater shall be suitable for being supplied at 120 VAC, single phase, or 208/240 VAC, single phase. The Contractor shall change or modify the branch circuit and circuit breaker serving the block heater as required to coordinate with the block heater actually provided
9. Batteries: 24-volt DC (two 12 volt batteries in series) lead acid batteries of sufficient capacity for cranking the engine a minimum of four times for at least 30 seconds at firing speed without recharging. Batteries shall be mounted in an earthquake-proof rack on the skid or set frame or approved separate locations with connections provided. Provide terminals to connect power from batteries to automatic transfer switches.
10. Battery charger: Silicone rectifier static type, self-regulated with high current and full float operation with a filtered output. Ten ampere DC high current charging rate when the battery voltage is below the “float voltage setpoint”. Full floating charging when voltage is above the setpoint. Battery charger operates from 120 VAC. The charger is

complete with voltmeter, ammeter, charging rheostat, automatic equalizing timer and low battery voltage alarm. Battery charger shall be mounted on the engine generator.

11. Generator Windings Heater: provide as integral to the armature stator to prevent condensation buildup. The heater shall be suitable for operation at 120 VAC, single phase. Provide a contact operated from the control panel to stop heating when the Generator is operating.

2.3 GENERATOR

A. Four-pole, revolving field generator

1. Enclosure is of drip-proof construction.
2. Insulation Class H
3. 2/3 pitch windings.
4. Wiring is 12-lead, re-connectable, for 3-phase, 4 wire, 480Y/277V, 60 Hz operation.

B. Voltage regulator: solid state, maximum regulation ±2 percent – NO LOAD TO FULL LOAD.

2.4 GENERATOR SET CONTROL PANEL

A. Control panel is of the deadfront type, vibration mounted on the housing.

B. Operates at 24 volts direct current from the generator/battery electrical system.

C. Control Panel includes the following functions/devices:

1. Automatic starting system:

a. Provides four cranking and three reset periods
b. Operation is automatically initiated by the closing of contacts in the automatic transfer control circuit.
c. Alarm and dry contact output which is energized if the engine has not started by the end of the final cranking cycle.

2. Indicating and alarm lights for:

a. RUN
b. LOW COOLANT LEVEL
c. HIGH ENGINE TEMP
d. LOW OIL PRESSURE
e. OVERSPEED
f. OVERCRANK.
g. LOW BATTERY VOLTAGE
h. BATTERY CHARGER MALFUNCTION
i. LOW COOLANT TEMPERATURE
j. NOT IN AUTO
k. LOW FUEL LEVEL
l. FUEL LEAK - FUEL TANK
m. FUEL LEAK - FUEL TRANSFER SUMP
n. LOAD CIRCUIT BREAKER OPEN

3. AC voltmeter and switch (Phase 1-2, 2-3, 3-1, and OFF).
4. AC ammeter and switch (Phase 1, 2, 3, and OFF).
5. Frequency meter (55-65 Hz).
6. Engine "AUTO-OFF-MANUAL" control selector switch.
7. Lube oil pressure gauge.
8. Coolant temperature gauge.
9. Running time meter.
10. Generator field protection circuit breaker.
11. Emergency shutdown button/switch.
12. Automatic exercise and cycle timer. (This unit function may be included in the transfer switch specified in Division 26 Section 26 36 23 "Transfer Switches".)
13. Time-delay-relay to permit operation at "NO-LOAD" after re-transfer of load to normal source. (This unit function may be included in the transfer switch specified in Division 26 Section 26 36 23 "Transfer Switches".)
14. Automatic safety controls which shut down the engine on:
    a. high engine or jacket water temperature
    b. low coolant level
    c. low lubricating oil pressure
    d. engine overspeed.
15. Separate contacts for transmission of signals to remote location.
    a. 2 separate dry contacts for generator run: one N/O and one N/C.
    b. 2 separate dry contacts for generator alarm: one N/O and one N/C.
    c. 2 separate dry contacts for generator fuel low level: one N/O and one N/C.
    d. 2 separate dry contacts for generator fuel high level: one N/O and one N/C.
    e. 2 separate dry contacts for generator fuel leak: one N/O and one N/C.
    f. 2 separate dry contacts for generator battery low: one N/O and one N/C.
    g. 2 separate dry contacts for each generator load circuit breaker status: one N/O and one N/C.
    h. 2 separate dry contacts for generator high current (load shed): one N/O and one N/C.
16. Relay with 4 separate normally closed, form C, 10 ampere at 120/240 volt dry contacts for generator "Called To Run". These contacts shall be used for louver control and shall be suitably rated for both 24 volt AC/DC and 120 VAC circuits.
17. Provide capabilities in generator control panel to monitor inputs from fuel leak detection panel (minimum three inputs).

D. Network Interface Module – shall provide Modbus/TCP or Ethernet IP communications over Ethernet communications cabling. The Network

Interface Module system shall provide the status, indication, and measurements listed in section C.

1. If the engine generator control panel is mounted indoors, provide an Ethernet network connection and space for a telecommunications outlet within the control panel. Provide patch cords as needed, one for each device. Two Cat5e or Cat6 Ethernet cables will be installed to the control panel.
2. If the engine generator control panel is within a weather-proof (or sound attenuated enclosure), provide a fiber optic Ethernet interface compatible with a Cisco GLC-SX-MMD fiber optic transceiver. (In other words, the signaling shall be IEEE 802.3z 1000 Base SX.) Provide fiber optic patch cords and provisions to terminate the fiber optic cable. All equipment installed within the control panel or used to establish communications to the SCADA network shall be suitable for operation at -25°C to 45°C.

E. Control wiring meets the specifications for Division 40 Section 40 67 16 "CONTROL PANELS".

2.5 ACCESSORIES

A. Sub-base: fabricated steel sub-base for mounting the engine generator unit on a concrete foundation.

1. include seismically certified spring vibration isolators (Korfund or equal) between the unit and the concrete foundation. Non-spring isolators are not acceptable and will be rejected.
2. Vibration isolation efficiency 99 percent at 1800 rpm.

(Optional vibration Isolator specification – use this if Structural Engineer says it is acceptable not to use spring isolators or there is an outdoor sub base fuel tank)

3. include seismically certified vibration isolators between the unit and the concrete foundation.
4. Vibration isolation efficiency 90 percent at 1800 rpm.

B. Exhaust Silencer: critical rated, welded steel exhaust silencer.

1. Finish complying with operating temperature to 1000 degrees F.
2. Sufficiently sized to ensure against loss of power due to excessive back pressure in accordance with engine manufacturers recommendations, including tailpipe sizing verification. Include a drain plug and drip leg in exhaust piping to protect engine.
3. Manufactured by Kittle, Maxim, or equal.

C. Exhaust connection: stainless steel flexible exhaust connection at least two feet long with an exhaust water condensate trap. Provide flapper rain cap on end of exhaust stack.

D. Sub-base fuel tank: suitable for #2 diesel fuel.

1. Capacity for 24 hours of full load operation.

2. Overflow basin.
3. Vent piping to building exterior
4. Fuel fill connection on tank.
5. Level Indicator.
6. Low fuel level float and contacts.
7. Fuel leak detection system for transmission of low fuel and fuel leak alarms to set control panel and/or remote annunciator.

E. Sound attenuated, weatherproof enclosure: Provide a weatherproof enclosure with sound attenuation features to reduce sound at full load to 74 dBA or less, measured at 7 meters.

2.6 FINISH

A. The entire standby generator set and accessories shall be factory painted with heat-resistant enamel paint and primer. Gen-set manufacturer shall provide appropriate epoxy/polyurethane coating system for high heat conditions.

1. Metal shall be cleaned, primed, and finish painted with a minimum of two coats of manufacturer's standard color.

2.7 SOURCE QUALITY CONTROL

A. Factory Test: Test assembled sets at the factory prior to shipment to the job site.

1. Advise the Engineer of the test date at least ten working days in advance so that it may be witnessed if desired.
2. Perform manufacturer’s standard factory tests.
3. Test for a minimum of four hours at full load.
4. Record voltage, frequency, amperage, engine temperature, generator temperature, lube oil pressure, etc., during the test.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install the complete set per the manufacturer’s installation instructions.

1. Anchor the set to concrete housekeeping base or pad.
2. Install accessories, including exhaust silencer, flexible exhaust connections, batteries, battery charger.
3. Make electrical connections between accessory items which are not factory wired.

B. Maintain minimum workspace around unit and components per manufacturer’s installation shop drawings and NFPA 70 National Electrical Code.

C. Provide a complete fill of lubricating oil.

D. Provide a complete fill of anti-freeze (ethylene-glycol) and water to protect the engine and heat exchanger cooling system to minus 25 degrees Fahrenheit.

E. Provide a complete fill of diesel fuel oil including topping up after testing i.e. leave tank full when all testing is complete and accepted by Owner.

3.2 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.3 GROUNDING

A. Provide ground continuity to facility electrical ground system as indicated.

3.4 FIELD QUALITY CONTROL

A. Provide services of a factory-authorized service representative to supervise installation and connection of unit and to report results in writing.

B. Supervised Adjusting and Pretesting: Under supervision of a factory-authorized service representative, pretest all system functions, operations, and protective features. Provide all instruments and equipment required for tests. Adjust to ensure operation is according to Specifications.

C. Perform Field testing of installed unit with temporary load bank.

1. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
2. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.

D. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.5 GENERATOR CONTROL PANEL CONFIGURATION

A. Configure the IP address for the Generator Modbus/TCP gateway to be 192.168.1.10, Subnet mask of 255.255.255.0, Gateway of 192.168.1.1, and DNS addresses of 192.168.1.2 and 192.168.1.3. Addresses with the last octet between .10 and .254 may be utilized for generator related IP addresses, but the SCADA system will poll 192.168.1.10.

3.6 ADJUSTING

A. Adjust voltage and frequency output of set to nominal ratings.

B. Adjust time response of control system to meet performance requirements.

3.7 CLEANING

A. On completion of installation, inspect engine generator set. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES

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 automatic transfer switches whether individually mounted or group mounted in switchboards or motor control centers and similar equipment.

B. Automatic transfer switches specified under this Section include:

1. “04 ATS” Aqua Building Automatic Transfer Switch.
2. “08 ATS” UV/RAS Building Automatic Transfer Switch.
3. “11 ATSA” Dewatering Building Automatic Transfer Switch A.
4. “11 ATSB” Dewatering Building Automatic Transfer Switch B.
5. “11 ATSC” Dewatering Building Automatic Transfer Switch C.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 26 05 19 for lug requirements for cable connection to switches.
2. Section 26 28 16 for transfer switches containing circuit breakers.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. Submit transfer switch information with or after the Electrical System Study Report (ESSR) as specified under Section 26 05 01 . Equipment submitted prior to submission of the ESSR will be returned as “Not Reviewed”. Transfer switch equipment shall not be ordered until the ESSR has been reviewed and approved.

C. Product Data: For transfer switches and accessories specified in this Section. This includes, but is not limited to:

1. Nameplate ratings including the following at a minimum:

a. Ampere and voltage rating

b. Service entrance rating (where applicable)

c. Fault current rating

d. Phase and wire sizes

2. Wiring diagrams specific to proposed units.

3. List of transfer switch delay parameters specific to this project with proposed settings. Provide at least the settings indicated in Section 3.4, below.

4. Mounting methods.

5. Dimensioned plans (showing available conduit entry locations), sections, and elevations. Enclosures which will not accept the quantities and sizes of conduits as shown on the Contract Plans will be rejected.

6. Lug configuration showing quantities and sizes of conductors transfer switch can accept. Lugs or connections for switches and circuit breakers which are not able to accept the quantities and sizes of conductors as shown on the Contract Plans will be rejected.

D. Operations and Maintenance Manual: Shall include the following:

1. Testing Results (must be approved prior to energization of the system) (see Section 3.2 for further information).

2. Maintenance Data

3. Wiring Diagrams

4. Initial settings and parameters

5. Product Data

1.4 QUALITY ASSURANCE

A. Refer to Section 26 05 01 paragraph 1.7.

B. Source Limitations: Obtain transfer switches from one source and by a single manufacturer.

C. Comply with NEC for components and installation.

D. Comply with UL 1008 “Standard for Transfer Switch Equipment” for transfer switches.

E. Product Selection for Restricted Space: Space for installation of transfer switches is limited. The Plans indicate typical physical sizes or dimensions for transfer switches, including clearances between transfer switches and adjacent

surfaces and items. Transfer switches 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 centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the transfer switches with the available space and shall verify that the proposed transfer switches are capable of being installed in the available space prior to making a submittal. Transfer switches of dimensions larger than the available space shall not be submitted, and if is submitted, shall be rejected. The decision of the Owner as to the acceptability of transfer switches 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.

F. 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 transfer switch 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.

G. Product Selection for Electrical System Selective Coordination: In accordance with the Electrical System Study Report 26 05 01, equipment with frame sizes or trip settings other than as specified or shown on the plans that better meets the requirements of the selective coordination requirements will be acceptable provided the interrupting capacity, normal current capacity, and voltage rating as shown on the contract drawings are also satisfied. This substituted equipment for selective coordination must also meet all the requirements above, including 1.4.E 'Product Selection for Restricted Space'.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering transfer switches that may be incorporated into the Work include, but are not limited to, the following:

1. Automatic Transfer Switches:

   a. ASCO

   b. Cutler Hammer

   c. Onan/Cummins

   d. Generac

2.2 AUTOMATIC TRANSFER SWITCHES

A. Features

1. UL listed and approved.

2. NEMA 1 enclosure unless otherwise noted on Contract Plans. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans. Provide side gutters or oversized enclosures if shown on the plans

3. Lugs or connections shall be able to accept the quantities and sizes of conductors as shown on the Contract Plans. Provide compression style lugs in the quantities shown unless otherwise noted.

4. Capable of transferring the connected load from “Utility” to “Generator” power and re-transferring back to “Utility”.

5. Selectable commit to transfer function – when the transfer switch senses the loss of normal power, once the sequence of transfer has begun, the transfer switch shall transfer to standby power even if normal power is restored during the transfer sequence.

6. Selectable “Y-Y Primary Failure Detection”: this algorithm shall function to inhibit retransfer until a dedicated timer expires, the alternate source fails, or measurable evidence permits a reasonable presumption of a truly restored preferred source.

7. Electrically operated by a single solenoid or motor mechanism and mechanically held.

8. High current-breaking capacity with silver-surfaced contacts equipped with arc barriers and magnetic blow-out coils.

9. Contacts rated in accordance with UL 1008 for current carrying and switching capabilities.

10. Suitable for repetitive load transfer switching.

11. Floating solid neutral connection (ungrounded).

12. Interlocked to prevent supplying the load from more than one source at a time.

13. “NEUTRAL DELAY” to allow motors to stop on transfer.

14. Adjustable close differential voltage monitoring relays provided on all three phases to sense voltage on the “Utility” and “Generator”.

15. Auxiliary contacts

a. One set form C (normally open and normally closed) for each position “Utility” and “Generator” which operate in parallel with the main transfer contacts to indicate switch position.

b. Two sets form C (normally open and normally closed) for “Utility Available” and “Generator Available” to be used for louver control and shall be suitably rated for 120 VAC circuits. If required provide an additional relay to provide these contacts.

c. One set form C with each set of voltage relays to indicate when these relays are signaling the switch that voltage is adequate or inadequate (90% and 70%, respectively).

d. Auxiliary contacts are isolated, dry contacts suitable for 120V, 10A inductive loads, NEMA B10 rated. Wired to terminals in the switch low voltage control area.

16. Dry contact output (ratings coordinated with generator) to signal generator to start and run.

17. Adjustable time delays for:
(a) Call for generator to start and run (minimum of 0-30 seconds). The transfer switch manufacturer shall provide an alternate power source in the transfer switch as necessary to permit the transfer switch to operate without normal power being available during the full time delay.
(b) Transfer to standby source (minimum of 0-30 seconds)
(c) Neutral delay time (minimum of 0-30 seconds)
(d) Transfer to utility source (minimum of 0-30 minutes)
(e) Generator Cool down (minimum of 0-30 minutes)

18. Adjustable voltage setpoints for:
(a) utility source acceptable (70-100% of nominal)
(b) utility source unacceptable (70-100% of nominal)
(c) standby source acceptable (70-100% of nominal)
(d) standby source unacceptable (70-100% of nominal)”

19. Adjustable features for exercising generator set (coordinate provision of this feature with Section 26 32 13 Generator).

B. Operation

1. Transfers from “Utility” to “Generator” when normal voltage falls to set percent of rated value (typically 70-90 percent) and standby voltage is at set percent of rated value (typically 90-95 percent).

2. Re-transfers to Utility when normal voltage returns to set percent of rating (typically 90-95 percent) unless commit to transfer function is activated. If commit to transfer function is active, the re-transfer to

Utility will occur after the timeframe set in the commit to transfer function.

3. Two separately adjustable time delays prevent transfer to Generator and re-transfer to Utility on voltage dips. Retransfer delay to Utility is overridden if connected source is below set percent of rating (typically 90-95 percent).

4. Immediately retransfer to Utility power if the Generator power fails.

PART 3 — EXECUTION

3.1 INSTALLATION

A. Install equipment enclosures level and plumb in locations as indicated, according to manufacturer's written instructions.

B. For floor mounted transfer switches, level concrete base by grinding or with grout or imbed channels if not flat and level with manufacturer's tolerance or 1/8" in 3' whichever is more restrictive.

C. For wall mounted equipment enclosures located at walls, bolt units to wall or mount on structural–steel channels bolted to wall. For wall mounted enclosures not located at walls, provide structural stanchion supports conforming to Section 26 05 02 Basic Materials.

D. Install wiring between transfer switches, control, and indication devices.

E. Connect transfer switches and components to wiring system and to ground as indicated and as instructed by manufacturer.

1. Tighten electrical connectors and terminals 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.

F. Identify each transfer switch according to requirements specified in Section 16050.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: After installing transfer switches and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Provide services of a qualified independent testing agency as described in Section 26 05 01 to perform specified testing for transfer switches.

2. Testing shall not commence until the Electrical System Study Report has been reviewed and approved.

3. Procedures:

a. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.22.3 for transfer switches. Certify compliance with test parameters.

4. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 START-UP AND TRAINING SERVICES

A. Provide the services of the manufacturer's factory authorized representative for startup of transfer switches and training of the Owner's personnel for operation and maintenance of the transfer switches.

1. Inspect the installation of each transfer switch for conformance with the manufacturer's recommended installation practices.

2. Program and/or configure each transfer switch to properly operate with the generator to which it is connected. Set programming parameters such as adjustable time delays and voltage setpoints.

3. Program the transfer switch with engine generator exercising timeframes in cooperation with the Owner. The exercising timeframe shall be discussed with the Owner prior to programming and shall be set prior to final acceptance of the transfer switch by the Owner.

4. Test the operation of each transfer switch after programming/ configuring the transfer switch. The testing shall include single phasing the normal power source under load in cooperation with the serving Utility. Contractor shall make arrangements & schedule testing with Utility and pay any associated costs for the testing. The Utility shall single phase each phase leg of the service one phase leg at a time and the Contractor shall verify that the transfer switch properly transfers the load to the generator and retransfers back to the Utility.
The Contractor shall make adjustments to the transfer switch as required for successful operation for of the transfer switch during open leg (single phase) events in coordination with the Owner and Engineer. During this test, the Contractor shall obtain the services of an independent testing agency to monitor and record voltages during the test. The independent testing agency shall provide a written report describing the test results including the methods, locations of measurements and sequence of events.

5. Reprogram and/or reconfigure and then retest as required to obtain proper operation of each transfer switch. Document the final configuration and programming parameters after successful startup and

provide copies of the documentation to the Owner. Documentation shall be provided in hard copy and electronic form.

6. Provide a minimum of four hours training to the Owner, at the Owner's facility, prior to start-up of the transfer switches. Training shall cover installation, maintenance, operation, and problem troubleshooting for each type of transfer switch provided.

7. Provide a minimum of four hours additional training, program revisions, and maintenance at the Owner's facility approximately one to three months after completion of the project.

8. Provide a minimum of 2 days on site start-up services. These days shall be coordinated with the start-up of affected portions of the plant.

3.4 INITIAL TRANSFER SWITCH PARAMETERS

A. The following table represent the parameters available with an ASCO 7000 ATS as a basis for the settings. If a different ATS or different version of ATS is provided, adjust and record the parameters accordingly.

Table 1 Voltage and Frequency Settings

Description	Settings	Default Setting (for reference)	Initial Setting
Normal Source Voltage	Dropout	85%	85%
	Pickup	90%	90%
	Over Voltage Trip	Off	107%
	Unbalance Enable	No	Yes
	Unbalance Dropout	20%	5%
	Unbalance Pickup	10%	3%
Emergency (Generator) Source Voltage	Dropout	75%	75%
	Pickup	90%	90%
	Over Voltage Trip	Off	Off
	Unbalance Enable	No	No
	Unbalance Dropout	20%	20%
	Unbalance Pickup	10%	10%
Normal Source Frequency	Dropout	90%	90%
	Pickup	95%	95%
	Over Frequency Trip	Off	Off
Emergency (Generator) Source Frequency	Dropout	90%	90%
	Pickup	95%	95%
	Over Frequency Trip	Off	Off

Table 2 Feature Time Delay Settings

Feature Code	Time Delay	Default Setting (for reference)	Initial Setting
1C	override momentary Normal source outages	1 second	6 seconds
1F	override momentary Emergency source outages	0 seconds	0 seconds
2B	transfer to Emergency	0 minutes	10 seconds
2E	unloaded running (engine cooldown)	5 minutes	10 minutes
3A	retransfer to Normal (if Normal fails)	30 minutes	15 minutes
	retransfer to Normal (if just a test)	30 seconds	30 seconds
31F	Normal to Emergency pre–transfer signal	0 seconds	0 seconds
31M	Normal to Emergency post–transfer signal	0 seconds	0 seconds

Feature Code	Time Delay	Default Setting (for reference)	Initial Setting
31F, 31M	bypass 31F & 31M if Normal fails	No	No
31G	Emergency to Normal pre–transfer signal	0 seconds	0 seconds
31N	Emergency to Normal post–transfer signal	0 seconds	0 seconds
31G, 31N	bypass 31G & 31N if Emergency fails	No	No
7ADTS/B	delay transition time	0 seconds	30 seconds

Table 3 Feature Settings

Feature	Default Setting (for reference)	Initial Setting
Commit to transfer	No	Yes
Shed load direction	From E	From E
Shed load in phase	No	No
Shed load in phase time delay	1.5 Seconds	1.5 Seconds
Shed load isolate load on source failure	Yes	Yes
Shed load isolate load on test 17	No	No
Phase rotation monitor enable	No	No
Phase rotation monitor reference	ABC	ABC
Inphase monitor enable	no	no
Inphase monitor time delay	1.5 second	1.5 second
Y–Y primary failure detection enable	no	no
Y–Y primary failure sensing time delay	1.0 second	1.0 second
Y–Y primary failure retransfer time delay	1.0 hour	1.0 hour

Table 4 General Settings

Parameter	Default Setting (For Reference)	Initial Setting
Language	ENGLISH	ENGLISH
Serial communications baud rate	19.2k	Mbus19.2k
Serial communications address	1	1
Event log enable	No	Yes
Print enable	No	No
Clear log	No	No
Password	1111	1111

Table 5 Engine Exerciser Settings

	Parameter	Default Setting (For Reference)	Initial Setting
	Month	JAN	Set to current date and time
	Day	1	
	Year	1	
	Hour	1	
	Minute	1	
P1	Engine exercise enable	No	Yes
	Engine exerciser transfer load	No	Yes
	Engine exerciser start hour	0	10
	Engine exerciser start minute	0	15
	Engine exerciser run week	All	Fifth[1]
	Engine exerciser run day	SUN	MON[1]
	Engine exerciser run duration hours	0 hours	0 hours
	Engine exerciser duration minutes	0 minutes	45 minutes
P2	Engine exercise enable	No	Yes
	Engine exerciser transfer load	No	No
	Engine exerciser start hour	0	11
	Engine exerciser start minute	0	15
	Engine exerciser run week	All	Alternate[1]
	Engine exerciser run day	SUN	MON[1]
	Engine exerciser run duration hours	0 hours	0 hours
	Engine exerciser duration minutes	0 minutes	30 minutes
P3 .. P7	Engine exercise enable	No	
	Engine exerciser transfer load	No	
	Engine exerciser start hour	0	
	Engine exerciser start minute	0	
	Engine exerciser run week	All	
	Engine exerciser run day	SUN	
	Engine exerciser run duration hours	0 hours	0 hours
	Engine exerciser duration minutes	0 minutes	30 minutes

[1] Set ATS on Bus A to Monday, Bus B to Tuesday, etc. Stagger starting schedules such that the ATS starts the engine no more than once a week and on different days (depending upon bus), but the engine is connected to load no more than once every three weeks.

3.5 ADJUSTING

A. For transfer switches with circuit breakers, set field-adjustable circuit-breaker trip setting ranges as indicated.

1. Where transfer switch circuit breakers are included in the short circuit study, set the trip as recommended in the study.

B. Adjust configuration settings, time delays and similar settings in transfer switches to obtain satisfactory operation of the switch in coordination with operation of downstream process equipment.

C. Provide at least three complete reprogramming and configuration of each automatic transfer switch using parameters determined by the Owner.

3.6 CLEANING

A. After completing system installation, including 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 26 43 13

SURGE PROTECTIVE 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 Surge Protective Device (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the Contract Plans. To maximize performance and reliability, the AC surge protection shall be integrated into electrical distribution equipment such as switchboards, panelboards and/or motor control centers.

B. Related Sections include the following:

1. Section 26 05 02 for materials and installation.
2. Section 26 24 13 for switchboards containing SPDs.
3. Section 26 24 16 for panelboards containing SPDs.

1.3 REFERENCES

A. SPD units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL Listed standards (UL 1449, 3rd Edition), UL 1283.

1.4 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. Product Data: For surge protective devices and accessories specified in this 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. Verification that the SPD complies with the required UL 1449 3rd Edition.
3. Actual let through voltage test data in the form of oscillograph results for the ANSI/IEEE C62.41 Category C3 & C1 (combination wave) and B3 (ring wave) tested in accordance with ANSI/IEEE C62.45.
4. Spectrum analysis of each unit based on MIL-STD-220A test procedures between 50 kHz and 200 kHz verifying the devices noise attenuation equals or exceeds 50 dB at 100 kHz.
5. Test report in compliance with NEMA LS1 from a recognized independent testing laboratory verifying the suppressor components can survive published surge current rating on both a per mode and per

phase basis using the IEEE C62.41, 8 x 20 microsecond current wave. Note that test data on individual module is not accepted.

C. Interconnecting and wiring diagrams specific to this project.

D. Operations and Maintenance Manual: Shall include the following:

1. Maintenance Data (as specified in Division 1)
2. Interconnecting and Wiring Diagrams
3. Initial settings and parameters
4. Product Data

1.5 QUALITY ASSURANCE

A. Refer to Section 26 05 01 Basic Electrical Requirements 1.7 Quality Assurance.

B. Comply with UL 1449, "Standard for Surge Protective Devices".

1.6 QUALIFICATIONS

A. The manufacturer must have a 24-hour response capability with nationwide field engineering personnel. The field service organization must have fully accredited, Power System Engineers located across the North America who are capable of performing complete grounding, Power Quality analysis, and coordination studies. Factory trained SPD sales personnel do not qualify as Power System Engineers.

B. The manufacturer of the surge protective equipment shall be the same manufacturer as the manufacturer of the low voltage distribution equipment in which the SPD units are installed.

C. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

1. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
2. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.
3. If integrated into a switchboard, panelboard or MCC, the seismic qualification of the enclosing equipment shall not be reduced because of the integration.

1.7 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. General Electric Co., Electrical Distribution & Control Div.

B. Siemens Energy & Automation

C. Square D / Schneider Electric

D. Cutler Hammer/Eaton

2.2 VOLTAGE SURGE SUPPRESSION – GENERAL

A. Electrical Requirements

1. Unit Operating Voltage – Refer to the Plans for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) – The MCOV shall be greater than 115% of the nominal system operating voltage.
3. The suppression system Surge Protection shall incorporate a hybrid designed Metal-Oxide Varistors (MOV) surge suppressor for the service entrance and other distribution level. The system shall not utilize silicon avalanche diodes, selenium cell, air gaps or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes – For a wye configured system, the device must have directly connected suppression elements between line-neutral (L-N), line-ground (L-G), and neutral-ground (N-G). For a delta-configured system, the device must have suppression elements between line to line (L-L) and line to ground (L-G).
5. UL 1449 3rd Edition Suppressed Voltage Rating (SVR) – The maximum UL 1449 3rd Edition SVR for the device must not exceed the following:

Modes	208Y/120	480Y/277
L-N; L-G; N-G	400V	800V
L-L	800V	1800V

6. ANSI/IEEE Cat. C3 Let Through Voltage – The let through voltage based on IEEE C62.41 and C62.45 recommended procedures for Category C3 surges (20 kV, 10 kA) shall be less than:

Mode	208Y/120	480Y/277
L-N	560V	960V

7. ANSI/IEEE Cat. B3 Let Through Voltage – Let through voltage based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 amps) shall be less than:

Mode	208Y/120	480Y/277
L-N	160V	165V

B. SPD Design

1. Electrical Noise Filter – Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be 50 dB at 100 kHz using the MIL-STD-220A insertion loss test method. Products not able to demonstrate noise attenuation of 50 dB at 100 kHz shall be rejected.
2. Extended Range Filter –The Surge Protective Device shall have a High Frequency Extended Range Tracking filter in each Line to Neutral mode with compliance to UL 1283 and NEMA LS1. The filter shall have published high frequency attenuation rating in the attenuation frequencies.

Attenuation Frequency	50k Hz	100 kHz	500 kHz	1 MHz	10 MHz	100 MHz
Insertion Loss (ratio)	40	316	316	89	200	79
Insertion Loss (dB)	32	50	50	39	46	38

3. Internal Connections – No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be hardwired with connections utilizing low impedance conductors and compression fittings.
4. Standard Monitoring Diagnostics – Each SPD shall provide integral monitoring options:

    a. Each unit shall provide a solid-state indicator light for each phase. The indicator light shall indicate which phase(s) have been damaged.
    b. Remote Status Monitor – The SPD must include form C dry contacts (one NO and one NC) for remote annunciation of unit status. The remote alarm shall change state if any of the three phases detect a fault condition.
    c. Event Counter – The SPD shall be equipped with an LCD display system designed to indicate to the user how many surges, sags, swells and outages have occurred at the location. The event counter triggers each time under each respective categories after

significant event occurs. A reset pushbutton shall also be standard allowing all counters to be zeroed.

d. Push to Test – The SPD shall be equipped with push-to-test feature is designed to provide users with real time testing of the suppressor's monitoring and diagnostic system. By depressing the test button, the diagnostic system initiates a self test procedure. If the system is fully operational, the self test will activate all indicator lights.

5. Overcurrent Protection Fusing: In order to isolate the SPD under any fault condition, the manufacturer shall provide:

a. Individual Fusing: MOV's shall be individually fused via Copper Fuse Trace. The Copper Fuse shall allow protection during high surge (kA) events.

b. Thermal Protection: MOV's shall be equipped with Thermal Fuse Spring (TFS) Technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30Amp, or if the occurrence is over a longer period of time, the TFS will disconnect first.

c. All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

C. Minimum Repetitive Surge Current Capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992

1. The suppression filter system shall be repetitive surge tested in every mode utilizing a 1.2 x 50µsec, 20kV open circuit voltage. 8 x 20µsec, 10kA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current. The minimum repetitive surge current capability as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45 – 1992 shall be:

a. Service Entrance: 12000 impulse per mode.
b. Distribution Panelboard: 10000 impulse per mode.
c. Branch Location Panelboard: 9000 impulse per mode.

2.3 SYSTEM APPLICATION

A. Surge Current Capacity – The minimum total surge current 8 x 20 microsecond waveform that the device is capable of withstanding shall be as shown in the following table:

Minimum total surge current and withstand Capability with compliance to ANSI/IEEE C62.41 AND NEMA LS1			
Application	Per Phase	Per Mode	Surge Withstand Capabilities ANSI/IEEE C3 Wave (10 kA)
Service Entrance Locations (Switchboards, Switchgear, MCC Main Entrance)	240 kA	120 kA	12000
High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA	10000
Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA	9000

B. Switchgear, Switchboard, MCC and Panelboard Requirements

1. The SPD application covered under this section is for switchgear, switchboard, MCC and panelboard locations. Service entrance located SPD shall be tested and suitable for ANSI/IEEE C62.41 Category C3 environments.
2. The SPD shall be of the same manufacturer as the switchboard, MCC or panelboard.
3. The SPD shall be factory installed inside the switchboard, MCC and panelboard at the assembly point by the original equipment manufacturer.
4. Locate Type II SPD on load side of main disconnect device, as close as possible to the phase conductors and ground/neutral bar.
5. Provide a disconnect for type II SPDs. The disconnect shall be directly integrated to the SPD and assembly bus using bolted bus bar connections.
6. The SPD shall be integral to switchboard, MCC and panelboards as factory standardized design.
7. All monitoring diagnostics features shall be visible from the front of the equipment.

2.4 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted on the Plans or in Section 26 05 02 .

PART 3 — EXECUTION

3.1 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.2 INSTALLATION

A. The Contractors shall install all equipment per the manufacturer's recommendations and the Plans.

3.3 WARRANTY

A. The manufacturer shall provide a full five (5) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

SECTION 26 51 19

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 26 05 01 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 26 05 01 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. Two spare LED luminaires 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. 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 ten 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 driver 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 LEDs for all LEDs 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 26 56 00

EXTERIOR LIGHTING

PART 1 — GENERAL

1.1 RELATED DOCUMENTS

A. The work of this Section applies to the Drawings, Specifications, and provisions of the Contract. The revised General Conditions, Special Project Conditions, and other Division 0 and 1 Specification Sections apply to the Work of this Section.

1.2 SUMMARY

A. This section includes work for exterior site lighting fixtures, LED drivers, pole standards and accessory materials as required for complete installation of all exterior site lighting equipment.

1.3 RELATED SECTIONS

A. Section 01 33 00 – Substitutions and Product Options

B. Section 26 05 19 - Power Conductors and Cables

C. Section 26 05 33 - Raceway and Boxes for Electrical Systems

1.4 REFERENCES

A. References as described in Section 26 00 00 shall apply to this section

B. UL listed for the application.

C. ANSI/IESNA RP-16-05 – Nomenclature and Definitions

D. ANSI C62.41.2 - Surge Protection.

E. ANSI C78.377 – Lamp color temperature (Chromaticity).

F. ANSI C78.09 82 - Fixture Safety Specification.

G. ANSI C82.77 - Harmonic Emission Limits.

H. LM-79 – Test Reports (Luminous Flux).

I. LM-80 – Lumen maintenance.

1.5 DEFINITIONS

A. Definitions as described in Section 26 00 00 shall apply to this section.

B. Fixture: A complete 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.

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.

E.

1.6 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)

1.7 SUBMITTALS

A. Comply with Submittal requirements as described in Section 26 00 00.

B. Submit the following:

1. Product Data describing fixtures, lamps, divers/ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:

    a. Outline drawings indicating dimensions and principal features of fixtures.

    b. Electrical Ratings and Photometric Data: Certified results of laboratory tests for fixtures and lamps.

2. Maintenance data for fixtures to include in the operation and maintenance manual specified in Division 1.

3. Provide one of the following sets of data regarding the output of the luminaire over time:

    a. 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.

    b. 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.

1.8 QUALITY ASSURANCE

A. Comply with Quality Assurance requirements of Section 26 00 00.

B. 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.

1.9 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Comply with Delivery, Storage and Handling requirements of Section 26 00 00.

B. Storage and Handling of Poles

1. 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.

2. Metal Poles: Retain factory-applied pole wrappings until just before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.10 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.

1.11 WARRANTY

A. Comply with warranty requirements as described in Section 26 00 00.

B. Comply with warranty requirements as listed in the lighting fixture schedule.

PART 2 — PRODUCTS

2.1 GENERAL

A. Comply with the Products requirements of Section 26 00 00.

B. Listed manufacturer (in Lighting Fixture Schedule) was used as a guideline for the basis of design. An approved equivalent for any equipment and sub parts may be submitted for review.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products specified in Lighting Fixture Schedule.

2.3 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.

2.4 LED 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.

2.5 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.

2.6 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 GENERAL

A. Comply with the Execution requirements of Section 26 00 00.

3.2 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 03.

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.

3.3 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. Include the following:

E. Replace or repair damaged and malfunctioning units, make necessary adjustments, and retest. Repeat procedure until all units operate properly.

3.4 ADJUSTING AND CLEANING

A. Clean units after installation. Use methods and materials recommended by manufacturer.

3.5 LIGHTING FIXTURE SCHEDULE

A. Lighting Fixture Schedule is shown on the Drawings.

END OF SECTION 26 53 00

DIVISION 27 – COMMUNICATIONS

SECTION 27 00 00

COMMUNICATIONS CIRCUITS

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 the work of this Section.

1.2 SUMMARY

A. Provide all materials and labor for the installation of a TIA/EIA 568A and lSO/IEC 11801 compliant Communications Structured Cabling System (CSCS — see DEFINITIONS below). The system is intended to integrate voice and data onto a common media.

B. Section Includes:

1. Communications Enclosures specified under this Section include:

a. Lab/Operations Building Communications Enclosure

b. UV/RAS Building Communications Enclosure

c. Aeration Structure Electrical Building Communications Enclosure

d. Dewatering Building Communications Enclosure

e. Influent Pump Station Communications Enclosure

f. Aqua Building Communications Enclosure

C. Related Sections include the following:

1. Section 26 05 33 — “Raceway and Boxes”

1.3 REFERENCES

A. ANSI/TIA/EIA - 568A: *Commercial Building Telecommunications Cabling Standard*

B. ANSI/TIA/EIA - 569: *Commercial Building Standard for Telecommunication Pathways and Spaces*

C. ANSI/TIA/EIA - 606: *The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings*

D. ANSI/TIA/EIA - 607: *Commercial Building Grounding and Bonding Requirements for Telecommunications*

E. TIA/EIA -TSB67: *Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems*

F. ISO/IEC IS 11801: *Generic Cabling for Customer Premises*

1.4 DEFINITIONS

A. "CSCS" shall mean *Communications Structured Cabling System*. The CSCS is defined as all required equipment and materials including (but not limited to) TIA/EIA 568A and ISO/IEC 11801 compliant Category 6 and fiber optic cable, communications outlets, termination jacks, termination blocks, patch panels and patch cables, racks/enclosures (such as EIA standard equipment racks, enclosures, cable runway, and vertical and horizontal cable management hardware), and pathway/raceway materials (such as sleeves, D-rings, surface metal and surface plastic raceway), and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

1.5 CONTRACTOR QUALIFICATIONS

A. Prior to bidding the project, the Contractor:

1. Shall be trained and certified by the Manufacturer to install, test, and maintain the CSCS and shall be certified by the Manufacturer to provide the Manufacturer's 15-year product, performance, and application Warranty. The Contractor shall bid only one manufacturer and shall only bid a manufacturer for which the Contractor is certified. The Contractors shall be certified as the following:

    a. AMP NetConnect Design & Installation Contractor (ND&I)'

    b. Commscope/Superior Essex

2. Leviton Premier Network Installer Contractor Shall have employees directly involved with the supervision, installation, and testing of the CSCS trained and certified by the selected CSCS' manufacturer for installation and testing. Training and certifications shall be as follows:

    a. All Installation Supervisors/Project Foremen shall be trained and certified.

    b. All Test Technicians shall be trained and certified.

    c. 50% of Installation Technicians shall be trained and certified. NOTE: Upon award of the project, the Contractor shall have the manufacturer train and certify, at no cost to the Owner, any remaining untrained technicians to be assigned to this project.

    d. Other personnel not responsible for installation or testing of the CSCS (such as project managers, cleanup crew, etc.) need not be manufacturer trained and certified.

3. Shall have employees whose duties are to apply firestopping material trained and certified by the specified firestopping manufacturer.

4. Shall have a list of references for no less than five similar projects (in terms of size and construction cost) performed by the Contractor under the Contractor's

current business name within the past three years. The reference list shall detail, for each project:

a. Project name and location

b. Construction cost

c. A brief description of the project and the components involved (fiber, Cat 6 UTP, etc.)

d. Number of workstation drops

e. Contact names, phone numbers, and addresses

1.6 QUALITY ASSURANCE

A. The Contractor shall have only manufacturer trained and certified Installation Supervisors/Project Foremen, Test Technicians, and Installation Technicians on the job site.

1.7 WARRANTY

A. The Contractor shall provide a Manufacturer endorsed and backed extended 15-year product, performance, application, and labor warranty which shall warrant:

1. Against defects in materials and workmanship (extended product warranty) for a period of 15 years.

2. That all cabling components of the installed system will meet or exceed the specifications of TIA/EIA 568A and ISO/IEC IS 11801 (performance warranty) for a period of 15 years.

3. That all unshielded/shielded twisted pair cabling links/channels will meet or exceed the attenuation and NEXT requirements of TIA/EIA TSB 67 and ISO/IEC 11801 (performance warranty) for a period of 15 years.

4. That the system shall be application independent and shall support both current and future applications that use the TIA/EIA 568A or ISO/IEC 11801 component and link/channel specifications for cabling (application warranty), for a period of 15 years.

5. That all labor attributable to and required by the above shall be supplied at no cost to the Owner for a period of 15 years.

B. Active electronics for the Communications system shall have at least 3 years coverage of Next Business Day coverage for each device covered in this section. The Owner shall be listed on the Contract as the End User on the support agreement.

C. The warranty period shall begin at the Owner's acceptance of the work.

1.8 SUBMITTAL INFORMATION

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

B. The Contractor shall submit their statement of qualifications. The statement of qualifications shall include all documentation verifying compliance with Paragraph 1.5A (Contractor Qualifications), above.

C. The Contractor shall provide shop drawing submittal information for review before materials are delivered to the job site.

1. Provide material and equipment submittals for each item of equipment as follows:

a. Provide standard manufacturer's cut sheets or other descriptive information.

2. Provide a cable routing and grouping plan as follows:

a. Where cable routing and grouping is to be exactly as shown on the Drawings, do not provide a cable routing and cable-grouping plan.

b. Where changes in cable routing and grouping are proposed, provide a complete building floor plan showing the proposed routing, junction box locations, raceway sizes and cabling within raceway in a manner equal to that of the Drawings.

3. Provide a list of proposed test equipment for use in verifying the installation of the CSCS.

a. Provide for each testing device:

1) Manufacturer and product number.

2) Manufacturer documentation showing date and outcome of last re-calibration. Testing device shall have been re-calibrated within the last six months

3) Manufacturer documentation showing software revision. Software revision shall be most current revision available for device and based upon the most current TIA/EIA testing guidelines.

b. Provide proposed Category 6 UTP cable and fiber optic cable test forms

4. If materials requiring pre-approval by the manufacturer for inclusion into the manufacturer 15-year product, performance, and application warranty will be utilized, provide manufacturer written pre-approval (see PART 1 - WARRANTY above, PART 2 - MATERIALS, GENERAL below).

5. The operating and maintenance (O&M) instructions shall be provided at the time of submittal review for each device in the system. These instructions shall detail how to install and service the equipment and shall include all information necessary for rough-in in preparation for the building facilities to receive the materials. At the completion of the project, the O&M information shall be updated to reflect any changes during the course of construction, and shall be

provided to the Owner in a binder labeled with the project name and description. Provide three (3) bound copies of the final O&M information.

PART 2 — PRODUCTS

1.9 GENERAL

A. CSCS equipment and materials shall be manufactured by a single manufacturer. For a given manufacturer, CSCS equipment and materials shall be of a single CSCS product line unless stated otherwise in this Specification or in the Drawings. Equipment and components shall not be intermixed between different manufacturers. Equipment and components shall not be intermixed between different product lines unless otherwise noted. Substitution of manufacturer and/or CSCS product line is not acceptable.

a. The manufacturer and CSCS product line shall be: AMP Netconnect

b. Ortronics / Berk-tel Netclear

2. All CSCS Category 6 equipment and materials not required by the Contractor selected CSCS Manufacturer to be manufactured by the CSCS manufacturer, shall be pre-approved by the CSCS Manufacturer for use in the CSCS and shall be covered by the Manufacturer's 15-year product, performance, and application Warranty (see PART 1 — WARRANTY above, PART 1 - SUBMITTALS above).

B. Racks, rack cable distribution hardware, cable runway/ladder rack, and other rack and distribution components shall be manufactured by a single manufacturer unless stated otherwise in this Specification or in the Drawings. Equipment and components shall not be intermixed between different manufacturers. Substitution of manufacturer is not acceptable. The manufacturer for rack/distribution equipment shall be:

1. Chatsworth Products, Inc. (CPI)

2. Ortronics

C. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified or shown on the Drawings required for a fully operational, tested, certified and warranted system.

D. Unless otherwise noted, items shall be provided as specified. "Or equal" or equivalent items are not acceptable.

1.10 RACEWAY

A. Backboards**:** Provide backboards which are ¾" A-C plywood, void free, 2440-mm (8-ft) high unless otherwise noted, capable of supporting attached equipment, and painted with one coat of primer and one or more coats of fire-retardant light gray or off-white semi gloss paint.

B. Sleeves: Provide sleeves where required for cable pass-thru. Provide core drilling where required for sleeve installation. Sleeves shall be EMT conduit and shall be provided with insulated throat bushings for each end. Sleeve sizing shall be as noted on the Drawings. Where not noted, sleeve sizing shall be determined by the type and

quantity of cable to be routed through the sleeve per TIA/EIA 569 cable capacity standards, plus an additional 100% for future expansion.

1. D-Rings: Provide D-rings as necessary to route all exposed cables in communications closets and on backboards and for raceway for routing cable in non-exposed open access environments as shown on the Drawings. Rings shall consist of metal rings affixed to walls or other supports (but not the ceiling support system). Sizing shall be according to the type and quantity of cable to be routed through the ring per TIA/EIA 569 cable capacity standards, plus an additional 25% for expansion, and shall be a minimum of 2 inches in diameter. Plastic D-Rings are not acceptable. Rings shall be:ALLEN TEL PRODUCTS GB13A, B, or C or approved equal.

C. Innerduct: Provide bright orange innerduct as necessary for pathway for fiber optic cables from fiber patch panels to conduit or plenum entrances and as shown on the Drawings. Innerduct installed in plenum rated ceilings shall be plenum rated.

1.11 FIRESTOPPING

A. Provide firestopping material for all through and membrane penetrations of fire-rated walls and floors. Material shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814or UL 1479 fire test in a configuration that is representative of the actual field conditions. Firestopping material used to seal open penetrations through which communications cable passes shall be re-usable/re-enterable. Firestopping material shall be manufactured by:

1. Specified Tech. Inc.

1.12 EQUIPMENT RACKS/ENCLOSURES

A. Four-Post Free Standing Enclosed Rack (Lab Building)

1. Supports 19" rack-mount equipment
2. Cable Management
3. Front and Rear doors can be mounted open left or right
4. 42 units
5. Removable side panels to remove side between adjacent racks.
6. Ortronics OR-40500106 (-EX) or equal

B. Wall Mount Rack Enclosures w/ Racks:

1. Provide dual locking hinge (for front and back access) EIA standard universal wall mount rack enclosures, sized for a minimum of 22 (CPI) EIA standard (1.75”) mounting spaces and a 19” rack width and 24” deep as shown on the Drawings. Wall mount enclosures shall be mounted on a backboard.
2. Wall mount rack enclosures shall be:
    a. 24” deep — 11685-719 (black finish)

3. Provide each rack with the following:

a. One 1’ power protection strip (to be mounted in enclosure)

b. One grounding kit with #6 AWG insulated copper conductor grounded to grounding bus bar (see GROUNDING AND BONDING, below). Grounding kit shall be:

1) CPI

1.13 PATCH PANELS

A. Wall Mount Fiber Patch Panels: Fiber patch panels shall be complete with SC adapter plates and dust covers for unused ports.

1. Fiber Patch Panel: AMP 559560-2
2. Duplex SC Adapter Plates: AMP 559596-1

B. Workstation Patch Panels: Provide workstation patch panels to terminate all ports of workstation communication outlet ports. Patch panels shall be 4-pair Category 6 high density T568B wired patch panels with modular UTP 8-position/8-conductor IDC jacks on the front of each panel and 110 style termination blocks on the back of the panel. Patch panels shall meet or exceed TIA/EIA 568A Category 6 specifications for performance. Patch panels shall be manufactured by the selected CSCS Manufacturer and shall be:

1. Ortronics: See plans for part numbers.

2. AMP equal

3. Leviton equal

C. Fiber Patch Panels. Provide fiber patch panels/distribution enclosures/termination cabinets as shown on the Drawings. Fiber termination enclosures shall consist of enclosures pre-assembled with ST style adapter plates for singlemode fiber and LC style adapter plates for multimode fiber. Connectors shall be ceramic or stainless steel connectors, strain relief, rack mountable as shown on the Drawings, and sized (24, 36, 48, or 72 port) and installed as shown on the Drawings. Fiber termination enclosures shall be sized to accommodate the quantity of fiber to be terminated and shall be sized with a minimum of 6 additional spare ports for future use. Fiber termination enclosures shall be manufactured by the selected CSCS Manufacturer and shall be:

1. Ortronics: See plans for part numbers

2. AMP equal

3. Leviton equal

1.14 GROUNDING AND BONDING

A. Grounding Conductor: Provide #6 AWG insulated solid copper conductor (green) to bond all metallic raceway, racks, enclosures, etc. to the nearest approved building ground.

1.15 TERMINATION BLOCKS

A. Impact Tool: Provide one impact tool for installation/termination for Owner's use. Tool shall be manufactured by the selected CSCS Manufacturer and shall be:

1. AMP Impact Tool with Blade (569994-1)

1.16 WORKSTATION COMMUNICATIONS OUTLETS

A. Wall Mounted Telephone Plate: Provide wall mounted telephone jack assemblies for wall mounted telephone communication outlets. Assemblies shall be equipped with a brushed stainless steel faceplate with mounting lugs for installing modular wall telephone sets and with wall mount telephone communications jack. Assemblies shall be:

1. Ortronics #OR-403STJ1WP, or

2. Semtron 10E-A5-PHONE-DP (For AMP NetConnect System).

B. Modular 8-position IDC Jacks: Provide modular UTP 8-position/8-conductor IDC jacks for workstation communications outlets. Jacks shall utilize T568B wiring and shall meet or exceed TIA/EIA 568A Category 6 specifications for performance. Top jack of each communications outlet shall be blue, bottom jack shall be black. Jacks shall be manufactured by the selected CSCS Manufacturer.

1. Ortronics #OR-TJ600-13 (Electrical Ivory), or

2. AMP equal.

C. Provide faceplates for workstation communications outlets in gang widths as shown on the drawings.

1. Ortronics #OR-40300546-13 (electrical Ivory), or

2. AMP equal.

D. Blank Insert Covers shall be provided for unused workstation and workstation patch panel ports, color shall match.

1.17 CONNECTORS

A. Fiber connectors: 50/125 laser optimized multimode, Duplex SC, complete with fiber optic adapters where required for mounting.

1. AMP: 1588292-1

1.18 CABLE,

A. Indoor Cable: Cable used indoors shall be rated for indoor use. Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non-plenum rated otherwise. All cabling shall bear plenum or riser rated markings for the environment in which they are installed. Any cable installed below grade or in cement must be rated for outdoor use (OSP).

1. Category 6 Cable: Provide Category 6 cable for all workstation outlets, for both voice and data ports. Provide one cable per 8-position communications jack on a given workstation outlet. Category 6 cable shall exceed TIA/EIA 568B Category 6 specifications for performance, shall be part of the UL LAN Certification and Follow-up Program, and shall be defined by the Manufacturer as an "extended

performance Category 6 cable." Cable shall be 4-pair with 23 AWG solid copper conductors. Cable shall be UL Type CMP (plenum) or CM/CMR (non-plenum). For plenum cable, all 4 cable pairs shall be insulated with FEP. Cable shall be manufactured by or approved for use in the performance warranted/certified CSCS by the selected CSCS Manufacturer. Cable shall be:

a. Berk-Tek LANmark OR

b. AMP NetConnect

c. Provide 1000 foot reel/box to Owner for spare.

B. Outdoor Cable: Cable used outdoors shall be rated for outdoor use and rated for duct or direct burial installation (depending upon the application).

1. Copper Cable: Provide 24-AWG solid copper conductors insulated with filled foam skin-DEPIC and conforming to RUS 7 CFR 1755.890 (REA PE-89). Cable shall be sized in pair counts as shown on the Contract Documents.

a. General Cable – Filled Foam Skin QUALPETH Cable

2. Fiber Cable: Indoor/outdoor rated, all dielectric, multimode, 850 nm, laser optimized, plenum rated, water blocking fillers encased in a buffer tube surrounded by water blocking strength members, meeting or exceeding ANSI/TIA/EIA standards for 10 Gigabit Ethernet. Cables and fanout kits shall be manufactured by the selected CSCS and be provided in the strand counts shown in the Contract Documents.

1.19 PATCH CABLES

A. Fiber Patch Cords: Provide fiber patch cords for connection to network electronics. Patch cords shall be laser optimized singlemode duplex SC cords, pre-manufactured by the CSCS, and shall be:

1. Manufactured by AMP

2. Provide 30 fiber patch cords

B. Modular Data Patch Cables**:** Provide data patch cables for data cross-connects. Patch cables shall be pre-manufactured Category 6 UTP modular 8-position/8-conductor to modular 8-position/8-conductor plugs. Patch cables shall meet or exceed TIA/EIA 568A Category 5e specifications for performance.

1. Patch cables shall be manufactured by the selected CSCS Manufacturer.

2. Provide 40 patch cables for use in the communications enclosures. Cables shall be sized at 5 feet.

3. Provide 40 patch cables for use at the workstations. Cables shall be sized at 10 feet.

4. Provide four Velcro cable straps for each group of eight (or fewer) patch cables. Velcro cable straps shall be SIEMON VCM-100-060-2 (white).

1.20 LABELING AND ADMINISTRATION

A. Labels shall be as recommended in TIA/EIA 606. Labels shall be permanent/legible typed and created by a Brady LS-2000 label maker or equivalent system. Handwritten

labels are not acceptable. Labels are required for communications closets, riser cables, communications jacks, termination block columns for workstation and riser cables, termination strip pairs, and grounding bus bars.

PART 3 — EXECUTION

1.21 GENERAL

A. The Contractor shall install all components strictly to manufacturer's recommendations.

B. All work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, and the National Electrical Code as well as the ANSI/TIA/EIA and ISO/IEC standards listed in Part 1 — References, above.

1. Where questions arise regarding which standards apply, the more stringent specification or policy shall prevail.

C. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.

D. If raceway or pathway (conduits, sleeves, cable pathway etc.) is installed after walls are installed and/or after finish to walls has been applied, wall penetrations shall be sealed, patched and painted to match condition and finish of undisturbed wall.

1.22 RACEWAY

A. D-Rings installed in communications areas shall be mounted at 12" intervals. D-Rings used for raceway in open access environments shall be mounted at 4' intervals.

B. Cable runway shall be installed with ends of cable runway cut square. Ream cut ends to remove burrs and sharp edges. Cap cut ends with manufacturer's recommended caps. Mount retaining posts as required. Affix cable radius drop outs as required.

1.23 FIRESTOPPING

A. Install firestopping in open penetrations and in the annular space of penetrations for fire rated barriers.

B. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.

C. Installation of firestops shall be in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer's recommendations, local fire and building authorities, and applicable codes and standards referenced in Part 1 — References above.

1.24 EQUIPMENT RACKS/ENCLOSURES

A. Install EIA racks and hardware according to locations, elevations, and plan views as shown in the Drawings and Specifications.

1.25 PATCH PANELS

A. Install patch panels and horizontal wire management on walls according to locations, elevations, and plan views as shown in the Drawings and Specifications.

1.26 GROUNDING AND BONDING

A. All grounding and bonding work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, National Electrical Code, and UL 467, and ANSI/TIA/EIA standards listed in Part 1 — References above, as well as local codes which may specify additional grounding and/or bonding requirements.

1. Bond all metallic raceway, racks, cable runway, enclosures, and other metallic hardware used for communications distribution to the nearest approved building ground. Ensure that bonding breaks through paint to bare metallic surface of all painted metallic hardware.

1.27 TERMINATION BLOCKS

A. Workstation and/or riser cable shall enter termination block wall field from the bottom. Cable shall route horizontally along base of backboard until it reaches the termination block column on which it is to terminate and then route vertically to termination block.

B. Install termination block punch downs for riser cable as follows:

1. Punch down riser cable sequentially across the termination strips.

C. Punch down workstation and/or riser cable using only the selected CSCS Manufacturer-approved impact tool.

1.28 CABLE

A. Outdoor:

1. Test fiber optic cable on the reel upon delivery to the job site, and again prior to installation. Permanently affix the test results to the reel and submit a copy to the Owner prior to installation. Do not install cables that fail the on-reel test. Replace any cables that fail the on-reel test at no additional expense to the Owner.

a. Test shall conform to the procedures as outlined in the paragraph entitled TESTING at the end of this specification section.

2. Install cables in compliance with ANSI/TIA/EIA requirements, BICSI practices, and manufacturers recommendations. Adhere to the requirements detailed in the manufacturer's recommendations and ANSI/TIA/EIA Standards relating to bending radius, pulling tension, other mechanical stresses, and pulling speed.

a. Monitor pulling tension on runs of 300 feet or longer. Acceptable monitoring devices are:

1) Winch with a calibrated maximum tension
2) Breakaway link (swivel)

3) In-line tensiometer

Set up cable reels on the same sides of maintenance holes and hand holes as the conduit sections in which cables are to be placed. Level and align reels with conduit sections to prevent twisting of cables during installation into conduits. Pull cables into conduits from tops of reels in long smooth bends. Do not pull cables into conduits from bottoms of reels. Use a cable feeder guide (shoe) of suitable dimensions between the cable reel and the face of the duct to protect the cable and to guide it into the duct. Carefully inspect the cables for sheath defects as the cables are paid off the reel. If defects are found during the pulling operation or if the cable on the reel binds, twists, or does not pay off freely, stop the pulling operation immediately and notify the Owner's representative.

3. Cables of 1-¼ inch diameter or larger shall be equipped with factory installed pulling eyes, or install a core hitch on site. Use pulling grips for cables smaller than 1-¼ inches in diameter. Do not pound grips into the cable sheath to prevent the grips from slipping. Use a ball-bearing based swivel between the pulling-eyes or grips and the pulling strand.

4. Once pulling begins, and tension is applied to the cable, continue the pull at a steady rate. If it is necessary to stop the pull at any point, the tension shall not be released unless it is necessary to do so.Do not splice cables unless specifically noted on the Contract Documents.

5. For new ductbank, install cables in the lowest available conduit in a duct bank, working up as additional cables are installed. For existing ductbanks, do not place cables in ducts other than those indicated on the Contract Documents.

6. Where cables are pulled through maintenance holes or handholes, select the same duct at both sides of maintenance holes or handholes unless specifically noted on the Contract Documents. Avoid changes in duct selections, especially in elevations, to ensure that no damage occurs to the cable sheaths and that pulling tensions are kept as low as possible. Maintain a sufficient length of cable in each maintenance hole or handhole to properly rack the cable. Rack cables in maintenance holes and handholes as soon as practicable, but within one week after cable installation. Route cables in maintenance holes and handholes to avoid blocking duct access.

7. When more than one cable is being installed in a conduit, pull all cables through the conduit simultaneously.

8. Where practicable, feed cables into ducts from the end of the duct that creates the least sidewall pressure on a bend during installation (i.e. feed cable from the end closest to the bend).

9. Use pulling compound or lubricant where necessary. Use lubricants that are compatible with the cable jacket material and in accordance with the manufacturer's recommendations. Do not use soap-based lubricants. Where cable is pulled through a maintenance hole or handhole, re-lubricate the cable prior to feeding into the next duct. Immediately after cables have been

installed, clean lubricant from exposed cables in maintenance holes and handholes and at termination points using dry rags. Seal cable ends with end caps immediately after installation and until terminated in a termination enclosure to prevent moisture entry into the core of filled cables and to prevent damage during installation.

10. Provide a service loop long enough in the ER/TR's to reach termination equipment if moved to the farthest side of the room in the future, but no less than a minimum of 15 feet in the ER and 25 feet at each TR.

11. Comply with the NEC 50-ft rule when installing outdoor-rated cable (i.e. do not exceed 50 feet of exposed outdoor-rated cable length within a building).

12. Cable at the backboards:

    a. Lay and dress cables to allow future cabling to enter raceway (conduit or otherwise) without obstruction by maintaining a working distance from these openings.

    b. Route cable as close as possible to the ceiling, floor or other corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

    c. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Support cables so as not to create a load on the equipment upon which the cables are terminated. Tie-wrap together similarly routed and similar cables and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

13. Cable in the Telecommunications Rooms:

    a. For telecommunications rooms with ladder rack, lay cable neatly in ladder rack in even bundles and loosely secure cabling to the ladder rack at regular intervals.

14. Building Entrances: Seal conduits (both in-use and spare) that enter the building from the outside plant to prevent intrusion of water, gases, and rodents.

B. Outdoor Copper Cable:

1. Provide copper cable in quantities and pair counts as shown on the Contract Documents.

2. Test copper cable on the reel upon delivery to the job site, prior to installation. Permanently affix test results to the reel and provide a copy to the Owner prior to installation. Do not install cables that fail. Replace failing cables at no additional expense to the Owner.

    a. Conform to the test procedures as outlined in the paragraph entitled TESTING at the end of this specification.

b. Demonstrate that the test results are similar to the factory test results as shipped with the reel.

3. Terminate all pairs within a cable. Un-terminated cable pairs are not acceptable.

4. For shielded cable, bond the shield at both ends to the ground lug on the Building Entrance Protector.

5. Copper splices are not acceptable.

C. Outdoor Fiber Cable:

1. Provide fiber optic cable in quantities, strand counts, and types (singlemode, multimode, or composite multimode/singlemode (hybrid)), as shown on the Contract Documents. Provide cable with fan-out kits for both ends.

2. Test fiber optic cable on the reel upon delivery to the job site, prior to installation. Permanently affix test results to the reel and provide a copy to the Owner prior to installation. Do not install cables that fail. Replace failing cables at no additional expense to the Owner.

a. Conform to the test procedures as outlined in the paragraph entitled TESTING at the end of this specification.

b. Demonstrate that the test results are similar to the factory test results as shipped with the reel.

3. Terminate all fiber strands within a fiber cable. The installation of “dark fiber” is not acceptable.

4. Fiber splices are not acceptable.

D. The service slack stored inside the fiber patch panel cabinets shall be a minimum of 3 m (10 ft) for all cable:

E. Cable at the backboards:

1. Lay and dress all cables to allow other cables to enter raceway (conduit or otherwise) without difficulty at a later time by maintaining a working distance from these openings.

2. Cable shall be routed as close as possible to the ceiling, floor or other corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations.

3. Lay cables via the shortest route directly to the nearest edge of the backboard from mounted equipment or blocks. Tie-wrap all similarly routed and similar cables together and attach to D-rings vertically and/or horizontally, then route over a path that will offer minimum obstruction to future installations of equipment, backboards or other cables.

4. See TERMINATION BLOCKS above for details on routing workstation and riser cabling to termination blocks.

F. Patch Cables

1. Furnish patch cables to Owner.

1.29 LABELING AND ADMINISTRATION

A. Labels are required for riser cables, termination block columns riser cables and fiber patch panels. Labels shall comply with TIA/EIA 607.

B. Riser Cables: Riser cable labels shall be of the form "Y.FC-FC" where "Y" is "F" (for fiber riser), "V" (for voice riser), or "C5" (for Category 6 riser) and "FC" denotes the two communications closets (see above) between which the riser routes. Riser cables shall have labels affixed at each end. The label shall be a Panduit Marker Tie (or approved equal).

1. Example: A voice riser from the first communications closet on the first floor to the first communications closet on the fourth floor would have the label "V.1A-4A"

C. Termination Blocks for Risers: Termination blocks for riser cable shall be of the form "FC-RX-VX where "FC" is the closet at which the cable originates, "RX" is the rack at which the cable originates, and "VX" is the riser patch panel at which the cable originates.

1. Example: A termination block terminating cable from closet 4A, rack R3, and riser patch panel V1 would have the label "4A-R3-V1."

2. Termination strip pairs shall be labeled sequentially with the port of the patch panel at which the pair originates.

1.30 TESTING

1. Test records shall be provided on a form approved by the Owner and Engineer. The form shall include test results for each cable in the system. Each cable tested must be submitted on the form with identification as discussed under LABELING AND ADMINISTRATION above. The form shall include the ID, outcome of test, indication of errors found, cable length, retest results, and signature of technician completing the tests. Test results shall be provided to the Owner and Engineer for review and acceptance. Test records for each cable within the system shall be printed directly from the tester and shall be submitted in a binder and on diskette to the Owner and Engineer for review. Handwritten test results will not be accepted.

B. Test the CSCS after installation for compliance to all applicable standards as follows:

1. Test Category 5e Horizontal UTP Cable for compliance to ANSI/TIA/EIA 568A, ANSI/TIA/EIA TSB67, and ISO/IEC 11801 standards. Test with building electrical systems powered on (i.e. Lights, HVAC, etc.).

a. 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. Copper Backbone Distribution: Test copper cable on the reel upon delivery to the job site, again prior to installation, and again after installation.

   a. Test all cable pairs for length, shorts, opens, continuity, polarity reversals, transposition (wire map), and the presence of AC voltage. All pairs shall demonstrate compliance to TIA/EIA 568-B Category 3 standards.

   b. Test entire channel, from termination block to termination block.

   c. Use a TIA/EIA Level III testing instrument, re-calibrated within the manufacturer's recommended calibration period, with the most current software revision based upon the most current TIA/EIA testing guidelines, capable of storing and printing test records for each cable within the system.

      1) Fluke DSP-4000 with latest software and hardware releases, or approved equal.

3. Fiber: Test fiber cable on the reel upon delivery to the job site, again prior to installation, and again after installation.

   a. Prior to testing, calculate the cable loss budget for each fiber optic cable and clearly show the result on the test documentation. Calculate maximum loss using the following formula, assuming no splices:

      1) For Backbone Distribution:

         a) Max Loss = [(allowable loss/km) * (km of fiber)] + [(.3db) * (# of connectors)]

         b) A mated connector to connector interface is defined as a single connector for the purposes of the above formula.

         c) A given fiber strand shall not exceed its calculated maximum loss (per the above formula).

   b. Test all strands using a bi-directional end-to-end Optical Transmission Loss Test Instrument (OTDR) trace performed per ANSI/TIA/EIA 455-61 or a bi-directional end-to-end power meter test performed per ANSI/TIA/EIA 455-53A, and ANSI/TIA/EIA 568-B, and the Avaya Communication SCS Field Testing Guidelines (latest edition).

1) Calculate loss numbers by taking the sum of the two bi-directional measurements and dividing that sum by two.

2) Provide test measurements as follows:

a) For Multimode Cable: Test at both 850 and 1300nm.

c. Test results shall conform to:

1) The criteria specified in ANSI/TIA/EIA-568-B

2) The Contractor's calculated loss budget above

3) The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)

a) In addition to the above, perform tests both recommended and mandated by Avaya. Tests shall confirm/guarantee compliance to Avaya Ethernet GigaSPEED 1000B-X performance, and IEEE 802.3z for a maximum end-to-end dB loss of 2.5 dB.

d. The criteria specified in IEEE 802.3z (1000Base-X Gigabit Ethernet)

C. Identify cables and equipment that do not pass to the Owner and Engineer/Designer. Determine the source of the non-compliance and replace or correct the cable or the connection materials, and retest the cable or connection materials at no additional expense to the Owner. Provide new test results to the Owner and Engineer/Designer in the same manner as above.

D. Damaged cables which are replaced shall be subject to the testing procedures above.

1.31 FOLLOW UP

A. After the system and facility has been placed in operation, provide technical assistance for the first two weeks of operation on a standby call basis for troubleshooting, education, and problem solving. At a period, no less than one month and no more than three months after startup, provide a one day service and operation review for the Owner. Provide any technical services required, assistance on the use of the system and the use of any special features, which may require time to become familiar with a period of time, no less than six months and no greater than one year after startup, provide a second one day service and operation review for the Owner. After each service and operation review, provide a written statement to the Engineer, outlining who visited the site, which of the Owner's representatives were present, what issues were discussed/services provided, and the response to all questions.

END OF SECTION

SECTION 27 21 19

ETHERNET ACTIVE ELECTRONICS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Provide all materials and labor for the installation of Managed Ethernet Networks

1. A dedicated SCADA/Controls network for communications between SCADA devices segmented by building and use.
    (a) VLANs shall segregate an “Office” or “City” access network from the SCADA network.
    (b) The “City” or “Office” network shall have limited access to the SCADA network.

B. Section Includes:

1. Providing (furnishing and installation of) Active Ethernet Electronics

C. Related Sections:

1. Section 40 67 16 – Control Panels

1.03 REFERENCES

A. IEEE 802.1 Network architecture and sub set standards.

B. IEEE 802.3 Ethernet communications and sub set standards

C. IEEE 802.11 Wireless local area network and sub set standards.

D. Internet Engineering Task Force Requests for Comments

1.04 DEFINITIONS

A. “CSCS” shall mean *Communications Structured Cabling System*. The CSCS is defined as all required equipment and materials including (but not limited to) TIA/EIA 568A and ISO/IEC 11801 compliant Category 5e and fiber optic cable, communications outlets, termination jacks, termination

blocks, patch panels and patch cables, racks/enclosures (such as EIA standard equipment racks, enclosures, cable runway, and vertical and horizontal cable management hardware), and pathway/raceway materials (such as sleeves, D-rings, surface metal and surface plastic raceway), and other incidental and miscellaneous equipment and materials as required for a fully operational, tested, certified, and warranted system, compliant with all applicable codes and standards.

1.05 QUALITY ASSURANCE

A. The Contractor shall have a branch office within 300 miles with full time technicians.

B. Refer to Section 26 05 01 paragraph 1.7.

1.06 WARRANTY

A. The Contractor shall provide a Manufacturer endorsed and backed service contract with support licenses for a minimum of 3 years and next business day response:

1. Against defects in materials and workmanship (extended product warranty) for a period of 5 years.

B. The warranty period shall begin at the Owner's acceptance of the work.

1.07 SUBMITTAL INFORMATION

A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections

1. The Contractor shall submit their statement of qualifications. The statement of qualifications shall include all documentation verifying compliance with Paragraph 1.05 (Contractor Qualifications), above.

B. Product Data: For each type of system components specified in the section. This includes, but is not limited to:

1. Specification sheets (cut sheets) of all proposed cables (indicate the exact cables that are to be supplied).

C. Field Test Reports: Indicate and interpret test results for compliance with manufacturer's published standards and performance requirements. (see Section 3.13 for further information)

D. The operating and maintenance (O&M) instructions shall be provided at the time of submittal review for each device in the system. These instructions shall detail how to install and service the equipment and shall include all information necessary for rough-in in preparation for the building facilities to receive the materials.

E. 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. Component Maintenance and Repair Manuals (specified in Division 1).
2. Spare Parts List
3. Field Test Reports
4. Product Data
5. Record Drawings: At the completion of the project, the drawings shall be updated to reflect any changes during the course of construction.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Active Ethernet Switches provided in this section shall be manufactured by Ubiquiti Networks.

B. Point to Point and Point to Multipoint ethernet radios provided in this section shall be manufactured by Ubiquiti Networks.

C. Rack mount or wall mount equipment as indicated on drawings. Provide rack mounting kits from the switch manufacturer for installation of Active Ethernet switches as indicated on the plans. Provide rack mounting kits for existing active electronics where indicated on the plans.

D. Where equipment is mounted external to a building, provide roof, wall, pole, or other mounting kits as indicated on drawings. Provide weather-proofing on connections in the methods as recommended by the Manufacturer.

E. Provide latest stable main-stream switch firmware and operating system as recommended by equipment manufacturer.

F. If a specified product is included in an end of life notice, provide the recommended replacement part.

2.02 ACTIVE ETHERNET ELECTRONICS

A. Switches

1. In Control Panels provided as part of this project provide Phoenix Contact model FL SWITCH 1108N.
    (a) Provide one SFP/SFP+ module for each SFP/SFP+ port plus 1 spare per switch. Coordinate SFP with fiber provided under project

B. Radios and Ethernet Bridges

1. Provide Ubiquiti parts and models as noted on Contract Drawings.
2. Provide manufacturer recommended surge suppressors and protective equipment.

C. SFP/SFP+ Modules

1. Provide one per available SFP/SFP+ port in provided switches.
2. Coordinate SFP/SFP+ module speed and wavelength with fiber provided as part of this project.
3. SFP/SFP+ modules shall be manufactured by the Ethernet switch manufacturer in which they will be installed. 3rd party modules shall be rejected and replaced at the Contractor's expense.

2.03 SECURITY APPLIANCES

A. Provide Netgate 4100 pfSense+ security appliance.

PART 3 - EXECUTION.

3.01 GENERAL

A. The Contractor shall install all components to Manufacturers' recommendations.

B. All work shall comply with the Uniform Building Code, Uniform Fire Code, WAC, and the National Electrical Code as well as the ANSI/TIA/EIA and ISO/IEC standards listed in Part 1 — References, above.

1. Where questions arise regarding which standards apply, the more stringent specification or policy shall prevail.

C. Materials (ceiling tiles, cables, network equipment, etc.) inadvertently demolished or damaged by the Contractor during the course of construction shall be replaced and/or repaired by the Contractor at no additional cost to the Owner.

D. If raceway or pathway (conduits, sleeves, cable pathway etc.) is installed after walls are installed and/or after finish to walls has been applied, wall penetrations shall be sealed, patched and painted to match condition and finish of undisturbed wall.

E. Apply all necessary licenses, support contracts, and so on with the Owner as the contract holder.

F. Owner shall supply Ethernet switch configurations.

3.02 TESTING

A. A testing configuration shall be provided by owner to the Contractor.

B. Testing shall be performed before shipment to the Owner's site to verify that all components, ports, and stacking cables are in proper working order.

C. Equipment shall be retested onsite upon installation prior to Owner's representative loading final switch configurations. Contractor shall remedy all failed components or switches prior to Owner's representative migrating switches from "testing configuration" to "production configuration".

3.03 INSTALLATION

A. Area shall be clear of debris and installation work of process and electrical distribution equipment shall be complete before network switch installation, unless otherwise noted in the Drawings.

B. Network switch shall be powered from permanent building power, unless otherwise noted in the Drawings.

END OF SECTION

DIVISION 31 – EARTHWORK

SECTION 31 10 00 – SITE CLEARING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Work included in this section consists of all work necessary to prepare the site for further site Work activities such as installation of the rammed aggregate pier foundation system.

B. This section includes removal of surface debris; removal of plant life; removal of surface rock; and excavation and stockpiling of topsoil.

C. Dust control shall be provided for the full duration of the project. The Contractor shall be responsible for obtaining and paying for any required permits.

1.02 RELATED SECTIONS

A. Section 31 14 11 – Soil Materials

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable Local, State, and Federal codes for environmental requirements, disposal of debris, burning debris on site, and use of herbicides.

B. Coordinate clearing Work with utility companies.

C. Conform to clean air regulations of the Washington Department of Ecology. A copy of the regulations is available at the Central Regional Office of the Washington Department of Ecology located in Yakima, Washington.

D. Comply with the State of Washington regulation regarding disposal of waste material as outlined in WAC 173-304, Subchapter 461.

1.04 SUBMITTALS

A. No submittals required for this section.

1.05 QUALITY ASSURANCE

A. Work shall be performed in accordance with the requirements of Section 2-01, Clearing, Grubbing, and Roadside Cleanup, and Section 2-02, Removal of Structures and Obstructions, of the WSDOT Standard Specifications.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Materials not used.

PART 3 – EXECUTION

3.01 PREPARATION

A. Identify a salvage or stockpile area for placing removed materials.

B. A waste site has not been provided by the Contracting Agency for disposal of unsuitable material, asphalt concrete, debris, waste material, or any other objectionable material that is directed to waste by the Engineer.

3.02 PROTECTION

A. Locate, identify, and protect from damage any utilities which remain.

B. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work.

B. Remove brush, shrubs and surface rock.

C. Remove any unsuitable soil materials not meeting the requirements of Section 31 14 11 – Soil Materials.

3.04 REMOVAL

A. Remove debris, pipes, rock, extracted plant life, and any other objectionable or unsuitable material from the site.

B. Remove existing fencing where in conflict with new construction. Existing fence materials may be salvaged by the Contractor for use in replacement of existing fence where called out on the Plans. Damaged materials shall be disposed of as described above.

3.05 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated or re-graded, without mixing with foreign materials.

B. Do not excavate wet topsoil.

C. Stockpile in area on site to depth not exceeding 8 feet and protect from erosion.

D. Topsoil shall be saved for use as backfill adjacent to the new improvements and to achieve subgrade elevations. Refer to Section 31 14 11 – Soil Materials for material use requirements.

E. Excess topsoil not required for construction of improvements shall be removed from the project site.

3.06 DUST CONTROL

A. The Contractor shall be solely responsible for dust control on this project and shall protect motoring public, adjacent businesses, homes, orchards, and crops from damage due to dust, by whatever means necessary. The Contractor shall be responsible for any claims for damages and shall protect the Contracting Agency, Yakima County, and the Consultant from any and all such claims.

B. When directed by the Engineer, the Contractor shall provide water for dust control within two hours of such order and have equipment and manpower available at all times including weekends and holidays to respond to order for dust control measures.

END OF SECTION 31 10 00

SECTION 31 14 11 – SOIL MATERIALS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes the requirements for subgrade materials and topsoil materials, whether obtained from project excavations, or imported from off-site sources.

B. Suitable soil materials obtained from project excavations shall be separated and stockpiled for later incorporation into the Work.

C. Placement of soil materials is covered in related sections.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 31 10 00 – Site Clearing

D. Section 31 22 13 – Rough Grading

E. Section 31 23 11 – Excavation, Backfill and Compaction for Structures

F. Section 31 23 15 – Trench Excavation and Backfill

G. Section 32 11 11 – Aggregate Materials

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

B. ASTM D 2487 – Classification of Soils for Engineering Purposes.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit name, address and phone number of imported materials source. Submit material data for verification that soil materials are in conformance with the specifications.

C. Submit results of tests specified in this Section and/or required by Section 01 45 11 – Testing, Inspections, Supervision.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with WSDOT Standard Specifications.

PART 2 – PRODUCTS

2.01 SUBGRADE MATERIALS

A. Subgrade materials are those materials used to accomplish rough grading and to bring ground surfaces to top of subgrade elevation, including the following:

1. Common Fill:

a. Suitable material obtained from project excavations.

b. Rock embankment material - common fill material which contains 25 percent or more, by volume, gravel or stone 4 inches or more in diameter.

c. Earth embankment material - common fill material other than rock embankment material.

d. Free of debris.

e. Imported common fill (if required) shall conform to the requirements of Section 9-03.14(3) of the Standard Specifications for “Common Borrow”

2. Structural Fill:

a. Imported, well-graded, crushed aggregate material conforming to the requirements of Section 9-03.9(3) of the Standard Specifications for “Crushed Surfacing Base Course.”

2.02 TOPSOIL MATERIALS

A. Topsoil shall be Type B or Type C per Section 9-14.1 of the Standard Specifications with the following properties:

1. Friable silt loam.

2. Reasonably free of roots, rocks larger than 2-inches, subsoil, debris, large weeds, and foreign matter.

3. Acidity range (pH) between 5.5 and 7.5.

4. Containing a minimum of 4 percent and a maximum of 20 percent inorganic matter.

2.03 SOURCE QUALITY CONTROL

A. Perform testing and analysis of topsoil materials in accordance with ASTM D1557.

B. If material tests indicate materials do not meet specified requirements, change material and retest.

C. For each type of materials provided to the project, use the same source throughout the Work.

PART 3 – EXECUTION

3.01 MATERIAL REMOVAL

A. Excavate rock, subsoil and topsoil from areas designated.

B. Remove lumped soil, boulders, and rock from topsoil.

C. Separate removed materials for later use as topsoil and common fill.

D. The Contractor may provide a screen for separation of the excavated materials into the gradations required for use as common fill or structural fill.

3.02 STOCKPILING

A. Stockpile materials on site at locations shown on the Plans for Contractor's Work area.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

3.03 STOCKPILE CLEANUP

A. Stockpile soil materials and leave area in a clean and neat condition. Grade site surface to prevent free-standing surface water.

B. Excess material shall be wasted to a location secured by the Contractor.

END OF SECTION 31 14 11

SECTION 31 22 13 – ROUGH GRADING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes all Work necessary to achieve the top of subgrade elevations shown on the Plans or otherwise required to achieve suitable foundations for structures, roadways, parking areas, and landscaped areas.

B. Work required in this section may include, but not necessarily be limited to, unclassified excavation, backfilling, embankment construction, placement of structural fill, and backfilling of over-excavated areas.

C. Additional Work required to accomplish the requirements of this section is specified in the related sections.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 31 10 00 – Site Clearing

D. Section 31 14 11 – Soil Materials

E. Section 31 23 11 – Excavation, Backfill and Compaction for Structures

F. Section 31 23 15 – Trench Excavation and Backfill

G. Section 31 11 11 – Aggregate Materials

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit test results as required by Section 01 45 11 – Testing, Inspections, Supervision.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with WSDOT Standard Specifications.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil: As specified in Section 31 14 11 – Soil Materials.

B. Subgrade Common Fill: As specified in Section 31 14 11 – Soil Materials.

C. Structural Fill and Structural Backfill: As specified in Section 31 23 11 – Excavation, Backfill and Compaction for Structures.

PART 3 – EXECUTION

3.05 EXAMINATION

A. Verify site conditions prior to beginning Work.

B. Verify that survey bench mark and intended elevations for the Work are as indicated.

C. Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

3.06 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage utilities which remain.

D. Notify utility company to remove and relocate utilities.

E. Protect above- and below-grade utilities which remain.

F. Protect plant life, lawns, rock outcropping, and other features remaining as a portion of final landscaping.

G. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

H. Comply with WSDOT Standard Specifications, Section 2-03.

3.07 SUBGRADE EXCAVATION

A. Excavate subgrade materials from areas to be further excavated, re-landscaped, or regraded.

B. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion.

E. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.08 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Place fill material on continuous layers and compact in accordance with WSDOT Standard Specifications.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise.

E. Make grade changes gradual. Blend slope into level areas.

F. Remove surplus fill materials from site.

G. Comply with WSDOT Standard Specifications, Section 2-03.

3.09 TOLERANCES

A. Top surface of subgrade in roadway areas: To line and grade shown on Plans.

B. Top surface of subgrade beneath structures: Plus 0.00 feet above the line and grade shown on the Plans to minus 0.30 feet below the line and grade shown on the Plans.

C. Unless otherwise approved by the Engineer, manufactured or imported aggregate materials shall not be used to achieve subgrade elevations.

3.10 FIELD QUALITY CONTROL

A. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 31 22 13

SECTION 31 23 11 – EXCAVATION, BACKFILL AND COMPACTION FOR STRUCTURES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered within this section includes structural excavation, structural fill, and structural backfill necessary to construct this project as shown on the Plans and as specified herein.

B. Rock excavation is also included in this section. No blasting will be allowed.

C. Quantities and work required for excavation, backfill, and compaction for structures shall be included in the Bid Items related to site work. No separate distinction shall be made for excavation, backfill, and compaction for structures.

D. The limits of structural excavation, structural fill, and structural backfill are defined as follows:

1. Structural Excavation: That excavation required to establish subgrade below the structure with a horizontal limit extending to no more than 1 foot outside the limits of the footing or slab, or as otherwise indicated on the Plans.

2. Structural Fill: That fill placed on prepared subgrade up to the base of the footing or slab, with a horizontal limit beginning 1 foot outside the limits of the footing or slab, and extending down and out to the base of the fill at a slope of 1 horizontal to 1 vertical. Material placed outside these limits shall be considered common fill.

   Structural fill also includes fill paced inside structure walls up to the base of interior footings/slabs.

3. Structural backfill: That structural fill placed against the outside of the structure within a distance equal to the height of the backfill above the top of the footing, or 4 feet, whichever is less. Material placed outside these limits shall be considered common fill.

E. Additional requirements for backfilling and final subgrade preparation outside of structure areas shall be as specified in Section 31 22 13 – Rough Grading.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 10 00 – Concrete Forming and Accessories

D. Section 31 00 00 – Site Clearing

E. Section 31 14 11 – Soil Materials

F. Section 31 22 13 – Rough Grading

G. Section 31 23 15 – Trench Excavation and Backfill

H. Section 31 23 19 – Dewatering

I. Section 32 11 11 – Aggregate Materials

1.03 REFERENCE STANDARDS

A. American Society for Testing and Material (ASTM):

1. D 422 – Particle-Size Analysis of Soils.

2. D 1557 – Moisture-Unit Weight Relations of Soils and Soil-Aggregate Mixtures Using 10-pound Rammer and 18-inch Drop.

3. D 2487 – Classification of Soils for Engineering Purposes.

4. D 2922 – Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

5. D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

B. Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit test results as required by Section 01 45 11 – Testing, Inspections, Supervision.

C. Submit an excavation plan, in accordance with governing state and federal requirements, showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during excavations 4 feet or more in depth.

D. The excavation plan submittal is for record purposes only, and shall not be construed as a detailed analysis for adequacy of the support system, nor shall any provisions of the above requirements be construed as relieving the Contractor of his overall responsibility and liability for the work. The Contractor shall be solely responsible for any and all liabilities which may arise from failure to provide adequate shoring, bracing, or sheeting as necessary to support the excavation under any and all conditions of loading which may exist, or which may arise during construction.

E. In addition, the Contractor shall obtain, pay for, and comply with all provisions or the Accident Prevention Division of the Washington State Workman's Compensation Department.

1.05 PROTECTION

A. Protection of adjacent work must be accomplished. Properly slope cuts to provide stability. Temporary cuts should be no steeper than 1 vertical to 1 horizontal, except temporary cuts in rock may be as steep as 1 vertical to 0.5 horizontal. Permanent slopes should be no steeper than 1 vertical to 2 horizontal, or as shown on the Plans.

PART 2 – PRODUCTS

2.01 EXCAVATION MATERIAL

A. The Contractor shall make his own deductions and conclusions as to the nature of the materials to be excavated and the difficulties which may arise from subsurface conditions.

B. Material produced from rock excavation shall be suitable for use as common fill. No more than 10 percent of the excavated material by volume shall have rocks larger than 12 inches.

C. The material shall be capable of being compacted to 95 percent (or the percentage otherwise indicated), of maximum dry density without undue weaving and heaving as determined by ASTM D 1557.

D. Payment for excavation will be made as described in 1-09.3(1) of Section 01 11 50 – Special Provisions. Payment will include all costs to dewater, excavate, load, and haul the material.

E. Stockpile excavated material in area designated on-site in accordance with Section 31 14 11 – Soil Materials and Section 32 11 11 – Aggregate Materials. Remove excess or unsuitable material from site. Suitable material shall be used for fill, backfill, and embankment construction.

2.02 STRUCTURAL FILL AND BACKFILL MATERIALS

A. Structural fill and structural backfill shall consist of the following materials:

1. Crushed Surfacing Base Course: As specified in Section 32 11 11 – Aggregate Materials.

2.03 FILTER FABRIC AND GEOGRID (IF USED)

A. Filter fabric shall be a sheet structure of non-woven construction fabric and consist of rot-proof polymeric continuous filaments. The fabric shall conform to the physical property requirements listed below:

Physical Property	Minimum Requirements
Weight	4 oz./sy
Thickness	30 mils
Grab Strength	120 lbs.
Elongation	60%
Trapezoidal Tear	65 lbs.
Specific Gravity Flux	100 gal/min/sf

B. Filter fabric shall be Mirafi 140N, or Engineer approved equal.

C. Geogrid shall be TriAx TX140, as manufactured by Tensar International Corporation, or Engineer approved equal.

2.04 PIPE ENCASEMENTS UNDER STRUCTURES

A. Pipes 6 inches or larger in diameter, where placed under structures, shall be encased in Class 3000 concrete as specified in Section 03 30 00 – Cast-In-Place Concrete. Details for such encasement shall be as shown on the Plans. Encasement shall provide bearing for overlying structures.

B. Pipes less than 6 inches in diameter, where placed under structures, shall be bedded in imported pipe bedding (crushed surfacing top course), unless otherwise specified or noted on the Plans.

PART 3 – EXECUTION

3.01 PREPARATION

A. Notify Utility Notification Center at least 48 hours prior to start of excavation. Notify utility company to remove and/or relocate utilities, if applicable.

B. Verify that survey bench mark and intended elevations for the work are as indicated.

C. Identify required lines, levels, contours, and datum locations.

D. Locate, identify, and protect from damage utilities which remain.

E. Protect plants and other features remaining as part of the final landscaping.

F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

G. Review safety requirements. Comply with OSHA/WISHA regulations.

H. Prior to backfilling:

1. Verify sub-drainage, damp proofing, and waterproofing installation has been inspected.

2. Verify structural stability of unsupported walls to support imposed loads by the fill.

3.02 CONTROL OF WATER

A. Dewatering: Excavations are to be kept free of standing water. Dewater excavations as required for subsequent construction.

B. Grade top perimeter of excavations to prevent surface water and/or runoff from draining into excavations.

3.03 GENERAL EXCAVATION

A. The method of excavation shall be the Contractor's option, but the Contractor shall exercise care when approaching the final grade to leave it in undisturbed condition. If the final grade is disturbed or becomes wet or dried out during the course of construction, the Contractor shall remove and replace the material as indicated in this section at no cost to the Owner. The Contractor is advised that footings should be placed as soon as possible to minimize these conditions.

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

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

D. Notify the Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume work. Unsuitable foundation materials, as determined by the Engineer, shall be removed and disposed of off-site.

E. Suitable excavated material shall be used in fills and in backfills, and as embankment fill. Stockpile excavated material in an area designated on-site in accordance with Section 31 14 11 – Soil Materials and Section 32 11 11 – Aggregate Materials. Excess suitable material shall be hauled to a location secured by the Contractor as specified in Section 31 14 11 – Soil Materials.

3.04 EXCAVATION FOR STRUCTURES

A. In general, all structures shall bear on suitable foundation material and shall be excavated to the depth required to construct the slabs and substructure elements. All footings and slabs shall bear on a minimum of 6 inches of crushed surfacing base course. Where existing grade is below finished grade, the Contractor shall remove the layer of unsuitable material and replace it with structural backfill material to the proper elevation.

B. Over-excavation for structures due to unsuitable subgrade material shall be as directed by the Engineer. Where over-excavation extents are not identified, over-excavation shall be provided to meet minimum bearing requirements for footings or slabs of 6 inches of crushed surfacing base course. Placement of structural fill following any over-excavation shall be completed according to the requirements of paragraph 3.06 – Placement of Structural Fill.

C. When fill is placed adjacent to walls, footings, and the like, heavy equipment for spreading and compacting shall not be operated closer to any wall than a distance equal to the height of the backfill above the top of the footing, or 4 feet, whichever is less. Fill adjacent to walls shall be all-weather material compacted to 92 percent of the maximum dry density as determined by ASTM D 1557, with small vibratory or hand compactors.

3.05 PREPARATION OF EARTH SUBGRADE FOR CONCRETE

A. When excavating for bottom mat slabs, final excavation to grade shall be done in a manner so as not to disturb the existing soil. If the soil is disturbed, the Contractor will be required to remove the disturbed material and replace it with structural fill material. Concrete shall not be placed on surfaces that are muddy, frozen, or dried out. If, during the course of construction, bottom surfaces become saturated with water, muddy, disturbed or dried out, the Contractor shall, at no cost to the Owner, remove the undesirable material and replace with compacted structural backfill as indicated above.

B. Fill under slabs on grade shall consist of a minimum of 6 inches of crushed surfacing base course, unless otherwise specified or noted on the Plans.

3.06 PLACEMENT OF STRUCTURAL FILL

A. Structural fill shall be placed in lifts not exceeding 8 inches for heavy-duty vibratory roller compactors, or 4 inches for hand operated compactors. Structural fill shall be compacted to 95 percent of maximum dry density as determined by ASTM D1557. The compaction effort will be field verified by a representative of the Engineer using a calibrated nuclear density gauge, in accordance with ASTM D6938.

B. Structural fill shall bear on rock or other firm base.

C. The structural fill shall be spread in lifts as indicated and each lift shall be compacted with a minimum of four passes with a heavy steel drum vibratory roller in a systematic pattern and as many additional passes as necessary to satisfy the Engineer. The vibratory roller will have the following characteristics, unless otherwise approved by the Engineer.

Static Weight:	18,900 lbs. minimum
Total Applied Weight:	58,900 lbs. minimum
Vibrating Shaft Speed:	1000 to 1500 RPM
Speed:	2 MPH maximum

D. In freezing weather, the following additional requirements will apply:

1. Prior to terminating work for the day, the final layer of compacted subbase material, after compaction, shall be rolled with a smooth-wheel roller, if necessary to eliminate ridges of soil left by tractors or trucks used for compaction.

2. A layer of loose protective material shall be left on top at the end of each day's operation. This material shall be removed and wasted at start of the next day's operations.

3. The Contractor shall not place a layer of compacted fill on snow, ice, or soil that was permitted to freeze prior to compaction. Removal of these unsatisfactory materials will be required prior to fill placement as directed by the Engineer at no additional cost to the Owner.

4. No frozen material shall be used in structural fill.

E. The Contractor shall bring the structural fill to the top of subgrade elevation, using materials described above, to within the following tolerances of the elevations indicated on the Plans: Plus 0.00 feet above subgrade elevation and minus 0.30 feet below subgrade elevation.

F. No payment will be made for excess structural fill used to correct subgrade elevations that are outside of the tolerances listed above.

3.07 PLACEMENT OF FILTER FABRIC AND GEOGRID

A. Filter fabric and geogrid shall be placed as specified herein, in those areas shown on the Plans, and as directed by the Engineer. Tears or blowouts of the fabric shall be exposed and repaired by a minimum of a 3-foot overlap on all sides and shall be incidental to the unit price. Filter fabric shall overlap a minimum of 3 feet.

3.08 FINAL TRIMMING AND CLEAN-UP

A. Final trimming and clean-up shall consist of all work as follows:

1. All irregularities shall be made smooth, washouts shall be filled, slopes made uniform, slightly rounded at top and bottom, and the entire area of the fill compacted and completed to the required lines, grades, and cross sections with 1/10 foot above or below the established grade.

2. Where additional material is required for filling, it shall be similar to that used in fill and may be obtained from a source approved by the Engineer.

3. When work is completed, the Contractor shall remove and dispose of all surplus material including stumps, trees, and brush, and leave premises in condition acceptable to the Engineer.

3.09 TESTING

A. Compaction tests will be performed by a certified independent testing laboratory, employed by the Owner. In the event the first compaction test of an area does not comply with the requirements of the Specifications, additional compaction shall be performed by the Contractor to obtain the required density, or the compacted material shall be replaced in accordance with the Specifications. Additional compaction tests for the repaired areas shall be performed by the certified testing laboratory and all costs associated with these additional compaction tests shall be paid for by the Contractor. This process shall be repeated until the soil compaction complies with the requirements of these Specifications.

END OF SECTION 31 23 11

SECTION 31 23 15 – TRENCH EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes requirements for excavation and backfill of trenches for utilities outside of buildings and structures, including all site piping.

B. Work includes, but is not necessarily limited to, the following:

1. Placement and compaction of pipe bedding material within the pipe zone for utilities outside of buildings and structures.

2. Placement and compaction of pipe bedding material within the pipe zone for utilities located beneath buildings and structures, when the trench is not filled with concrete.

3. Placement and compaction of trench backfill within the trench zone, from top of utility bedding (pipe zone) to subgrade elevations.

4. Dewatering required for trench excavation and backfill.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 31 14 11 – Soil Materials

E. Section 31 22 13 – Rough Grading

F. Section 31 23 19 – Dewatering

G. Section 32 11 11 – Aggregate Materials

1.03 REFERENCES

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

B. ASTM C 136 – Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D 1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

D. ASTM D 2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 SUBMITTALS

A. Submit test results as required by Section 01 45 11 – Testing, Inspections, Supervision.

1.05 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Pipe zone: That portion of the trench from 4 inches below the pipe to 6 inches above the pipe as shown on the Plans. The pipe zone shall be backfilled with bedding material per the Specifications.

C. Trench zone: That portion of the trench above the pipe zone. Backfill with native material unless otherwise directed by the Engineer.

1.06 FIELD MEASUREMENTS

A. Verify that survey bench mark, control point, and intended elevations for the work are as shown on the Plans.

B. Submit Construction Staking Request Form as required by 1-05.4(2) of Section 01 11 50 – Special Provisions.

1.07 COORDINATION

A. Coordinate work with other site construction activities.

B. Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 – PRODUCTS

2.01 FILL MATERIALS

A. As specified by WSDOT Standard Specifications, Sections 7-08 and 7-09.

B. Imported pipe bedding (pipe zone): Crushed surfacing top course per Section 9-03.9(3) of the Standard Specifications.

C. Imported select trench backfill (trench zone): Crushed surfacing base course per Section 9-03.9(3) of the Standard Specifications.

D. Trench backfill material (trench zone): Unless otherwise directed by the Engineer, trench backfill material shall be obtained from project excavations.

E. See typical trench section on the Plans.

2.02 EXCAVATED MATERIAL

A. Includes removal of all natural or man-made objects of whatever nature encountered which must be removed for installation of the utility.

B. Includes dewatering.

PART 3 – EXECUTION

3.01 PREPARATION

A. Notify Utility Notification Center at least 48 hours prior to start of excavation.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above- and below-grade utilities which are to remain.

F. Cut out soft areas of subgrade not capable of compaction in place. Backfill with fill material and compact to density equal to or greater than requirements for subsequent backfill material.

G. Review safety requirements. Comply with OSHA/WISHA regulations. Provide shoring, cribbing, or extra excavation as required.

3.02 EXCAVATING

A. Excavate trenches required for utilities.

B. Cut trenches sufficiently wide to enable installation and allow inspection per Sections 7-08 and 7-09 of the WSDOT Standard Specifications. Remove water or materials which interfere with work.

C. Stockpile excavated material in an area designated on-site and remove from site excess material not being used.

3.03 BACKFILLING

A. Employ a placement method which does not disturb or damage utilities in trench, and/or other physical features in place at the time of construction.

B. Mechanical compaction shall be required for all trenches. The Contractor is hereby cautioned that time extensions shall not be granted due to unstable trench backfill conditions caused by excessive watering. The Contractor shall be responsible for correcting such conditions caused by his own construction activities.

C. Maintain optimum moisture content of fill materials to attain required compaction density. All trench backfill shall be compacted to at least 95 percent of maximum density as determined by ASTM D 1557.

D. Detectable marker tape shall be installed over non-metallic pipe lines. The tape shall be placed approximately three feet above the top of the pipe and shall extend its full length. The horizontal location of the tape shall vary no more than 2 feet from the centerline alignment of the pipe. Detectable marker tape shall meet the requirements of Section 9-15.18 of the Standard Specifications.

E. Street crossing trenches and other locations as directed by the Engineer shall be backfilled for the full depth of the trench with select backfill meeting the requirements for crushed surfacing base course, in Section 9-03.9(3) of the Standard Specifications.

F. Remove surplus fill materials from site.

3.04 TOLERANCES

A. Excavation methods shall be controlled to prevent over-excavation. All over-excavated areas which result from inadequate control of excavation methods shall be backfilled to the correct bottom of trench elevation at no cost to the Owner.

B. Bottom of trench excavation: Plus 0.00 feet above the line and grade shown on the Plans to minus 0.30 feet below the line and grade shown on the Plans.

C. Top Surface of Backfilling Under Paved Areas: Shall be to required subgrade elevations.

D. Top Surface of General Backfilling: Plus or minus 1-inch from required elevations.

3.05 FIELD QUALITY CONTROL

A. See Section 01 45 11 – Testing, Inspections, Supervision.

B. Compaction testing will be performed in accordance with ASTM D 1557.

C. If tests indicate work does not meet specified requirements, remove work, replace, compact, and retest.

D. Frequency of Tests: Shall be at various depths in the trench section.

E. The first 200 feet of trench backfill operations shall be considered a test section for the Contractor to demonstrate his backfilling and compaction techniques. Notify the Engineer at least 3 working days prior to beginning trench excavation and backfill operations. Arrange for in-place density tests to be taken on the completed test section. No further trenching will be allowed until the specified density is achieved in the test section.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished work throughout remainder of construction.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION 31 23 15

SECTION 31 23 19 – DEWATERING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes construction dewatering. The costs for all dewatering operations required shall be included in the cost of other items of work. No separate measurement or payment will be made for construction dewatering.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 57 13 – Temporary Erosion and Sediment Control

C. Section 31 10 00 – Site Clearing

D. Section 31 22 13 – Rough Grading

E. Section 31 23 11 – Excavation, Backfill and Compaction for Structures

F. Section 31 23 15 – Trench Excavation and Backfill

1.03 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points and/or trenches and sumps; locations of headers and discharge lines; and means of discharge and disposal of water.

1.04 REGULATORY REQUIREMENTS

A. Comply with all requirements of the Washington State Department of Ecology 2011 Construction Stormwater General Permit related to dewatering.

1.05 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.

2. Prevent surface water from entering excavations by grading, dikes, or other means.

3. Accomplish dewatering without damaging existing buildings adjacent to excavation.

4. Dewatering water shall be managed separately from construction stormwater runoff.

1.06 PROJECT CONDITIONS

A. A geotechnical report was prepared for the project and is located in Appendix B.

B. The Contractor, at their own cost, may make test borings and conduct exploratory operations necessary to determine groundwater conditions, or for dewatering design. Coordinate with the Engineer at least one week prior to the bid date.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials used for dewatering, including pumps, pipes, hoses, filters, gravel for trenches, temporary sumps, etc. shall be designed, provided, installed, operated, maintained and removed by the Contractor.

PART 3 – EXECUTION

3.01 PREPARATION

A. Coordinate the dewatering design and implementation with the Plans. Refer to Section 01 57 13 – Temporary Erosion and Sediment Control for additional information.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.02 DEWATERING IMPLEMENTATION

A. Install dewatering system utilizing wells, well points, trenches, sumps, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until utilities and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, utilities, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, utilities, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation or as needed to meet specified compaction requirements, see Plans and Section 31 23 11 – Excavation, Backfill and Compaction for Structures.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that meets the requirements of Section 01 57 13 – Temporary Erosion and Sediment Control and the Construction Stormwater General Permit. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

G. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

3.03 CLEANUP

A. Remove dewatering system from Project site upon completion of dewatering.

B. Restore disturbed areas in accordance with the Plans and Section 01 57 13 – Temporary Erosion and Sediment Control.

END OF SECTION 31 23 19

DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 32 11 11 – AGGREGATE MATERIALS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes the requirements for manufactured or naturally-occurring aggregate materials. Manufactured materials may be obtained from approved off-site sources, or manufactured on site by the Contractor.

B. No off-site materials source has been designated for this project.

C. Placement of aggregate materials is covered in related sections.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 31 14 11 – Soil Materials

D. Section 31 22 13 – Rough Grading

E. Section 31 23 11 – Excavation, Backfill and Compaction for Structures

F. Section 31 23 15 – Trench Excavation and Backfill

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

B. AASHTO M147 – Materials for Aggregate and Soil-Aggregate.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit name, address and phone number of imported materials source. Submit material data for verification that aggregate materials are in conformance with the specifications.

C. Submit results of tests required by Section 01 45 11 – Testing, Inspections, Supervision.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with WSDOT Standard Specifications.

PART 2 – PRODUCTS

2.01 AGGREGATES

A. Crushed Surfacing Base Course: Conforming to WSDOT Standard Specifications, Section 9-03.9(3), for “Crushed Surfacing Base Course.”

B. Crushed Surfacing Top Course: Conforming to WSDOT Standard Specifications, Section 9-03.9(3), for “Crushed Surfacing Top Course.”

C. Gravel Borrow: Conforming to WSDOT Standard Specifications, Section 9-03.14(1), for “Gravel Borrow.”

D. Gravel backfill for infiltration trenches and subsurface drains: Conforming to WSDOT Standard Specifications, Section 9-03.12(4) “Gravel Backfill for Drains,” or Section 9-03.12(5) “Gravel Backfill for Drywells.”

E. Gravel backfill for walls and footing drains: Conforming to WSDOT Standard Specifications, Section 9-03.12(2) “Gravel Backfill for Walls.”

2.02 SOURCE QUALITY CONTROL

A. Field inspection, source testing, and analysis of aggregate material will be performed under provisions of Section 01 45 11 – Testing, Inspections, Supervision.

B. If tests indicate materials do not meet specified requirements, change material or material source and retest.

C. For each type of materials provided to the project, use the same source throughout the Work.

PART 3 – EXECUTION

3.01 STOCKPILING

A. Stockpile materials on site at locations designated by Engineer.

B. Stockpile in sufficient quantities to meet project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Direct surface water away from stockpile site so as to prevent erosion or deterioration of materials.

3.02 STOCKPILE CLEANUP

A. Remove stockpile, leave area in a clean and neat condition. Grade site surface to prevent free-standing surface water. Excess aggregate materials purchased under the unit price provisions of the contract may be stockpiled on site at locations designated by the Engineer for later use by the Owner.

3.03 PLACEMENT OF AGGREGATE MATERIALS

A. Verify that subgrade has been inspected, gradients and elevations are correct and dry.

B. Place aggregate materials in a maximum of 6-inch layers and compact to 95 percent of maximum density as determined by ASTM D 1557 (modified proctor).

C. Refer to WSDOT Standard Specifications, Section 4-04.3(5).

END OF SECTION 32 11 11

SECTION 32 12 16 – ASPHALT PAVING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish and install hot mix asphalt paving (HMA), wearing binder, or base course.

B. Furnish and install aggregate materials under hot mix asphalt concrete pavement and as gravel surfacing.

C. Furnish materials and apply lane marking paint (striping) to pavement surfaces.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 31 22 13 – Rough Grading

E. Section 31 23 15 – Trench Excavation and Backfill

F. Section 32 11 11 – Aggregate Materials

1.03 REFERENCES

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation (WSDOT).

B. ASTM D 946 – Penetration-Graded Asphalt Cement for Use in Pavement Construction.

C. TAI (The Asphalt Institute) – MS-2 Mix Design Methods for Asphalt Concrete and Other Hot Mix Types.

D. TAI (The Asphalt Institute) – MS-3 Asphalt Plant Manual.

E. TAI (The Asphalt Institute) – MS-8 Asphalt Paving Manual.

F. TAI (The Asphalt Institute) – MS-19 Basic Asphalt Emulsion Manual.

G. AASHTO-M-248.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit name, address and phone number of materials source.

C. Submit HMA Mix Design: The Owner will accept a mix design for HMA that has been approved by WSDOT within the past 12 months that uses the same aggregate source and asphalt cement source as is proposed for this project. Provide mix design, performed in accordance with WSDOT requirements, to the Engineer for review at least 10 working days prior to any paving operations.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with WSDOT Standard Specifications.

PART 2 – PRODUCTS

2.01 MATERIALS

A. All materials shall conform to the WSDOT Standard Specifications.

B. Lane Marking Paint: Chlorinated rubber-alkyd type, AASHTO-M-248, CFS-TT-P115), Type III, White or Yellow, 4 inches wide.

C. An asphalt prime coat will not be required on this project.

D. A soil sterilant will not be required to be applied to the subgrade.

2.02 ASPHALT PAVING MIX

A. Asphalt concrete paving shall be HMA Class 1/2-inch PG 64-28 and conform to WSDOT Standard Specifications, Section 5-04.

B. The use of more than 30 percent of recycled material in the asphalt concrete pavement will not be permitted.

C. Performance Grade (PG) asphalt binder will not be required to meet the additional requirements of Section 9-02.1(4) of the Standard Specifications.

D. Provide anti-stripping additive per the Contractor submitted, and Engineer approved WSDOT mix design.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify base conditions.

B. Verify that compacted granular base is dry and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Provide sufficient number of trucks to assure a continuous paving operation. Assure proper asphalt concrete mix temperatures are maintained.

E. Protect edges of existing pavement; if edges are damaged, re-trim to neat line.

F. Paving operations shall not proceed until base conditions are correct and sufficient hauling and placing equipment is available.

3.02 SUBBASE

A. Refer to WSDOT Standard Specifications, Section 4-04.

B. Place aggregate base materials to the compacted depths shown on Plans.

C. Place and compact gravel shouldering as required by Section 4-04.3(11) of the Standard Specifications.

3.03 PLACING ASPHALT PAVEMENT

A. Place asphalt concrete pavement in accordance with the requirements of WSDOT Standard Specifications, Section 5-04.3.

B. Compact to a minimum of 91% of theoretical maximum Rice density ASTM D 2041.

3.04 PAVEMENT MARKINGS

A. Apply pavement markings in accordance with the requirements of WSDOT Standard Specifications, Section 8-22.

B. Glass beads will not be required with pavement markings.

C. Two applications of paint will be required to complete all paint stripe markings.

3.05 TOLERANCES

A. Flatness: Maximum variation of 1/4-inch measured with 10-foot straightedge.

B. Variation from True Elevation: Paving surface to be at grade and elevations shown.

3.06 FIELD QUALITY CONTROL

A. Refer to Section 01 45 11 – Testing, Inspections, Supervision.

B. Take samples and perform tests in accordance with TAI MS-2.

3.07 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140°F.

END OF SECTION 32 12 16

SECTION 32 13 13 – CONCRETE PAVING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes all Portland Cement concrete work related to concrete sidewalks, concrete paving, stair steps, curbs and gutters, planter curbs, and integral curbs.

B. Furnish and install aggregate base materials beneath Portland Cement concrete work included in Item A.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 31 22 13 – Rough Grading

E. Section 32 11 11 – Aggregate Materials

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

B. ACI 304 – Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete

C. ASTM A 615 – Deformed and Plain Billet-Steel for Concrete Reinforcement

D. ASTM C 33 – Concrete Aggregates

E. ASTM C 94 – Ready Mix Concrete

F. ASTM C 150 – Portland Cement

G. ASTM C 260 – Air-Entraining Admixtures for Concrete

H. ASTM C 309 – Liquid Membrane-Forming Compounds for Curing Concrete

I. ASTM C 494 – Chemical Admixtures for Concrete

J. ASTM D 1751 – Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Provide product data on joint filler, admixtures, and curing compounds.

C. If colored concrete is used, submit samples of the full range of color to Engineer. Color to be verified by Engineer.

D. Submit name, address and phone number of materials source.

E. Submit mix design per Section 03 30 00 – Cast-In-Place Concrete.

F. Submit test results as required by Section 01 45 11 – Testing, Inspections, Supervision.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with WSDOT Standard Specifications, Section 8-04 and 8-14.

B. Obtain cementitious materials from same source throughout the course of the project.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40°F, or surface is wet or frozen.

PART 2 – PRODUCTS

2.01 FORM MATERIALS

A. Form Materials: WSDOT Standard Specifications, Section 8-14.

B. Joint Filler: ASTM D 1751.

2.02 REINFORCEMENT

A. Reinforcing Steel and Wire Fabric: WSDOT Standard Specifications, Section 9-07.

2.03 CONCRETE MATERIALS

A. Refer to Section 03 30 00 – Cast-In-Place Concrete.

B. Fine and Coarse Mix Aggregates: ASTM C 33

C. Water: Potable, not detrimental to concrete.

D. Air Entrainment: ASTM C 260

2.04 ACCESSORIES

A. Curing Compound: Cur-to-Spec-MS colorless curing system or equal.

2.05 CONCRETE

A. Refer to Section 03 30 00 – Cast-In-Place Concrete, Class 4000A.

2.06 SOURCE QUALITY CONTROL AND TESTS

A. Submit proposed mix design of each class of concrete for review prior to commencement of work.

B. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.

C. Test samples in accordance with WSDOT Standard Specifications and Section 03 30 00 – Cast-In-Place Concrete.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify base conditions.

B. Verify compacted subgrade, granular base, and stabilized soil is acceptable and ready to support paving and imposed loads.

C. Verify gradients and elevations of base are correct.

D. Concrete placement shall not proceed until base conditions are correct.

3.02 SUBBASE

A. Refer to WSDOT Standard Specifications.

B. Place aggregate base materials to depths shown on Plans.

3.03 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

A. Place reinforcement as indicated.

B. Interrupt reinforcement at contraction and expansion joints.

C. See Plans for specified joint requirements in reinforced concrete slabs.

3.06 PLACING CONCRETE

A. Refer to WSDOT Standard Specifications and the following revisions to Section 8-14.3(3):

1. This section is supplemented with the following:

a. All sidewalks not located in driveway entrance areas shall be four inches in thickness. All concrete approaches located behind a depressed curb and gutter section shall be 6 inches in thickness.

b. Sidewalks shall be marked across the entire width every five feet and with preformed asphalt impregnated joint fillers 3/8-inch thick every 20 feet. Concrete sidewalk shall be cured in accordance with Section 5-05.3(13)A of the Standard Specifications. Application of the curing compound shall be in accordance with the manufacturer's recommendations. Failure to properly secure or seal the cement concrete sidewalk will require the Contractor to remove and replace the sidewalk section at his expense.

c. First-class workmanship and finish will be required on all portions of cement concrete sidewalk work. Quality of workmanship and finish will be evaluated continuously and will be based solely upon the judgment of the Engineer. If at any time it is found that quality is unacceptable, work shall be immediately stopped, and no additional sidewalk shall be placed. Cement concrete sidewalk which does not comply with the section details on the Plans, or in the Engineer's opinion does not demonstrate first-class workmanship and finish, shall be removed and replaced at the Contractor's expense. Should the Contractor's equipment or methods be unable to produce sidewalk meeting the requirements of the Details and Specifications, no further sidewalk construction will be allowed until corrections have been made to said equipment.

3.07 JOINTS

A. Place expansion joints at maximum 24-foot intervals, unless noted otherwise. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4-inch typical, unless noted otherwise.

C. Provide scored control joints at 6 feet maximum in all flatwork.

D. Provide keyed joints as indicated.

E. Provide keyed or expansion joints extending each direction from building or structure corners.

F. Coordinate joint patterns with adjoining doorways and geometry of the flatwork. Provide equal spacing of joints.

G. Provide additional joints as directed by Engineer.

3.08 FINISHING

A. Paving: Light broom.

B. Sidewalk Paving: Light broom, radius to 1/2-inch radius, and trowel joint edges.

C. Curbs: Light broom.

D. Direction of Texturing: Perpendicular to pavement direction. Verify with Engineer.

3.09 JOINT SEALING

A. Refer to WSDOT Standard Specifications.

3.10 TOLERANCES

A. Variation from True Elevation: Paving surface to be at grade and elevation shown.

B. Flatness: Maximum variation of 1/8-inch measured with 10-foot straightedge.

C. Straightness of Vertical Faces and Edges: Maximum variation of 1/4-inch measured with 10-foot straightedge.

D. Ponding: No ponding will be allowed. All surfaces shall drain.

3.11 FIELD QUALITY CONTROL

A. Refer to Section 01 45 11 – Testing, Inspections, Supervision.

B. Testing firm will take cylinders and perform slump and air entrainment tests in accordance with ACI 301.

C. One additional test cylinder will be taken during cold weather and cured on-site under same conditions as concrete it represents.

D. One slump test will be taken for each set of test cylinders taken.

E. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

A. Immediately after placement, protect cement concrete pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian or vehicular traffic over cement concrete pavement for 7 days minimum after finishing, until 75 percent design strength of concrete has been achieved.

C. See Section 03 30 00 – Cast-In-Place Concrete for additional requirements.

END OF SECTION 32 13 13

DIVISION 33 – UTILITIES

SECTION 33 05 16 – PRECAST STRUCTURAL CONCRETE

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish, fabricate, deliver, and install precast reinforced concrete structures, complete, as shown on the Plans and specified herein.

B. Work under this Section applies to the:

1. Influent Lift Station Wet Well and Valve Vault

2. Dewatering Building Drain Lift Station Wet Well and Valve Vault.

C. Work shall include precast wet well sections, valve vault sections, base sections, top slabs, access openings, blockouts, cast-in pipe penetrations, embedded items, access hatches, ladders, joint materials, grout, coatings where indicated, and all appurtenant work required for complete installation.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittals Procedure

B. Section 03 30 00 - Cast-In-Place Concrete

C. Section 05 50 11 - Miscellaneous Metals

D. Section 09 90 00 - Painting and Coating

E. Section 33 14 16 – Site Water Utility Distribution Piping

F. Section 33 31 13 – Site Sanitary Sewerage Gravity Piping

G. Division 40 – Process Interconnections

H. Division 43 – Process Gas and Liquid Handling Equipment

1.03 REFERENCE STANDARDS

A. ASTM C33 - Concrete Aggregates.

B. ASTM C150 - Portland Cement.

C. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections, and Precast Box Sections Using Rubber Gaskets.

D. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

E. ASTM C857 - Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.

F. ASTM C858 - Underground Precast Concrete Utility Structures.

G. ASTM A615 or ASTM A706 - Reinforcing Steel.

H. ASTM A497 - Welded Wire Reinforcement, where used.

I. ASTM E329 - Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 - Submittals Procedure, for general submittal requirements.

B. Product Data: Submit manufacturer literature and data for precast structures, joint materials, grout, access hatches, ladders, and coatings.

C. Shop Drawings: Submit detailed shop drawings for each precast structure. Shop drawings shall bear the stamp of a Professional Engineer licensed in the State of Washington and shall include, at a minimum, the following:

1. Overall interior and exterior dimensions and section weights.

2. Reinforcement details.

3. Access hatch frame and cover details.

4. Ladder details.

5. Dimensioned locations of openings, blockouts, pipe penetrations, lifting devices, inserts, and sumps, where applicable.

6. Joint details and details of accessories and embedded items.

D. Deferred Submittals: Bidder-designed precast structures shall be submitted to the authority having jurisdiction as deferred submittals after review by the Owner and Engineer, when required by the permitting authority.

1.05 QUALITY ASSURANCE

A. Structural Calculations: Submit complete design calculations showing the wet wells and valve vaults are adequate for the anticipated design conditions indicated on the Drawings and specified herein. Calculations shall address dead load, live load, impact load, buoyancy, earth loads, surcharge loads, and loads imposed during fabrication, transport, erection, and installation, as applicable.

B. Design calculations shall be prepared and stamped by a professional engineer licensed in the State of Washington. The same engineer shall stamp the shop drawings.

C. Product Certification: Submit manufacturer certification that precast concrete products comply with the specified standards and the approved design.

D. Testing Agency Qualifications: Agencies performing required testing shall be qualified in accordance with ASTM E329.

E. Manufacturer Qualifications: Company specializing in manufacture of precast concrete utility structures of similar size and complexity, with not less than three (3) years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store precast concrete units in accordance with manufacturer recommendations to prevent cracking, distortion, chipping, and other physical damage. Arrange units so identification markings remain visible.

B. Lift and support precast units only at designated lifting and support points shown on the approved shop drawings.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish factory-manufactured precast reinforced concrete wet wells and valve vaults as indicated on the Drawings.

B. Dimensions shall be as shown on the Drawings. Structures shall be rigid and suitable for below-grade service.

2.02 MATERIALS

A. Concrete aggregates shall conform to ASTM C33.

B. Cement shall conform to ASTM C150, Type I/II.

C. Reinforcing steel bars shall conform to ASTM A615 or ASTM A706, Grade 60.

D. Welded wire reinforcement, where used, shall conform to ASTM A497.

E. Joint gaskets and sealants shall be suitable for watertight below-grade precast construction.

F. Mortar or grout used for joints, repairs, and appurtenant work shall be non-shrink and suitable for structural precast concrete applications.

2.03 DESIGN REQUIREMENTS

A. Precast structures shall comply with ASTM C858, except as modified herein, and shall be designed using the minimum structural loading criteria of ASTM C857 together with the project-specific requirements shown on the Drawings.

B. Design loads shall consist of dead load, live load, impact load, buoyancy load, earth loads, and surcharge loads, as applicable to the installed condition.

C. Minimum wet well and vault lid live loading shall be H20 where structures are subject to vehicular loading, unless otherwise indicated on the Drawings.

D. Design shall also accommodate additional stresses imposed during plant fabrication, handling, transport, erection, and backfilling.

E. Blockouts, penetrations, and cast-in openings shall be as shown on the Drawings and approved shop drawings.

F. Coordinate design with process piping, pumps, equipment, and appurtenances installed in precast concrete vaults, wet wells, and structures.

2.04 FABRICATION

A. All precast structures shall be factory manufactured.

B. Mark each precast member or section to indicate its location in the structure, top surface orientation, and date of fabrication.

C. Access hatches, ladder inserts, pipe penetrations, and other embedded items indicated to be cast in place shall be installed at the time of casting.

D. Vault floor slopes, channels, and sumps shall be as shown on the Drawings. Where permitted by the Drawings or approved shop drawings, floor slope may be formed or placed after casting using non-shrink grout or mortar compatible with precast concrete.

E. Coordinate location of cast in place vault sumps and sump grating requirements as shown on drawings.

2.05 ACCESS HATCHES

A. Furnish and install access hatches at locations shown on the Drawings and as specified in Section 05 50 11, including wet well lids and valve vault tops.

B. Access hatches shall be H20 load rated and shall be installed in precast concrete members at the time of casting.

2.06 LADDERS

A. Furnish and install ladders where indicated on the Drawings.

B. Fabricated access ladders shall be installed in vaults after casting has been completed. Coordinate ladder fabrication and installation with Drawings and Section 05 50 11.

2.07 COATINGS

A. Provide interior and exterior coatings where indicated on the Drawings.

B. Coatings shall conform to Section 09 90 00.

2.08 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete products in accordance with applicable ASTM standards and the manufacturer's quality control program.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install precast wet wells and valve vaults in accordance with ASTM C891, except as otherwise indicated on the Drawings or specified herein.

B. Install structures level and plumb and with orientation and depth coordinated with connecting piping to minimize bends and deflections and to provide proper alignment of openings and penetrations.

C. Unless otherwise indicated, support structures on a 6” minimum level bed of crushed stone or gravel compacted to the same density as adjacent undisturbed earth or as otherwise specified for structure foundation preparation.

D. Install structures at the elevations shown on the Drawings.

3.02 JOINTING AND ASSEMBLY

A. Thoroughly clean surfaces of precast sections to be joined before setting.

B. Install gaskets, sealants, grout, and joint materials in accordance with manufacturer recommendations and the approved shop drawings.

C. Joints below grade shall be watertight to prevent groundwater infiltration.

D. Do not use sections with cracks, major chips, or other defects that impair structural adequacy or watertightness.

3.03 OPENINGS, CONNECTIONS, AND FINISH WORK

A. Cut and fit for pipes or pipe sleeves and seal penetrations as indicated on the Drawings and approved shop drawings.

B. Channel wet well floors and complete sump or floor slope work as shown on the Drawings. Grout used for sloping wet well sumps/floors shall be as specified in Section 03 30 00. Coordinate installation with wet well inserts where specified or called out on the drawings.

C. Grout lifting holes and other voids requiring closure before application of specified coatings.

D. Route vault access hatch and lid drains to location indicated on the drawings.

3.04 FIELD QUALITY CONTROL

A. A. Test installed structures in accordance with the General Requirements and as otherwise indicated in the Contract Documents.

B. Repair damaged units only when approved by the Engineer and only when the repair does not impair structural adequacy, durability, or watertightness.

END OF SECTION 33 05 16

SECTION 33 14 16 – SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes all work required to furnish and install water pipelines, bedding, fittings, and accessories.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 31 23 15 – Trench Excavation and Backfill

E. Section 32 11 11 – Aggregate Materials

F. Section 33 14 50 – Disinfection of Water Utility Distribution

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

B. ASTM D 1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

C. ASTM D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

D. ASTM D 1784 – Polyvinyl Chloride (PVC) Pipe, Schedule 40.

E. ASTM D 2467 – Socket Type Plastic Fittings, Schedule 80.

F. ASTM F 876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

G. Approval and certification of the National Sanitation Foundation.

H. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

I. AWWA C111 – Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

J. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit product data indicating pipe and pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Submit test results in accordance with Section 01 45 11 – Testing, Inspections, Supervision.

F. Submit record drawings. Record location of pipe runs, connections, cleanouts, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

A. Refer to WSDOT Standard Specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Refer to WSDOT Standard Specifications.

1.07 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.08 REGULATORY REQUIREMENTS

A. Conform to all applicable Local and State codes for materials and installation of the work of this section.

1.09 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated.

PART 2 – PRODUCTS

2.01 WATER PIPE

A. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of Section 9-30.1(1) of the Standard Specifications. Pipe joints shall be rubber gasket push-on type, “Tyton Joint,” or approved equal. Fittings shall be mechanical joint in accordance with Section 9-30.2(1) of the Standard Specifications.

Connection couplings for ductile iron pipe, either transition or straight, shall be compression bolted-sleeve type flexible couplings conforming to Section 9-30.2(7) of the Standard Specifications.

B. Polyvinyl Chloride (PVC) Pipe: PVC pipe (4-inch and larger) shall conform to the requirements of Section 9-30.1(5) of the Standard Specifications. PVC Pipe (over 12-inch) shall conform to the requirements of AWWA C 905 DR 25. Joints shall be rubber gasket push-on type with thickened bell. Fittings shall be mechanical joint and/or flanged in accordance with the Plans and Section 9-30.2(1) of the Standard Specifications.

Polyvinyl Chloride (PVC) Pipe (smaller than 4-inch): PVC Pipe, Schedule 80, solvent weld with integral bell conforming to ASTM D 2672. PVC Fittings, Schedule 80, solvent weld.

C. Crosslinked Polyethylene (PEX) Pipe: PEX pipe shall be copper tube size (CTS), meeting the requirements of ASTM F876/F877 and AWWA C904, and shall be ANSI/NSF Standard 14/61 certified.

D. High Density Polyethylene Pipe (HDPE) shall be extra high molecular weight, high density ethylene/hexane copolymer, PE 3408 polyethylene resin. The Standard Dimension Ratio (SDR) shall be SDR 11 for all pipe sizes. Pipe material shall be provided in straight segments for pipe 4 inches and larger in diameter, or coiled for pipe smaller than 4 inches in diameter

The manufacturer's certification shall state that the pipe was manufactured from one specific resin in compliance with these Specifications. The certificate shall state the specific resin used, its source, and list its compliance with these Specifications. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same specification from the same raw material.

The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other deleterious defects, and shall be identical in color, density, melt index, and other physical properties throughout.

During extrusion production, the HDPE pipe shall be continuously marked with durable printing including (but not limited to) nominal size, dimension ratio, pressure rating, type (trade name), material classification, certification base and date.

Polyethylene fittings shall comply with all appropriate requirements of AWWA C901, AWWA C906, or CSA B137.1. Socket type fittings shall comply with ASTM D2683. Butt fusion fittings shall comply with ASTM D3261. Electrofusion fittings shall comply with ASTM F1055. Fabricated fittings shall be designed and manufactured to be as strong, or stronger, than the pipe to which the fittings will be joined. Mechanical fittings shall be approved only after submission of appropriate test data and service histories indicating their acceptability for the intended service. In all cases, the Specifications and requirements for the fittings supplied shall comply with the appropriate sections of AWWA C901, AWWA C906, or CSA B137.1.

Pipe stiffeners shall be used in conjunction with mechanical restrained fittings. Pipe stiffeners shall be designed to support the interior wall of the HDPE and maintain pipe round. The stiffeners shall support the pipe's end and control the "necking down" reaction to the pressure applied during normal installation. The pipe stiffeners shall be formed for 304 or 316 stainless steel to the HDPE manufacturers published average inside diameter of the specific size and DR of the HDPE.

2.02 VALVES FOR WATER MAINS

A. Gate Valves: All gate valves size 3-inch through 10-inch shall be resilient seated gate valves conforming to the latest AWWA Standard C 509. Valves shall be Mueller, Dresser, Clow, or equal.

All gate valves 3-inch and larger shall have mechanical joint and/or flanged connections as shown on the Plans, non-rising stems, open counterclockwise, and shall be provided with a 2-inch square operating nut. Stuffing box shall be O-ring type.

Valves smaller than 3-inch shall have screw type end connections and be non-rising stem, screwed bonnet, solid wedge disc type having a minimum working pressure of 200 psi. Valves shall be Crane 438, Stockham 103, or equal.

B. Butterfly Valves: Butterfly valves shall be suitable for direct burial and shall conform to the latest AWWA Standard C 504. Valves shall have mechanical joint and/or flanged connections as shown on the Plans and shall be of the same size as the line on which they are located. Valve shafts shall be a one-piece unit extending full size through the valve disc and valve bearings, with minimum shaft diameter as specified in AWWA C 504 Class 250B. Valve operators shall be worm gear type, sealed, gasketed, and lubricated for underground service. All valves shall open counter-clockwise and shall be provided with a 2-inch operating nut, unless otherwise specified.

C. Valve Boxes: All buried valves shall be installed with valves boxes. The top section of the valve boxes shall be Olympic Foundry Model 940, or approved equal, 18 inches high. The bottom section shall be Olympic Foundry Model 940, or equal, 36 inches high; extension sections shall be Olympic Foundry Model 940, or equal, 12 inches high.

Where depth of bury to the centerline of the valve is more than five feet, provide operating nut extension stems to bring the operating nut to within 1-foot of finished grade, Olympic Foundry Part No. VSE, or equal.

Valve box covers for water mains shall have the word “WATER” cast into them, Olympic Foundry model 940, or approved equal. Valve box covers for sewer force mains shall be provided with specially marked with word “SEWER” cast into them.

2.03 BEDDING AND COVER MATERIALS

A. See typical trench section shown on the Plans.

B. Imported pipe zone bedding for flexible pipes shall be crushed surfacing top course meeting the requirements of Section 9-03.9(3) of the Standard Specifications and shall be placed and compacted in layers as designated by the Engineer.

C. Pipe zone bedding for rigid pipes shall be native or imported gravel bedding material meeting the requirements of Section 9-03.12(3) of the Standard Specifications, or as approved by the Engineer.

D. Imported select backfill, where directed by the Engineer, shall be crushed gravel, placed and compacted in layers. The crushed gravel backfill shall conform to crushed surfacing base course meeting the requirements of Section 9-03.9(3) of the Standard Specifications, or as approved by the Engineer.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that trench excavation base is ready to receive work and that all excavations, dimensions, and elevations are as indicated on the Plans.

3.02 PREPARATION

A. Hand trim excavations to required elevations.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

C. No existing valves shall be opened or closed without permission of the Contracting Agency.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 15 – Trench Excavation and Backfill for work of this section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION – PIPE

A. Refer to WSDOT Standard Specifications, Section 7-08.

B. Backfill in accordance with Section 31 23 15 – Trench Excavation and Backfill.

C. Flush pipeline in accordance with Section 7-09.3(24)A of the WSDOT Standard Specifications.

D. Unless otherwise shown on the Plans, provide a minimum of 4 feet and maximum of 8 feet earth cover over exterior buried piping systems and appurtenances conveying water.

E. All utility water pipe installed above ground shall be insulated. Utility water pipe insulation shall be 1" minimum thickness preformed water-repellent mineral wool with protective aluminum jacketing. Jacketing material shall be 0.024-inch thick smooth or embossed aluminum with integral interior moisture barrier. Seal all joints and secure jacketing with 1/2-inch aluminum bands at 8 inches on center. Install factory-formed fittings around all elbows, joints, valves, etc. Pipe insulation and protective aluminum jacketing shall be as manufactured by Johns Manville, or engineer approved equal. Heat trace shall be self-regulating cable, 3.4 w/ft output, NVENT (Raychem) XLE series or approved equal, suitable for use on a 120VAC power source. Provide all power connection, splice kit, tee, and end seal accessories required for a complete installation.

3.05 INSTALLATION – HDPE PIPE

A. Handling of HDPE Pipe: The manufacturer shall package the pipe in a manner designed to deliver the pipe to the project neatly, intact, and without physical damage. The transportation carrier shall use appropriate methods and intermittent checks to ensure the pipe is properly supported, stacked, and restrained during transport such that the pipe is not nicked, gouged, or physically damaged.

Pipe shall be stored on clean, level ground to prevent undue scratching or gouging of the pipe. If the pipe must be stacked for storage, such stacking shall be done in accordance with the pipe manufacturer's recommendations. The handling of pipe shall be done in such a manner that it is not damaged by dragging over sharp objects or cut by chokers or lifting equipment.

Sections of pipe having been discovered with cuts or gouges in excess of 10% of the wall thickness of the pipe shall be cut out and removed or the section of pipe rejected.

B. Joining HDPE Pipe: Sections of polyethylene pipe shall be joined into continuous lengths on the job site, above ground. The joining method shall be butt fusion and shall be performed in strict conformance with the pipe manufacturer's recommendations and ASTM-F-585. The butt fusion equipment used in the joining process shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 ºF and interface fusion pressure of 75 psi. Socket fusion, hot gas fusion, threading, or solvent-cement joints and epoxies are not permitted.

The Contractor shall be responsible to verify the fusion equipment is in good working order and the operator has been trained within the past twelve months. The fusion equipment shall be equipped with a Datalogger for recording heater temperature and fusion pressure.

All fused joints shall be watertight and shall have a tensile strength equal to that of the pipe. All joints are subject to acceptance by the Owner prior to insertion. All defective joints shall be cut out and replaced at no additional cost to the Town.

The Contractor shall remove all HDPE trimmings or other miscellaneous material from the inside of the pipe being butt fused prior to installation. All HDPE pipe, both new and existing, shall be adequately covered at the end of each working day to prevent entry by animals (i.e. rodents, cats, etc.). If pipe is left open and unattended by the Contractor, he shall be responsible for verifying no animals have entered the pipe and provide suitable evidence to the Engineer. The Contractor shall not continue work until such evidence is provided and accepted by the Engineer.

C. Backfill in accordance with Section 31 23 15 – Trench Excavation and Backfill.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 45 11 – Testing, Inspections, Supervision.

B. Request inspections prior to and immediately after placing bedding.

C. Pressure test water mains in accordance with WSDOT Standard Specifications, Section 7-09.3(23).

D. Pressure Testing HDPE Pipe:

1. Pressure testing shall be conducted in accordance with ASTM F2164, Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. The HDPE pipe shall be filled with water raised to test pressure and allowed to stabilize. The test pressure shall be 60 psi. The pipe shall pass if the final pressure is within 5% of the test pressure for 1 hour. For safety reasons, hydrostatic testing only will be used. The Contractor shall maintain a log of all pipe testing on the project. At a minimum, the testing log shall indicate the following parameters: Name of technician, time, test pressure, test duration, and whether the test passed or failed.

E. No leakage will be allowed.

F. If tests indicate work does not meet specified requirements, remove work, replace, and retest at no cost to Owner.

3.07 PROTECTION

A. Protect finished installation.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 14 16

SECTION 33 14 50 – DISINFECTION OF WATER UTILITY DISTRIBUTION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes all work required for disinfection of potable water distribution and transmission system.

B. Flushing of water lines.

C. Testing and reporting results.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 33 14 16 – Site Water Utility Distribution Piping

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation (WSDOT).

B. AWWA B300 – Standard for Hypochlorites.

C. AWWA B301 – Standard for Liquid Chlorine.

D. AWWA B302 – Standard for Ammonium Sulfate.

E. AWWA B303 – Standard for Sodium Chlorite.

F. AWWA C651 – Standards for Disinfecting Water Mains.

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Test Reports: Indicate results comparative to specified requirements.

C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

1.05 PROJECT RECORD DOCUMENTS

A. Documents and procedures shall be in accordance with WSDOT Standard Specifications, Section 7-09.3(24).

1.06 QUALITY ASSURANCE

A. Perform work in accordance with AWWA C651.

B. Testing Firm: Company specializing in the testing and examining of potable water systems approved by the State Washington.

C. Submit bacteriologist's signature and authority associated with testing.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable Local codes or regulation for performing the work of this Section.

PART 2 – PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite; AWWA B301, Liquid Chlorine; AWWA B302, Ammonium Sulfate; and AWWA B303, Sodium Chlorite.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that piping system and water well have been cleaned, inspected, and pressure tested.

B. Perform scheduling and disinfecting activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.02 EXECUTION

A. Provide and attach required equipment to perform the work of this Section.

B. Flush system to remove debris and contaminants.

C. Pressure test water distribution pipelines in accordance with Section 33 11 16 – Site Water Utility Distribution Piping. Repair leaks and re-test if necessary.

D. Inject treatment disinfectant. Introduce treatment into piping system.

E. Maintain disinfectant in system for 24 hours.

F. Flush, circulate, and clean until required cleanliness is achieved; use domestic water.

G. Replace permanent system devices removed for disinfection.

3.03 FIELD QUALITY CONTROL

A. Refer to Section 01 45 11 – Testing, Inspections, Supervision.

B. Test samples in accordance with AWWA C651.

END OF SECTION 33 14 50

SECTION 33 31 13 – SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes all work required to furnish and install gravity flow sanitary sewer piping, bedding, fittings, and accessories.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 45 11 – Testing, Inspections, Supervision

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 31 23 15 – Trench Excavation and Backfill

1.03 REFERENCE STANDARDS

A. The Standard Specifications for Road, Bridge, and Municipal Construction prepared by the Washington State Department of Transportation.

B. ANSI/ASTM D 1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregates Using 10 lb (4.54 Kg) Rammer and 18-inch (457 mm) Drop.

C. ANSI/ASTM D 3034 – Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

D. ASTM D 2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

F. ASTM D 1784 – Rigid CPVC Vinyl Compounds

G. ASTM D 2321 – Underground Installation of Thermoplastic Pipe (non-pressure applications)

H. ASTM F 493 – Solvent Cements for CPVC Pipe and Fitting

I. ASTM F 1668 – Procedures for Buried Plastic Pipe

J. ASTM F 2618 – Standard for Chlorinated Poly (Vinyl Chloride) Chemical Waste Drainage Systems

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product Data: Submit product data indicating pipe and pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Submit test results in accordance with Section 01 45 11 – Testing, Inspections, Supervision.

F. Submit record drawings. Record location of pipe runs, connections, cleanouts, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 DEFINITIONS

A. Bedding: Fill placed under, beside, and directly over pipe, prior to subsequent backfill operations.

1.06 REGULATORY REQUIREMENTS

A. Conform to all applicable Local and State codes for materials and installation of the work of this section.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated.

1.08 COORDINATION

A. Coordinate the work with termination of sanitary sewer connections outside building, connection to structures, and trenching.

PART 2 – PRODUCTS

2.01 SEWER PIPE MATERIALS

A. PVC Sewer Pipe

1. Conform to the requirements of Section 9-05.12(1) of the Standard Specifications.

2. PVC Fittings for PVC sewer pipe, such as tees, wyes, elbows, plugs, etc., shall be flexible gasket joint fittings acceptable for use and connection to PVC sewer pipe.

B. Detectable Marker Tape: Marker tape shall be a detectable type and shall be marked “SEWER,” and shall conform to Section 9-15.18 of the Standard Specifications.

2.02 BEDDING AND COVER MATERIALS

A. See Typical Trench Section shown on Plans and Section 31 23 15 – Trench Excavation and Backfill.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Verify that trench excavation base is ready to receive work and that excavations, dimensions, and elevations are as indicated on Drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 31 23 15 – Trench Excavation and Backfill for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION – PIPE

A. Refer to WSDOT Standard Specifications, Section 7-08.

B. Clean and test pipe in accordance with the Standard Specifications. Section 7-17.3(2)A of the Standard Specifications shall be supplemented with the following:

All sewers and appurtenances shall be cleaned and tested after backfilling. Both infiltration and exfiltration testing of the gravity sewer pipeline will be required. Deflection testing of the pipeline will also be required, 15 days after completion of backfill and compaction. Deflection testing shall be done by pulling a steel mandrel through the pipe. All testing shall be witnessed by the Owner and the Engineer.

3.05 INSTALLATION – SIDE SEWERS

A. Refer to WSDOT Standard Specifications, Section 7-08, for general pipe installation requirements.

B. Side sewers shall be constructed in accordance with Section 7-18 of the Standard Specifications. Section 7-18.3(1) shall be supplemented with the following:

1. Side sewers shall be the same diameter from the building to the main sanitary sewer unless an increase in size is necessary as a result of connecting additional structures to the side sewer. The minimum pipe diameter shall be 6 inches. Larger sizes, if required, will be as shown on the Plans.

2. Pipelines shall be installed at a minimum slope of 1/4-inch per foot whenever practicable. Flatter slopes will be allowed where it is impractical, due to the depth of the main sanitary sewer or structure features, to maintain the minimum slope of 1/4-inch per foot. Allowable minimum flatter slopes are 1/8-inch per foot for 4-inch through 6-inch diameter pipes, and 1/16-inch per foot for 8-inch diameter and larger pipe.

3. Cleanouts shall be of the same size and type of material as the side sewer in which they are installed. Provide side sewer cleanouts at the following minimum locations:

a. At the outside of the structure.

b. At intervals not to exceed 100 feet in straight pipe runs.

c. At the end of aggregate changes in direction exceeding 90 degrees.

d. At other locations deemed necessary by the Engineer.

4. Manholes may be used in lieu of cleanouts and shall be placed at intervals not to exceed 300 feet. If manholes are used, the minimum location requirements for cleanouts will apply except for spacing in straight runs. Manholes are required in side sewers 8-inches in diameter and larger and shall be placed at all changes in horizontal alignment or vertical grade.

5. Grade bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness and imported pipe bedding. Remove hard spots which would prevent a uniform thickness of bedding. Before laying each section of pipe, check the grade and correct any irregularities found. The trench bottom shall form a continuous and uniform bearing and support for the pipe. Carefully place imported pipe bedding material around the pipe so the pipe barrel is completely supported and no voids or uncompacted areas are left beneath the pipe. Place remaining backfill material in uniform layers and compact each layer, taking care not to damage the side sewer.

6. Imported pipe bedding will be required. The trench shall be backfilled with imported pipe bedding from 3 inches below the bottom of the pipe to 3 inches above the top of the pipe.

7. Side sewers shall not be backfilled prior to inspection by the Engineer. The completed sewer shall provide a continuous connection from the structure to the main sanitary sewer and shall show no signs of possible leakage. All deficiencies shall be corrected as directed by the Engineer prior to the backfilling and acceptance of the side sewer.

C. Side sewers shall be tested up to the property line, or nearest joint thereto, simultaneously with the sanitary sewer main, for both the required infiltration and exfiltration tests. The Contractor shall provide all fittings necessary to test the side sewers as outlined in Section 7-17.3(4) of the Standard Specifications. That segment of the side sewer between the property line and the building structure may be tested with the main line, or separately, and the Contractor may install a tee fitting at the property line to facilitate testing. All necessary test fittings shall be removed and all openings plugged at the completion of the test.

3.06 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under the provisions of Section 01 45 11 – Testing, Inspections, Supervision.

B. Request inspections prior to and immediately after placing bedding.

C. Refer to WSDOT Standard Specifications.

D. Perform leakage tests in accordance with Section 7-17.3(2) of the WSDOT Standard Specifications.

E. If tests indicate work does not meet specified requirements, remove work, replace, and retest at no cost to Owner.

3.07 PROTECTION

A. Protect finished installation.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 31 13

DIVISION 40 – PROCESS INTERCONNECTIONS

SECTION 40 01 11 – PROCESS SYSTEM TESTING

PART 1 – GENERAL

1.01 GENERAL

A. Refer to Section 01 45 11 – Testing, Inspections, Supervision for general requirements.

B. It is the intent of the Owner to have a complete and operable facility. All facilities shall be tested during construction and/or during the Contractor's operational period to insure the facility is complete, is operable to the satisfaction of the Engineer, and meets the design performance requirements.

C. General test requirements are specified in this section. Additional test requirements may be specified in other divisions of these Specifications and in other sections of this division. In submitting a proposal for this work the Contractor agrees that any specified performance requirements, testing procedures, leakage allowances, or other requirements are fair and practicable and that he guarantees to secure the results specified.

D. All costs for power, gas, water, labor and material (including chemicals) required for testing shall be borne by the Contractor.

E. Defective items revealed by the testing shall be removed and replaced or otherwise corrected as directed by the Engineer, and the system again subjected to the same test. All cost for power, gas, water, labor and material (including chemicals) required for re-testing shall be borne by the Contractor.

1.02 TESTING

A. Equipment and Systems: All equipment and systems shall be tested by the Contractor under the review of the Engineer, to verify the proper operation thereof in accordance with these Specifications.

B. Pipe and Fittings: After completion of the installation, the Contractor shall test all piping and pipe work as specified herein. The Contractor shall furnish all material, equipment and labor for testing and re-testing the piping systems.

Each system may be tested as a unit or in sections, but each complete system shall successfully meet the requirements specified herein before acceptance by the Engineer. Should any defects appear in the pipe or fittings, the necessary repairs shall be made and the line re-tested until it shall meet the requirements.

The Contractor shall take all necessary precautions to prevent any joints from withdrawing while the pipelines and their appurtenances are being tested, and he shall, at his own expense, repair any damage to the pipes and their appurtenances or to any other structures resulting from or caused by these tests.

C. Water Main Piping: All pressure water main piping shall be hydrostatically pressure tested in accordance with Section 7-09.3(23) of the WSDOT Standard Specifications supplemented with the following:

Replace the first sentence with:

All water mains and appurtenances shall be tested under a hydrostatic pressure of 150 psi.

D. Refer to Section 33 11 16 – Site Water Utility Distribution Piping, for additional pipe testing requirements.

E. Connections to the existing water mains shall be tested following the testing of all new piping per the above test requirements. The Engineer shall be notified immediately if any leaks are detected in existing piping outside of the project limits. The Contractor shall be responsible for repairing and retesting leaks at the connection points.

F. Process Piping: All pressure process piping shall be hydrostatically tested in accordance with the requirements for water main piping, unless otherwise specified.

G. Gravity Pipe Lines (PVC, DI, cast iron, and concrete drain and sewer): All gravity pipe lines shall be tested in accordance with Section 33 31 11 – Site Sanitary Utility Sewerage Piping.

H. Building Plumbing: All plumbing shall be tested in accordance with applicable state and local codes and as specified.

1. Before final connections are made to main sewers and prior to backfilling of trenches or connecting of fixtures, all drainage piping shall be hydrostatically tested. All openings shall be capped or plugged and the system filled with water to the top of a vertical section of pipe ten feet high, temporarily connected to the highest point of the underground system. The water shall be allowed to stand in the system for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drained from the system. Final connections shall then be made to the main sewers and the trenches backfilled.

2. Before any fixtures are connected, all water piping shall be hydrostatically tested and proven tight at a pressure of not less than 150 psig at the lowest point in the system. The pressure shall be maintained for at least one hour for inspection. If the pressure remains constant and no leaks are found during the period of inspection, the water shall be drained from the systems and final connections shall then be made to the fixtures.

3. Should any leaks, flaws or defective materials or equipment be found during the testing operations, such leaks or flaws shall be corrected and effective materials and equipment replaced. After corrections have been made, tests shall be repeated until all systems are proven tight. All corrections and re-tests shall be made without additional cost to the Owner.

I. Water Containing Structures: Water retaining structures shall be tested for water-tightness and repaired in accordance with Section 03 30 00 – Cast-In-Place Concrete.

END OF SECTION 40 01 11

SECTION 40 02 11 – PROCESS SYSTEM BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this section describes the materials and methods common to all sections of Division 26 – Electrical and Division 40 – Process Interconnections. Mechanical materials specified under other sections of Division 40 – Process Interconnections shall meet the requirements of this section, unless part of larger factory assembled equipment.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 05 50 11 – Miscellaneous Metals

D. Division 26 – Electrical

E. Division 40 – Process Interconnections

1.03 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

B. American Society of Mechanical Engineers (ASME):

1. ANSI/ASME B1.20.1 – Pipe Threads, General Purpose (Inch).

2. ANSI/ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings.

C. Anti-Friction Bearing Manufacturers Association (AFBMA).

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Contractor shall investigate the capacity and space requirements of the proposed equipment before submitting shop drawings.

C. Submit product data for all materials and equipment used on the project, including drawings, catalog-cuts, etc. Indicate model numbers and specified options and accessories that are proposed for use.

D. Fees and permits: Obtain required permits necessary to execute the work under this division. See Section 01 11 50 – Special Provisions and Section 01 45 11 – Testing, Inspections, Supervision for additional information related to permits.

E. The Contractor shall verify all actual conditions and shall refer to architectural, structural, piping and electrical Plans. Rerouting of pipe from that shown on construction Plans due to interferences, types of material and equipment submitted that are different from those originally shown on Plans and/or specified, Contractor's convenience for construction that does not compromise functional intent, etc., will be permitted only after review by the Engineer. In this case, shop drawings shall be submitted consisting of plan and section views clearly showing all pipe, fittings, valves, pipe hangers, supports, and mechanical and electrical equipment. Shop drawings shall be completely dimensioned and labeled, and reviewed and approved by the Engineer prior to beginning construction.

1.05 QUALITY ASSURANCE

A. All pressure vessels, safety devices, and appurtenances shall comply with standards of and bear stamp of ASME.

B. All electrical devices and wiring shall comply with standards of NEC. All devices shall be UL listed and so identified.

1.06 PRODUCT HANDLING

A. Contractor is responsible for protection of all material, equipment and apparatus provided under this section from all damage both in storage and when installed, until final acceptance.

B. Provide temporary storage facilities for material and equipment. Provide heat for equipment storage as recommended by manufacturer.

C. Any material, equipment or apparatus damaged because of improper storage or protection will be rejected and any repair or replacement will be at no cost to the Owner.

1.07 JOB CONDITIONS

A. Electrical requirements

1. Starters: Except for starters specifically included in Division 26 – Electrical, furnish all starters for motors in this division.

2. Disconnects. Except for disconnects factory mounted on mechanical equipment, or in combination with starters, motor disconnects are specified in Division 26 – Electrical.

3. Power wiring: Except for factory wiring on mechanical equipment, power wiring is specified in Division 26 – Electrical. Equipment devices and wiring shall comply with NEC.

4. Provide controls, controllers, transformers, and switches required by the work of this section.

5. Factory wired assemblies and panels shall be prewired to numbered terminal strips for connection to field wiring.

6. Provide disconnect switch for each control circuit connection to prewired assemblies and control panels.

7. Provide approved wiring diagrams for work as specified in Division 26 – Electrical and Division 40 – Process Interconnections.

8. Provide weatherproof devices and installations for outdoor applications or as specified in Division 26 – Electrical.

9. Install wiring as specified in Division 26 – Electrical.

PART 2 – PRODUCTS

2.01 FLANGES AND PIPE THREADS

A. Unless otherwise noted, all flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI/ASME B16.1, Class 125. All pipe threads shall conform in dimension and limits of size to ANSI/ASME B1.20.1, Class 2 NPT, Taper Pipe Thread.

B. Grooved pipe connections shall be Victaulic or equal.

2.02 GUARDS

A. All exposed moving parts shall be provided with guards in accordance with the requirements of the Occupational Safety and Health Act. Guards shall be fabricated of 12-gauge steel and expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and shall be designed to be readily removable.

2.03 BEARINGS

A. Unless otherwise specified, all equipment bearings shall be oil or grease lubricated, ball or roller anti-friction type of standard manufacture. Bearings shall be conservatively designed to withstand all stresses of the service specified. Each bearing, except when otherwise noted, shall be rated in accordance with the latest revisions of AFBMA Methods of Evaluating Load Ratings of Ball and Roller Bearings for one of the following classes of B-10 rating life: Class M1, 8,000 hours of operation; Class M2, 20,000 hours of operation; Class M3, 50,000 hours of operation; of Class M4, 100,000 hours of operation. Bearings shall be not less than Class M3 unless otherwise noted.

B. All grease lubricated bearings, except those specified to be factory lubricated for life, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be the standard hydraulic type.

C. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60˚C and shall be equipped with a filler pipe and an external level gauge.

2.04 V-BELT DRIVES

A. Unless otherwise noted, V-belt drives shall be Dodge Dyna-V belts with matching Dyna-V sheaves and Dodge Tapper-lock bushes, Woods' Super-V belts with matching Sure-Grip sheaves and Woods' Sure-Grip bushes, or Eaton Hy-T wedge with Eaton High Torque QD sheaves, or equal.

B. Pulleys and bushes shall be dynamically and statically balanced. Pulleys shall be separately mounted on their bushes by means of three pull-up grub or cap tightening screws. Bushes shall be key-seated to the driver shaft.

C. Belts shall be selected for not less than 150 percent of rated driver horsepower and, where 2 pulley sizes are specified, shall be capable of operating with either set of pulleys. Belts shall be of the anti-static type where flame-proof equipment is specified.

D. Each belt-driven unit shall be furnished with a complete set of spare belts. Spare belts shall be properly identified as to design, horsepower speed, length, pulley size and use and shall be packaged and stored as specified for spare parts storage and marking. Where 2 or more belts are involved, matched sets of belts shall be provided.

2.05 SHAFT COUPLINGS

A. General: Shaft couplings for direct connected electric motor-driven equipment 1/2 HP or larger shall be Type I or Type II as specified herein. Type I couplings shall be utilized for all reversing drives, positive displacement pumps or high torque loads. Type II couplings shall be employed on all other drives. Where requirements of the equipment dictate specialized features, the manufacturer may substitute the coupling normally supplied for the service. All couplings shall be non-lubricated type, designed for not less than 50,000 hours operating life.

Coupling sizes shall be as recommended by the manufacturer for the specific application, considering horsepower, speed of rotation and type of service. The use of couplings as specified herein shall not relieve the Contractor of his responsibility for precision alignment of all driver-driven units.

B. Type I couplings: Positive displacement pumps and reversing equipment or equipment where sudden torque reversals may be expected shall be connected to their drivers by flexible couplings which can accommodate angular misalignment, and end float, and which cushion shock loads and dampen torsional vibrations. The flexible member shall consist of a built-up elastic member comprised of synthetic rubber, duck and wire reinforcement with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap screws and the flanges shall be attached to the stub fit. There shall be no metal-to-metal contact between the driver and driven unit.

C. Type II couplings shall be employed on normal torque, non-reversing applications. Type II couplings shall be of the pin and preloaded neoprene cylinder type, designed to accommodate shock loading, vibration and shaft misalignment or offset. Stub shafts shall be connected through collar or round flanges, firmly keyed to their shafts, to neoprene cylinders held to individual flanges by through pins. Couplings with cylinders pinned to both coupling flanges will not be acceptable.

2.06 ELECTRICAL DEVICES

A. All electrical motors, starters, controls and other devices furnished with mechanical systems shall be UL labeled or furnished with other certification satisfactory to the administrative authority. In addition, electrical components shall comply with Division 26 – Electrical of these specifications. See diagrams on electrical plans.

2.07 EQUIPMENT PADS

A. All mechanical equipment shall be installed on a concrete pad with a minimum height above the floor of 4 inches. Details for a typical concrete pad are included in the Plans.

2.08 PIPE SUPPORTS

A. Pipe supports shall conform to the Manufacturers Standardization Society (MSS) Standard Practice Manual SP-69 (Selection and Application); SP-58 (Materials, Design and Manufacture); SP-89 (Fabrication and Installation Practices). MSS Standard Practice Manual SP-90 contains Guidelines on Terminology for Pipe Hangers and Supports.

B. Pipe supports shall be manufactured by competent and reputable companies experienced in the application of pipe hanger and support systems. Pipe supports shall be constructed of hot-dip galvanized steel or stainless steel, as called out on the Plans. Fasteners and/or anchor bolts shall be stainless steel.

C. Pipe stands shall be supported by Schedule 40 pipe of the diameter required for adequate support, or as shown on the Plans, whichever is more conservative. Pipe stands shall include either pre-manufactured or shop formed pipe cradles and base plates. Pipe supported on stands that are greater than 4 feet 0 inches above the floor level (CL) shall have hold-down straps or clamps.

D. All piping shall be properly supported by anchors, brackets or hangers. Supports shall be placed at a maximum spacing of 10 feet, unless otherwise specified and at all other locations needed to facilitate take-down of pipe and equipment removal. Maximum horizontal pipe hanger and support spacing shall not exceed distances as herein specified, as shown on the Plans, or as shown on Table 3 of MSS SP-69.

E. Overhead piping shall be supported with acceptable hangers as shown on the Plans, of the standard manufacture of a reputable manufacturer. Fastening of supports to structural components shall be in accordance with methods approved by the structural component manufacturer and the Engineer. Provisions shall be made to distribute pipe loads over the proper, structural components of the building with approved fastening devices.

F. The following pipe support equipment and practices will not be acceptable:

1. Use of wire or perforated straps.

2. Hanging from unreinforced roof decks or any portion of structure not approved by the engineer.

3. Hanging from grating or other removable walkways or structural components.

PART 3 – EXECUTION

3.01 GENERAL

A. All equipment shall be installed in accordance with manufacturer's recommendations unless specifically directed by the Engineer otherwise.

3.02 PLANS

A. Plans are diagrammatic and show the general design, arrangement and extent of the systems. Do not scale Plans for roughing in measurements, nor use as shop drawings. Make field measurements and prepare shop drawings as required. Coordinate work with shop drawings of other specification divisions.

3.03 SLEEVES AND INSERTS

A. Contractor shall be responsible for locating and installing sleeves, inserts and supports, including pipe supports, as required during the construction.

3.04 REVISIONS DURING INSTALLATION

A. Contractor shall be responsible for making minor changes in the piping, ductwork and equipment locations due to structural obstructions or conflicts with work specified in other divisions.

3.05 EQUIPMENT INSTALLATION

A. Belt driven equipment: Mount with motors on common steel base with adjustable motor mount.

B. Locate and install sleeves, inserts and supports as required at proper stage of construction.

C. Install equipment so nameplates are visible.

D. Basis for equipment and material installation is the published recommendations of manufacturer. Submit such recommendations for review.

3.06 TESTING BUILDING SYSTEMS

A. Contractor shall notify Engineer at least one week prior to testing. Provide tests specified. Provide all test equipment including test pumps, gauges, instruments, and other equipment required. Pressure gauges used shall be graduated in increments suitable for magnitude of test pressures specified and shall have range of approximately twice test pressure. Use only gauges and instruments recently calibrated.

B. Where testing is specified, completed installation shall comply with designated requirements. Provide replacement materials as may be required to accomplish this compliance.

C. Piping

1. Remove from systems, during testing, all equipment which would be damaged by test pressure. Replace removed equipment after testing. Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system. Correct leaks by remaking joints with new material; makeshift remedies will not be permitted. Test time will be accrued only while full test pressure is applied to system.

2. Do all testing before backfilling, concealing, insulating, or painting.

3. Tolerance shall be no pressure drop, except that due to temperature change or as specified in test procedure. Perform tests in accordance with requirements in Section 40 01 11 – Process System Testing and Section 40 20 11 – Process Piping.

D. Valves

1. Test valve bonnets for tightness. Test operate valves from closed-to-open-to-closed position while valve is under piping test pressure.

2. Test automatic valves by actuating from fully open to fully closed.

E. Piping Specialties

1. Test pressure gauges for accurate indication.

2. Test all other piping specialties for proper operation.

F. Hangers and supports: With systems in normal operation, test hangers, supports and rods to ensure they are plumb and supporting proper share of load. Additionally, support, as required, systems and equipment that sway, crawl, or vibrate.

G. Other materials and equipment: Test other materials and equipment as specified, as recommended by equipment manufacturer, or directed to assure they are complete, operable and ready for use.

3.07 CLEANING

A. During progress of work, keep premises reasonably free of debris, cuttings and waste material. Upon completion of work, and at other times as directed, remove all such debris from premises.

B. Clean equipment and materials. Remove foreign materials including dirt, grease, splashed paint and plaster. Restore to original condition any damaged finish.

C. Clean, by flushing, interior of water piping after pressure testing. Upon completion of flushing, completely drain systems at all low points; remove, clean and replace all strainer baskets and refill systems.

3.08 STARTUP PROCEDURES

A. General: Provide material and labor required to perform startup of each respective item of equipment and system prior to beginning of test, adjust and balance procedures. Provide information and assistance required, cooperate with test, adjust and balance services.

1. Comply strictly with manufacturer's specified procedures in starting up mechanical equipment.

B. Bearings:

1. Inspect for cleanliness, clean and remove foreign materials.

2. Verify alignment.

3. Replace defective bearings and those which run rough or noisy.

4. Lubricate as necessary and in accord with manufacturer's recommendations.

C. Drives:

1. Adjust tension in V-belt drives and adjust varipitch sheaves and drives for proper equipment speed.

2. Adjust drives for alignment of sheaves and V-belts.

3. Clean, remove foreign materials before starting operation.

D. Motors:

1. Check each motor for amperage comparison to nameplate value at full equipment load.

2. Correct conditions which produce excessive current flow and which exist due to equipment malfunction.

3. Check for proper rotation before running equipment.

E. Pumps:

1. Check mechanical seals for cleanliness and adjustment before running pump.

2. Inspect shaft sleeves for scoring.

3. Inspect mechanical faces, chambers and seal rings, replace if defective.

4. Verify that piping system is free of dirt and scale before circulating liquid through the pump.

F. Control Valves:

1. Inspect both hand-operated and automatic control valves, clean bonnets and stems.

2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.

3. Replace packing in valves to retain maximum adjustment after system is judged complete.

4. Replace packing on any valve which continues to leak.

5. Remove and repair bonnets which leak.

6. Coat packing gland threads and valve stems with a surface preparation of “Moly-Cote” or “Fel-Pro” after cleaning.

G. Verify that control valve seats are free from foreign material and are properly positioned for intended service.

H. Tighten flanges and couplings after system has been placed in operation.

1. Replace all gaskets which show any sign of leakage after tightening.

I. Inspect screwed and welded joints for leakage.

1. Promptly remake each joint which appears to be faulty, do not wait for rust to form.

2. Clean threads on both parts, apply compound and remake joints.

3. Cut out welded joint and replace with new section of pipe and new couplings.

J. After system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems to assure system is free of foreign materials.

K. Remove rust, scale and foreign materials from equipment and renew any defaced surfaces.

L. Inspect fan wheels for clearance and balance.

1. Provide factory-authorized personnel for adjustment when needed.

M. Check each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.

N. Inspect each pressure gauge, thermometer, meter, and process instrument for calibration.

1. Replace items which are defaced, broken, or which read incorrectly.

O. Repair damaged insulation.

P. Vent gases trapped in any part of systems.

1. Verify that liquids are drained from all parts of gas or air systems.

Q. Check piping for leaks at every joint, and at every connection, using “Leak-Tek” or other approved compound.

3.09 CONTINUING ADJUSTMENTS

A. Provide such periodic continuing adjustment services as necessary to ensure proper functioning of mechanical systems after occupancy of the project and for warranty period stated in Section 1-05.10(1) of Section 01 11 50 – Special Provisions.

END OF SECTION 40 02 11

SECTION 40 03 11 – PROCESS SYSTEM CODING AND IDENTIFICATION

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work covered by this section consists of furnishing all labor, materials, and equipment required for the color coding and identification of mechanical and electrical systems as shown on the Plans and as specified in Division 26 – Electrical and Division 40 – Process Interconnections, including but not limited to the following:

1. Identification of all exposed piping, panels, equipment cabinets, and mechanical equipment.

2. Locating devices for concealed controls and equipment and buried piping and utilities.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 09 90 00 – Painting and Coating

C. Division 26 – Electrical

D. Division 40 – Process Interconnections

1.03 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).

B. American Society of Mechanical Engineers (ASME).

C. National Electric Code (NEC).

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. The Contractor shall submit product data and samples of legend markers, valve tags, and plastic plates, indicating all materials and colors prior to painting and installation.

PART 2 – PRODUCTS

2.01 COLOR CODING OF PIPELINES

A. Piping shall be painted in colors as selected by the Owner to match existing piping color coding system where applicable, or colors as specified herein for the pipe service.

B. Piping shall be painted and color coded in accordance with Section 09 90 00 – Painting and Coating, and the Washington State Department of Ecology (WSDOE) recommended piping color code scheme. A portion of the WSDOE color code scheme, along with corresponding Sherwin Williams 4000 series industrial color numbers, is provided in the following schedule:

Service	Color	Sherwin Williams No.
Potable Water	Dark Blue	4086 Safety Blue
Non-Potable Water	Jade Green	4070 Generator Green
Sludge	Brown	4001 Bolt Brown
Polymer Solution	Tan	4003 Pallet Tan

2.02 PIPING IDENTIFICATION SYSTEMS

A. General: All exposed piping, and appurtenances shall conform to an identification system. Items shall be considered exposed unless buried or concealed in the construction. Insulated pipe shall be identified as required for the carrier pipe. The Contractor shall obtain the Engineer's approval of all color coding and identification prior to application.

B. Standards: Identification markers for piping shall have background and legend colors as specified herein. All identification shall be in accordance with the following standards unless otherwise specified or directed by the Engineer:

1. Background: White
2. Legend: Black

C. Manufacturers:

1. Subject to compliance with the specifications, equivalent products by the following manufacturers are acceptable:

a. Brady Worldwide, Inc., 6555 W. Good Hope Rd, Milwaukee, WI 53223; Phone: (800) 250-3082; Fax: (800) 292-2289; www.bradyid.com.

b. Seton Identification Products, 20 Thompson Rd., Branford, CT 06405; Phone: (800) 571-2596; Fax: (800) 345-7819; www.seton.com.

D. Identification Materials:

1. Legend markers: Provide self-sticking vinyl labels or Snap-On type markers with legends and/or symbols with borders as approved by the Engineer. Arrows indicating direction of flow shall point away from legend. If flow may be both ways, use double-headed arrows.

2. Self-sticking labels shall be equal to Brady material number B-946, suitable for temperature ranges of -40 ºF to 180 ºF (-4 ºC to 82 ºC). Snap-on type markers shall be equal to Brady material number B-915. Pipe markers for stainless steel air piping shall be equal to Brady material/number B-689 with maximum service temperature of 248˚F or higher.

3. Self-sticking markers for piping 3 inches in diameter to 6 inches in diameter shall be Brady Style 1, piping less than 3 inches in diameter shall be Brady Style 4 and piping 8 inches in diameter and larger shall be Brady Style 1HV. Snap-on or strap-on markers shall be in a style appropriate for the size of piping.

2.03 EQUIPMENT IDENTIFICATION SYSTEMS

A. Plastic-laminated plates for equipment identification shall be made of engraving stock, melamine plastic laminate punched for mechanical fasteners. Thickness shall be 1/16 inch for signs up to 20 square inches and 1/8 inch for larger signs. Engraved legend shall be white letters on black face. Use self-tapping stainless-steel screws or no. 10 stainless steel machine screws with nuts, flat washers, and lock washers.

B. Refer to Division 26 – Electrical for additional electrical equipment and cabinet identification material requirements.

2.04 VALVE, GATE AND INSTRUMENT TAGS

A. Provide Type 304 stainless steel, 1-1/2-inch diameter steel tags with eyelet holes for all valves, gates and instruments identified in the applicable schedules on the Plans. Tag lettering shall be engraved or stamped with the applicable valve, gate or instrument number per the Plan schedules. Printed or written lettering shall not be acceptable. Provide Brady B-919 tags, Seton Item 08212 tags, or equivalent products manufactured by others.

B. Provide stainless steel chains and fasteners to securely mount tag to valve, gate, or instrument.

PART 3 – EXECUTION

3.01 PIPING SYSTEMS

A. All exposed piping in rooms, vaults, and outdoors shall be painted in accordance with paragraph 2.01 of this section.

B. Identify piping by legend markers and arrows to show pipe contents and direction of flow. Legend markers and arrows shall be provided at the following locations:

1. Behind every access door or panel.

2. At each valve.

3. At each “T” joint.

4. At each point of entry or exit where pipe passes through walls, floors or ceilings.

5. At intervals not exceeding 50 feet apart on long runs.

6. On overhead piping, provide legends on the lower portion of the pipe where view from the floor is unobstructed.

C. The number and location of the markers shall be sufficient to readily identify each pipe along its entire exposed length. In general, legend markers and directional arrow markers shall be placed at the inlets and outlets of equipment, both sides of valves, into and out of walls, at each riser and tee joint, and at 10-foot intervals of long runs, or as determined by the Engineer.

D. Where two or more pipes run parallel, markings shall be applied in the same relative location on each side so as to be in vertical or horizontal linearity as the case may be, and present a workmanlike appearance.

E. Where numerous fittings occur close together, as in manifolds and around equipment, the above Specifications as to location of markers shall be modified as indicated by good judgment to prevent a cluttered appearance.

3.02 EQUIPMENT

A. All equipment, including apparatus cabinets, switchgear, panels, dampers, fans, pumps, etc., shall have identification consisting of plastic-laminated plates as approved by the Engineer showing equipment number, nature, and function of each piece of equipment, and a designation corresponding to control diagrams and directions. Voltages shall be indicated where applicable.

1. Plates shall be on outside of boxes, cases, motor control centers, control panels, etc.; except panel cabinets, which shall be identified on the inside of the doors unless otherwise indicated.

2. Fans and air supply units shall be identified with the following information after the fan systems have been adjusted:

Unit Number	Running Current
Fan RPM	Starting Current
Static Pressure	CFM
Motor HP	Direction of Fan Rotation

B. Refer to Division 26 - Electrical for additional electrical equipment and cabinet identification requirements.

3.03 VALVE, GATE AND INSTRUMENT TAGS AND DIRECTORY

A. All interior and exterior valves, gates and instruments identified on the applicable Plan schedules shall be provided with identification tags as specified above.

1. Provide a printed directory of valves, gates and instruments giving tag symbol, location, use, type, size, pressure rating and manufacturer's name. Five copies shall be delivered to the Engineer for transmittal to the Owner.

2. Tag lettering shall correspond to the label indicated on the Plan schedules, or as coordinated by the Engineer.

3. Tags shall be securely mounted to the specified item with stainless steel chain, and fasteners.

4. The location and type of mounting or attachment shall not affect the operation of the valve, gate or instrument in any way.

END OF SECTION 40 03 11

SECTION 40 20 11 – PROCESS PIPING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work included in this section consists of furnishing and installing pipe, fittings and related items, complete as specified herein and as indicated on the Plans. Special pipe, fittings or installation requirements may be specified with the particular equipment involved.

B. Any pipe and fitting materials in substantial contact with drinking water shall be NSF 61 approved.

C. Not all the pipe and fittings listed in this section are used in this project.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 09 90 00 – Painting and Coating

C. Section 33 11 16 – Site Water Utility Distribution Piping

D. Division 40 – Process Interconnections

1.03 REFERENCE STANDARDS

A. American Water Works Association (AWWA).

B. American National Standards Institute (ANSI).

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Product data in the form of drawings, catalog cuts, etc. shall be submitted for all items proposed for use on the project.

C. Submit shop drawings of all exposed interior piping. Detailed shop drawings showing plan and field-verified dimensional information; connection types, sizes and locations; valves and fittings; and all required appurtenances, including piping support types, sizes and locations, shall be submitted for review and approval for all fabricated DI, PVC, and stainless steel piping systems specified and shown on the plans.

PART 2 – PRODUCTS

2.01 PIPE MATERIALS

A. General:

1. All pipe and fittings shall be of the type and size indicated on the Plans. All pipe of each type shall be of the same manufacturer.

2. Pipe shall be grooved piping system, flanged, mechanical joint or push-on joint as required or as specified. Unless otherwise shown on the Plans or specified herein, the following shall apply:

a. Mechanical joint with mechanical restraints shall be used for all buried ductile iron fittings.

b. Fused connections shall be used on all buried HDPE pipe.

c. Regarding joint restraint, it is the intent of the Plans and Specifications to use “Grip Ring” or “Meg-a-Lug” type mechanical restraints in lieu of thrust blocking.

d. All exposed piping shall be flanged or Victaulic type grooved pipe connections.

3. Ductile iron and cast iron pipe and fittings in submerged applications shall be fusion-bonded epoxy coated inside and out per AWWA C116 and AWWA C213. Field welded or cut materials shall be field coated with two coats of epoxy per AWWA C210.

4. Exposed pipe and fittings shall be coated as specified in Section 09 90 00 – Painting and Coating.

5. Glass lining, where required, shall be vitreous inorganic material applied to internal pipe surfaces that have been prepared by blasting. The lining shall be applied in a minimum of two coats, separately applied and fired at a maturing temperature of approximately 1,400 °F to fuse the vitreous and inorganic materials to the metal surface. The entire finish coating shall be a minimum of 10 mils dry film thickness. Glass lining shall be as manufactured by US Pipe Fabrication, or approved equal.

B. Ductile Iron Pipe and Fittings: Ductile iron pipe shall conform to the provisions of ANSI A21.51/AWWA C151. Ductile iron pipe thickness shall conform to provisions of ANSI M1.50. All pipe and fittings shall be cement-mortar lined and seal coated in accordance with ANSI 21.4. Thickness class for all pipe and fittings shall be as follows:

Use	Required Class
General Use, 12-inch Diameter and Smaller	52
General Use, Over 12-inch Diameter	50 or 51
Threaded Taps	52
Threading, for Threaded Flanges	53

Ductile iron pipe shall be furnished with mechanical joints, flanged joints or push-on joints as specified and shall conform to ANSI A21.11/AWWA C111 and ANSI A21.15/AWWA C115. Flanges shall conform to ANSI B16.1, Class 125 drilling.

Fittings shall be ductile or cast iron unless otherwise shown on the Plans, and shall conform to ANSI 21.53/AWWA C153 or ANSI A21.10/AWWA C110 and ANSI A21.11/AWWA C111. Where taps are shown on fittings, tapping bosses shall be provided.

Where restrained joints are required, provide locked-type mechanical retainer glands with mechanical joint fittings, “Grip Ring,” “Meg-a-Lug” or approved equal. Push-on joints shall be supplied with “Field-Lok” gaskets or approved equal.

Grooved pipe shall conform to AWWA Standard C606, or the coupling manufacturer's recommendations for rigid grooving dimensions. Flexible grooves shall be provided as necessary for settlement or expansion only where shown on the Plans or as approved by the Engineer.

C. Cast Iron Pipe and Fittings: Cast iron pipe shall conform to the current provisions of the ANSI A21.1, A21.7, and A21.10. Cast iron pipe shall be Thickness Class 22.

Flanged pipe shall be flanged in accordance with ANSI B-16.1, with Class 125 drilling and full face gaskets. Rubber gasket joints shall conform to ANSI 21.11.

All cast iron pipe shall be cement lined and seal coated in accordance with ANSI 21.4, unless specified otherwise.

D. High Density Polyethylene (HDPE) Pipe and Fittings: See Section 33 11 16 – Site Water Utility Distribution Piping for HDPE material specifications.

E. Cross-Linked Polyethylene (PEX) Pipe and Fittings: PEX pipe shall conform to ASTM F876/F877 and AWWA C904. PEX pipe fittings/adapters shall be brass crimp type fittings, compatible with the piping used.

F. PVC Pipe and Fittings: Unless otherwise shown, PVC pipe shall conform to the requirements of the “Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch for Water,” (AWWA C900) or “Standard for Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 inches through 36 inches,” (AWWA C905) and shall be furnished in cast iron equivalent outside diameters. Pipe shall be Pressure Class 150. Pipe fittings shall be Class 150 cast iron, mortar lined, and meet the requirements of the “American National Standard for Gray Iron and Ductile Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids,” (ANSI 21.10/AWWA C110) and the “American National Standard for Cement Mortar Lining for Ductile Iron and Gray Iron Pipe and Fittings for Water,” (ANSI A21.4/AWWA C104), respectively.

Unless otherwise shown or specified, PVC pressure pipe 3 inches and smaller shall be Schedule 80, Type 1 and shall conform to ASTM D 1785. Buried pressure fittings 3 inches and smaller may be rubber gasket or solvent weld joints. Fittings shall conform to ASTM D 2467, Schedule 80 for solvent weld joints. Threaded joints shall be provided where connecting to unions, valves and where future disassembly may be required.

PVC gravity sewer pipe shall be as specified in Section 33 31 11 – Site Sanitary Utility Sewerage Piping.

G. Fabricated PVC pipe and fittings, where called for on the plans, shall be constructed of schedule 80 material conforming to ASTM D1785 and ASTM D2467. Solvent cements shall conform to ASTM D2564. Pipe and fittings shall be fabricated and assembled by the manufacturer in lengths and configurations as shown on the plans to allow for easy installation in the field and future disconnection. Field assembly of fabricated PVC pipe and fittings will not be allowed. Provide flanged or socket weld joints where shown on the plans and approved by the Engineer. Fabricated PVC pipe and fittings shall be as manufactured by Spears® Manufacturing Company, or Engineer approved equal, and meet the following minimum performance criteria:

1. Dimensional Conformance

    a. All sockets shall have an interference fit with applicable pipe.

    b. All change-of-direction fittings shall not exceed ± 1° variance in the specified angle.

    c. All standard stock fittings shall have specified cut lengths for all components in order to maintain dimensional consistence. Maximum overall deviations shall not exceed ±1/2-inch for fittings to 12 inches, ±1-inch for sizes 14 inches and larger and all wyes.

2. Structural Conformance

a. Burst Pressure - representative sample of fittings shall be tested to a minimum of two times the applicable maximum internal pressure rating in accordance with ASTM D1599.

b. Fabricated fittings shall meet the applicable requirements of the following Quality Assurance testing in accordance with the designated Standard Test Method:

TEST STANDARD	TEST METHOD
Burst Test	ASTM D1599
Lap Shear Test	CAN/CSA B181.2
Joint Delamination	Spears® Test
Air-Gap Spark Test	Spears® Test
Fusion Bond Tensile Test	CAN/CSA B181.2
Fusion Bond Deflection	CAN/CSA B181.2
Branch Deflection Test (Bending)	CAN/CSA B181.2/ ASTM F1866

c. All DWV and Low Pressure fittings shall additionally meet the requirements of ASTM F1866 and the applicable portions of CAN/CSA B181.2.

d. Fittings designed for use at pressures in excess of 130 psi may be reinforced where reinforcement has been deemed necessary for proper fitting performance.

e. Fiberglass reinforced fittings shall be free of visible chips, cracks, foreign inclusions, air bubbles, lack of fill-out, delamination and sharp obtrusive surfaces as defined in ASTM D2563.

3. All fittings or product packaging shall be labeled with the manufacturer's name, part number, size, description, product code and ASTM Specification Number, if applicable.

4. All pipe, fittings and complete fabricated assemblies shall be meet the pressure ratings and flow conditions as shown on the plans or specified herein.

H. Copper Pipe and Fittings: Copper pipe shall conform to ASTM B-88, Type K. Fittings shall be wrought copper solder joint fittings conforming to ASA-B16.22.

Copper piping shall be silver-soldered with minimum 45 percent silver content; Handy Harman, Easy-Flow, or equal with flux as recommended by manufacturer. In making screwed joints, tin male threads with soft solder. Epco or equal dielectric unions shall be used for all connections between copper and ferrous piping.

I. Brass Pipe and Fittings: Brass pipe and fittings shall conform to ASTM B43 and AWWA C800.

J. Galvanized Steel Pipe and Fittings: Galvanized steel pipe and fittings shall be provided in accordance with ASTM A120, ASTM A197, or ASTM A47. The minimum wall thickness shall be Schedule 40. 2-1/2 inch or smaller pipe shall have screwed couplings. 3-inch and larger pipe shall have grooved mechanical joint couplings or flanged couplings. Galvanized steel pipe and fittings shall not be used for potable water applications.

K. Welded Steel Pipe and Fittings: Welded steel pipe and fittings shall be manufactured of steel plate of thickness not less than 3/16-inch for pipes 12 inches in diameter and smaller, and not less than 1/4-inch for larger sizes. Pipe materials, fabrication, and shop testing of straight pipe shall conform to the requirements of the AWWA C200. All outlets, 4-inch diameter and larger, shall be provided with reinforcing designed for the water working pressure specified or shown. Shop drawings of all welded steel pipe and fittings 8 inches in diameter and larger shall be furnished in accordance with Section 01 33 00 – Submittals Procedure. Steel pipe and fittings shall be lined with cement mortar in accordance with AWWA C205

L. Stainless Steel Pipe and Fittings:

1. Stainless steel pipe for water or sewer applications shall be Type 304/304L, Sch. 40S, conforming to the requirements of AWWA C220. Stainless steel fittings shall be Type 304/304L, conforming to the requirements of AWWA C226, with flanged connections meeting the requirements of AWWA C228, Class SD minimum thickness, or grooved pipe connections conforming to AWWA C606.

2. Stainless steel pipe for process air applications shall be Type 304/304L, Schedule 10S per ASTM A312 or ASTM A778 with flange connections where shown on the Plans. Fittings shall be per ASTM A403 or A774 and flange connections shall be provided with stainless steel plate flanges welded to the pipe with 150 lb class drilling holes.

3. Stainless steel pipe and/or fittings passing through concrete structures shall be Type 316/316L and the exterior surfaces shall receive two coats of epoxy after fabrication, in accordance with AWWA C210. Fittings located within sewage wet wells shall also be Type 316/316L. Flange bolt isolation kits shall be provided in all locations where stainless steel piping is connected to dissimilar piping materials.

M. Miscellaneous Pipe and Fittings: Where indicated on the Plans, the Contractor shall furnish and install miscellaneous piping and fittings as required for the service indicated. All material shall be first class and suitable for the indicated service.

1.	Wrought Steel Pipe, Black and Galvanized	ASTM A120
2.	Wrought Iron Pipe, Black	ASTM A72
3.	Cast Iron Screwed Fittings	ASTM A126
4.	Malleable Iron Screwed Fittings	ASTM A197
5.	Welding Fittings, Black	ASTM A234

2.02 GASKETS

A. Gaskets for mechanical or push-on joints shall be rubber, conforming to ANSI A21.11/AWWA C111. Gaskets for mechanical joints used in air service piping shall be EPDM for temperatures up to 300˚F.

B. Gaskets for flanged fittings shall be full-face neoprene rubber. Flanged gaskets for air service piping shall be EPDM for temperatures up to 300˚F.

C. Gasket material shall be suitable for use in sewage, irrigation, or potable water lines.

D. Bolt-through mechanical joint restraint gaskets (foster adapters) shall be used for connection of mechanical joint fittings and valves where indicated on the Plans or where approved by the Engineer. Foster adapters shall be as manufactured by Infact Corporation, constructed of epoxy coated ASTM A536, Grade 65-45-12 ductile iron with gasket material as specified in paragraph A above. Bolts and nuts shall be as specified in paragraph 2.03.

2.03 BOLTS AND NUTS

A. Flange bolts and nuts connecting pipe and fittings shall be of a similar material to the pipe and fittings being connected, unless otherwise specified. At a minimum, carbon steel bolts shall be in accordance with ASTM A307 grade B, and stainless steel bolts shall be in accordance with ASTM F593. Stainless steel or “blue-coated” bolts and nuts, Romac R-blue, Tripac 2000, or Engineer approved equal shall be used for all underground connections. Stainless steel bolts and nuts shall be used for all submerged connections. Flange bolt isolation kits shall be provided where dissimilar materials are being connected. Length, size, and strength of bolts and nuts shall be in accordance with applicable AWWA standards.

2.04 COUPLINGS

A. Grooved Mechanical Joint Couplings: Grooved-end couplings shall conform to the requirements of AWWA C606 and shall be suitable for the pipe being joined. Depending on the piping requirements, the coupling shall either provide a rigid joint or controlled pipe movement (for deflection and/or thermal expansion). Pipe grooving shall be in accordance with the coupling manufacturer's specifications. Couplings shall be Victaulic System by Victaulic Company or approved equal.

B. Flexible Pipe Couplings: Flexible couplings are required on all pipes less than 36-inch diameter, wherever a pipeline penetrates a structure or, where shown on the Plans. Couplings shall be of the gasketed bolted sleeve type with diameter to properly fit the pipe, as manufactured by Romac, Smith-Blair, Dresser, or approved equal. Couplings shall be assembled on the job in a manner to insure permanently tight joints under all reasonable conditions of expansion and contraction. Gasket and O-ring material shall be as recommended by manufacturer for intended service. Buried or submerged couplings shall be provided with Type 316 stainless steel bolts and nuts. Couplings shall have an epoxy coating finish. Couplings for stainless steel piping shall be fabricated of Type 316 stainless steel and be provided with stainless steel bolts.

C. Threaded Joints: Threaded joints shall be made of clean-cut threads to standard lengths, so made up that joint leaves not more than three threads exposed. Apply approved pipe compound to male threads only.

2.05 BURIED PIPE RESTRAINT

A. “Grip Ring” or “Meg-a-Lug” type mechanical restraints shall be used for buried pipe restraint in lieu of thrust blocking, unless otherwise specified.

2.06 AIR PIPING EXPANSION JOINTS

A. Provide molded EPDM spherical expansion joint fittings with optional Type 304 stainless steel flanges and hardware suitable for use in high temperature blower applications up to 300^{o}F, 20 PSI or less, General Rubber Style 1101, Proco Style 240 or Engineer approved equal at all locations shown on the Plans. Size as called out on Plans. For outdoor installations expansion joints shall be provided with manufacturers optional UV and weather resistant protective coating.

2.07 MODULAR/MECHANICAL SEAL AND SLEEVE

A. Penetration Seals: Use a modular, mechanical seal, consisting of rubber links shaped to continuously fill the annular space between the pipe and the wall opening. Link-Seal® or Engineer approved equal, pressure plates shall be molded of glass reinforced nylon. Hardware shall be 316 Stainless Steel. Elastomer shall be identified with coloration of permanent marking for positive field identification. Each link shall have permanent identification of the size and manufacturer's name molded into the pressure plate and sealing element. PSI-Thunderline / Link-Seal® Modular Seal as manufactured by Pipeline Seal & Insulator, Inc., Houston, TX, or Engineer approved equal. Required seal elastomer materials shall be as follows and suitable for the application:

1. Typical application: Model “C” EPDM seal

2. High temperature application (air piping): Model “T” Silicone seal

B. Sleeves and Wall Openings:

1. For pipe diameters, up to 18-inch:

a. Install molded non-metallic high density polyethylene (HDPE) or PVC sleeves with integral hollow, molded water-stop ring larger than the outside diameter of the sleeve itself. Century-Line® Sleeve as manufactured by Pipeline Seal& Insulator, Inc, Houston, TX., or Engineer approved equal. See Plans for installation details.

2. For pipe diameters, greater than 18-inch:

a. Sleeve is not allowed. Provide spool with continuously welded wall collar as shown on Plans.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

A. Pipe shall be installed in accordance with good trade practice and in strict accordance with the manufacturer's instructions. The methods employed in handling and placing of pipe, fittings and equipment shall be such as to ensure that after installation and testing they are in good condition.

B. Refer to Section 33 13 00 – Disinfecting of Water Utility Distribution, for installation of piping outside of building limits.

3.02 INTERIOR AND EXTERIOR PIPING INSTALLATION

A. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals as shown on the Plans.

B. When entering or leaving structures with buried piping less than 36-inch diameter, install a flexible pipe coupling when shown on the Plans.

C. When entering or leaving structures with pipe 36 inches or larger, install a joint within 2 feet of point where pipe enters or leaves structure and install second joint not more than 6 feet nor less than 4 feet from first joint.

D. Install expansion devices as necessary to allow expansion and contraction movement.

E. Underground Pipe Anchorage:

1. Provide restrained joints unless shown or specified otherwise to prevent movement of piping caused by forces in or on buried piping tees, wye branches, plugs, valves or bends as shown and/or specified.

2. Place concrete blocking when shown or specified so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints.

3. Provide bearing area of concrete in accordance with drawing detail.

4. Restrain pipe joints within minimum distance from restrained fitting joints as shown below.

Pipe Size (inches)	Length of Restrained Pipe (feet) Each Side of Bend or Valve*		
	Fitting Angle		Plug or Valve
	0° to 45°	46° to 90°	
6	5	12	46
8	7	16	60
10	8	20	71
12	9	22	78
16	11	27	98
18	12	30	110
20	14	34	121
24	16	38	138
Listed lengths are based on a test pressure of 100 psi. To compute the length for a different test pressure, use the following equation: Length = (Test Pressure/100) x (Table Value)			

F. Install insulating components where dissimilar metals are joined together.

G. Underground Pipe Locating System:

1. Install over all underground piping and utility systems installed per this contract.

2. For pipes greater than 6-inch diameter install magnetic tape or tracing wire 6 inches above the top of the pipe center.

3. For pipes less than 6-inch diameter, install warning tape 24 inches above the top of pipe.

H. All above ground pipe shall be secured in place by use of pipe restraints or other approved methods as shown on the Plans.

Provide floor stands, wall bracing, concrete piers, hangers, brackets, clamps, etc., for all pipes running near the floors or near walls and which can be properly supported or suspended by the walls or floors. The weight of above ground piping shall be carried independently of equipment. Pipelines near concrete or masonry walls may also be hung by hangers carried from wall brackets at a higher level than pipe. Hanging of any pipe from another is prohibited. Special hangers and supports shall be as shown on Standard Details or on the Plans. See Section 40 02 11 – Process System Basic Materials and Methods for additional pipe support requirements.

I. Equipment shall be so positioned and aligned that no strain shall be induced within the equipment during or subsequent to the installation of pipe work.

J. In erecting the pipe, a sufficient number of screwed unions or flanged joints shall be used to allow any sections or run of pipe to be disconnected without taking down adjacent runs.

K. Flexible couplings shall be installed where shown on the Plans and at such other points as may be required for ease of installation or removal of the pipe, subject to approval of the Engineer. Flexible couplings shall be of the positive lock type where necessary to prevent separation of pipe due to internal pressures.

3.03 INSTALLATION AT CONCRETE WALLS AND FITTINGS

A. Whenever a pipeline of any material terminates at, or extends through, a structural wall or sump, the Contractor shall install, in advance of pouring of concrete, the fittings or special casting required for the particular installation.

B. Ductile iron or steel pipe to be cast in water bearing walls, or more than two feet below grade, shall have seep rings.

END OF SECTION 40 20 11

SECTION 40 20 12 – PROCESS VALVES AND GATES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall furnish and install all valves, gates, and accessories as shown and specified. In addition, valve-operating units, stem extensions and other accessories shall be furnished and installed by the Contractor where shown, or where required in the opinion of the Engineer, to provide for convenience in operation. Where buried valves are indicated, the Contractor shall furnish and install valve boxes to grade. All valves and gates shall be new and of current manufacture. All exposed shut-off valves, 6 inch and larger, shall have operators with position indicators. Where buried valves call for position indicators, they shall be provided with valve boxes and covers containing position indicators.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 09 90 00 – Painting and Coating

C. Division 22 – Plumbing

D. Division 26 – Electrical

E. Section 33 14 16 – Site Water Utility Distribution Piping

F. Section 40 20 11 – Process Piping

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit product data for all valves, operators, and controls (if applicable), including wiring diagrams and electrical data.

1.04 APPLICABILITY

A. Inclusion of products in this Specification section does not necessarily indicate that the particular product is installed for this project. If the product is used, it shall be furnished in accordance with this specification section unless otherwise approved by the Engineer.

B. Costs for all valves, gates, operators and appurtenances shall be included in the cost of applicable bid items as described in 1-09.3 of Section 01 11 50 – Special Provisions, complete and operable, and painted in accordance with Section 09 90 00 – Painting and Coating.

C. Valves and gates in piping systems shall be adequately supported to prevent their load from being imposed on any operating equipment, and in accordance with best practices to resist dislocation when adjacent piping or support is removed for maintenance, and to prevent injury to operation or maintenance personnel.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The flanges of valves may be raised or plain faced. Flanges of valves for water working pressures of 175 psi or less shall be faced and drilled to 125-pound American Standard template. Flanges of valves for water working pressures greater than 175 psi shall be faced and drilled to 250-pound American Standard template. Valves installed in grooved (Victaulic™) piping system shall be groove joint, or may be flanged with adapter flanges.

B. Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water working pressure.

C. Unless otherwise specified, all interior bronze parts of valves except gate valve stems shall conform to the requirements of the “Specification for Composition Bronze or Ounce Metal Castings,” (ASTM B62). Gate valve stems shall be of bronze containing not more than 5 percent zinc nor more than 2 percent aluminum, and shall have a minimum tensile strength of 60,000 psi, a yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured.

D. Except where otherwise provided, the exterior surfaces of all submerged valves shall be epoxy coated with 8 mils of “Scotchcoat” or Miccrow 650 or approved equal.

E. Where designated, certain valves and gates shall be furnished with electric operators provided by the valve or gate manufacturer. All operators of a given type shall be furnished by the same manufacturer. Where these operators are supplied by different valve manufacturers, the Contractor shall coordinate their operator selections to provide uniformity of each type of electric operator. Electric operators shall be of the same manufacturer to the extent possible, and shall conform to the applicable section of these Specifications. Care must be taken to assure that electric operators and controls for valves located in Classified Areas conform to restrictions to be explosion proof if required.

F. Valves and operators in particular locations may require a combination of units, sensors, limit switches and controls specified in this or in other divisions of these Specifications. It shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals. Care must be taken to assure that electric operators and controls for valves located in Classified Areas conform to restrictions to be explosion proof if required.

G. Unless specifically required to be equipped with other types of operators, all valves with centerline more than 6 feet above the operating floor shall be equipped with chain wheels and operating chains. Each chain wheel operated valve shall be equipped with a chain guide which will permit rapid handling of the operating chain without “gagging” of the wheel. A hanging bracket or hook shall be provided on an adjacent wall or structure to provide for securing the chain out of the walking area.

2.02 PVC VALVES

A. PVC Ball Valves: PVC ball valves shall be rated for 200 psi service with lever handle, EPDM seals and threaded double union body (True Union) that can be removed from the line without disengaging the end connections. PVC ball valves shall be Chemtrol® (NIBCO), Spears®, Asahi® or approved equal.

B. PVC Ball Check Valves: PVC ball check valves shall be rated for 200 psi service with PVC body, union-type end connections. PVC ball check valves shall be Chemtrol® (NIBCO), Spears®, Asahi® or approved equal.

C. All ball valves and ball check valves used for sodium hypochlorite solution and chemical solution piping shall be PVC.

D. Valve seal materials shall be suitable for use with specified chemicals. Viton® seals shall be used at all sodium hypochlorite and CIP valves.

E. Provide vented style ball valves for sodium hypochlorite service.

F. Socket weld PVC valves may be used in lieu of true union valves if unions are installed on either side of the valve for easy removal.

2.03 GATE VALVES

A. Gate valves 2-1/2 inches and under with screwed ends shall be 200 pound. WOG with bronze body and trim, union bonnet, rising stem and solid wedge disc. NIBCO, Crane, or equal.

B. Gate valves 3 inches and over with flanged ends shall be 200 pound WOG with iron body, bronze trim, resilient seal or resilient wedge gate valves, non-rising stem, by Clow, or equal. Valves located below the operating surface shall have Engineer approved extension stems with operating nut located at approximately the walking level, and stem mounted in suitable stem guides.

C. Gate valves for buried service shall be installed per Section 2.07 below.

2.04 BUTTERFLY VALVES

A. Butterfly valves shall be rubber-seated, conforming to the requirements of the latest version of AWWA C504, Class 250B, as specified herein. Valves shall be short-bodied with either flanged, mechanical joint, or grooved ends as called out on the plans. Flanged end connections shall have ANSI/ASME B16.1 Class 125 drilling. Mechanical joint ends shall be in accordance with ANSI/AWWA C111. Valve manufacturer shall have a minimum of five years of experience producing AWWA butterfly valves. Valves shall be as manufactured by Henry Pratt (Mueller Co.), DeZURIK®, Val-Matic, or Engineer approved equal.

B. Valve bodies and discs shall be constructed of ASTM A536, Grade 65-45-12 ductile iron. The valve disc shall be solid lens-shaped or profiled design to minimize pressure drop and line turbulence. Valve seat material shall be Buna-N or EPDM, bonded to valve body or disc. Seat retaining materials shall be constructed of stainless steel. Valve shafts shall be one-piece design extending completely through the valve disc and bearings, and shall be constructed of Type 316 stainless steel. Shaft seals shall be designed for use of standard v-type packing. All interior and exterior valve surfaces, except rubber seat and stainless steel materials, shall be epoxy coated.

C. Manual actuators for butterfly valves shall be of the worm gear of traveling-nut type with position indicator and hand wheel, chain wheel, or 2-inch operating nut, as shown on the plans. Actuators shall be of the self-locking type, designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be equipped with mechanical stop-limiting devices to prevent over-travel of the disc in the open and closed positions. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lb. on the operator.

Manual actuators shall be tested and capable of withstanding the torques specified in AWWA C504. The contractor shall submit certified copies of reports describing the procedures and test results for each actuator model provided. Refer to Section 33 11 16 – Site Water Utility Distribution Piping, for actuator requirements for buried service valves. Actuator housings and operators shall be epoxy coated.

2.05 WAFTER/LUG BUTTERFLY VALVES

A. Wafer/lug butterfly valves shall be resilient-seated, conforming to the requirements of MSS SP-67 and MSS SP-25, and meeting the intent of AWWA C504, Class 250B, as specified herein, and suitable for both on/off and throttling service. Valves shall be compatible with ANSI/ASME B16.1 Class 125 drilling and supplied with a minimum of four alignment holes. Lug style valves shall be used where indicated on the Plans. Valve manufacturer shall have a minimum of five (5) years of experience producing wafer/lug butterfly valves. Valves shall be as manufactured by Centerline (Crane®), Henry Pratt, DeZURIK®, or Engineer approved equal.

B. Valve bodies shall be constructed of ASTM A536, Grade 65-45-12 ductile iron, and shall be epoxy coated. The valve seat design shall be full-body, isolating the valve body and stem from the flow. Valve seat material shall be EPDM, suitable for operating temperatures up to 275^0F. The valve disk shall be constructed of Type 316 stainless steel. Valve shafts and taper pins shall be constructed of Type 416 stainless steel. Shaft bushings shall be PTFE and shaft seal shall be o-ring type.

C. Manual actuators for wafer/lug butterfly valves shall be lever or gear type as called out on the Plans. Lever operators shall allow for the valve to be held in any intermediate position and locked in 10 positions. Geared actuators shall be worm gear type with position indicator and hand wheel or chain wheel operator as indicated on the Plans. Actuator housings and operators shall be epoxy coated.

D. Valves shall be supplied with electric and pneumatic actuators where specified or indicated on the Plans.

2.06 PLUG VALVES (STANDARD, 3-WAY, V-PORT)

A. General: All plug valves of the same type and size shall be furnished by single manufacturer. Valves shall be of the non-lubricated, eccentric-type with screwed, flanged or mechanical joint ends as shown on the Plans or as required for the application. Plug valves shall conform to the requirements of the latest edition of AWWA C517, as specified herein. Valves shall be as manufactured by Henry Pratt, DeZURIK®, Val-Matic, or Engineer approved equal.

B. Construction: Bodies shall be constructed of ASTM A536, Grade 65-45-12 ductile iron. Seats in 3 inch and larger valves shall have a welded-in overlay of high nickel content on all surfaces contacting the plug face. Valves shall have permanently lubricated stainless steel bearings in the upper and lower plug stem journals. All valves shall be of the bolted bonnet design. All 4 inch and larger valves shall be designed so that they can be repacked without removing the bonnet, and the packing shall be adjustable. All exposed nuts, bolts, springs and washers shall be zinc plated. Flanged valves shall be faced and drilled to ANSI 125/150-pound standard. Valves in piping runs using grooved pipe couplers may have grooved ends, or may utilize adapters for coupling to adjacent piping.

C. Plugs: Standard and 3-way plug valves shall have resilient faced plugs. Resilient plug facings shall be of neoprene suitable for use with sewage, sludge or scum. Plugs shall be constructed of ATSM A536, Grade 65-45-12 ductile iron. Port areas of valves shall be at least 80 percent of full pipe area. Valves installed in sludge lines shall be installed with the seat on the upstream side. Three-way plug valves shall have separate screw-type operators for unseating and seating the plug, and for turning the plug while unseated.

D. Operators: Plug Valves shall have lever or gear actuators and tee wrenches, extension stems, floor stands, chain-wheels, etc., as required or indicated on the Plans. Valves 4 inches or less may have lever or t-wrench operators. Valves greater than 4 inches shall have gear operators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position, and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts and washers shall be zinc plated. Type and position of operators shall be approved by the Engineer for each valve. Chain hangers shall be mounted near all valves with chain wheel operators to allow hanging the chains out of operating areas.

E. Valves and gear actuators for buried or submerged service shall have seals on all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

F. Valves installed in grooved (Victaulic™) piping systems shall preferably be grooved joint, but may be flanged with adapter flanges to piping with approval of Engineer.

G. Valves shall be supplied with actuators where specified or indicated on the Plans.

2.07 VALVE BOXES FOR BURIED SERVICE

A. All buried valves shall be installed within valve boxes. The top section of the valve boxes shall be Olympic Foundry Model 940, or approved equal, 18 inches high. The bottom section shall be Olympic Foundry Model 940, or equal, 36 inches high; extension sections shall be Olympic Foundry Model 940, or equal, 12 inches high.

B. Where depth of bury to the centerline of the valve is more than five feet, provide operating nut extension stems to bring the operating nut to within 1-foot of finished grade, Olympic Foundry Part No. VSE, or equal.

C. Valve box covers for water mains shall have the word "WATER" cast into them, Olympic Foundry model 940, or approved equal. Valve box covers for sewer force mains shall be provided with specially marked with word "SEWER" cast into them.

2.08 SWING CHECK VALVES

A. Swing check valves shall be swing-type, external lever check valves. The valve shall have a cast iron body and disc, bronze seat, rubber seat ring and 303 stainless steel shaft. The external lever shall have an adjustable weight. Swing check valves shall be Mueller, Kennedy, Victaulic or equal.

B. Where called for on the Plans, including electrical or instrumentation Plans, valves shall be equipped with position sensor switches. Switches shall be mounted on approved stainless steel brackets located to not interfere with valve or adjacent equipment operation. Switches shall be micro-limit switches DPST or proximity switches. Switch actuation shall be for “non-closed” position indication.

2.09 SILENT CHECK VALVES

A. Silent check valves shall be globe style with 125 pound flanges, consisting of a heavy cast iron body, bronze seat, bronze disc and stainless steel spring. APCO Series 600, Cla-Val Series 581, or approved equal. The valve disc must be center divided at both ends with an integral shaft and shall be spring loaded for guaranteed silent shut-off operation. Valves springs shall be helical or conical and the seat and disc shall be field replaceable for ease of maintenance.

B. Silent check valves shall be capable of silent operation when installed in vertical or horizontal positions with flow either up or down. The flow area through the valve body shall be equal to or greater than the cross-sectional area of the equivalent pipe size.

2.10 PRESSURE REGULATING VALVES

A. Pressure-regulating valves shall be full line size indicated with adjustable range to suit the installation. Valves shall have a stainless-steel seat ring and cast bronze body.

2.11 BACKFLOW PREVENTER VALVES

A. Backflow preventer valves 2 inches and larger shall be reduced pressure type approved by the State of Washington Department of Health. Units shall be complete with inlet and outlet valves. Maximum pressure loss through the valve shall be 10 psi. Valve must be equipped with resilient seated shutoff valves and test cocks. Drain lines with air gaps shall be provided with piping to a floor sump. Backflow preventer valves shall be Clayton Model RP or equal.

B. Backflow preventer valves smaller than 2 inches shall be a reduced pressure-principle device meeting State of Washington Department of Health requirements. Backflow preventer valves shall have bronze bodies and bronze trim, 175 psi working pressure, 300 psi hydrostatic test pressure, and screwed ends. Backflow preventer valves shall be supplied with isolation gate valves of the same size as the RPBP valve, test cocks and threaded drain connection. Size shall be as shown on the Plans.

2.12 SOLENOID VALVES

A. Solenoid valves shall be the same size as the lines in which they are installed and shall be suitable for the intended service. All solenoid valves shall have explosion-proof, watertight enclosures. Provide manual operator where indicated on the Plans. Provide strainer ahead of all solenoid valves as specified and recommended by the manufacturer. Valves shall be suitable for operation on a 120V, 60 Hz, AC, single-phase power supply. Valves shall be as manufactured by Magnatrol Valve Corporation, or Engineer approved equal.

2.13 DUCKBILL CHECK VALVES

A. Duckbill check valve shall be as manufactured by Red Valve Co., ProCo, or equal. Valve shall be one-piece elastomer and shall utilize Type 316 stainless steel components, where applicable.

2.14 CORPORATION STOPS

A. Unless otherwise shown, corporation stops shall be Ford Meter Box Company, James Jones, Mueller or equal.

2.15 NON-FREEZE HYDRANTS

A. Yard hydrants shall have built in drain port and stop-and-waste capability to prevent freezing. Hydrants shall be installed in a 1.5 cubic foot gravel sump with drain valve 3foot minimum bury depth. Hydrants shall have 3/4-inch or 1-inch inlet as called out on the Plans and 3/4-inch hose connection unless otherwise called out. Operation shall be by lockable lift handle. Installation shall be according to the manufacturer’s recommendations. Hydrants shall be Zurn model Z-1395 or approved equal

B. Wall hydrants shall be anti-siphon, automatic draining type with integral backflow preventer, bronze casing and interior parts, 3/4-inch or 1-inch inlet as shown on the Plans and hose connection, stainless steel face and operating key, Zurn model Z-1310 or approved equal.

2.16 HOSE BIBBS

A. Interior wash down hose bibbs shall be cast bronze with 3/4-inch inlet and outlet, Zurn/Wilkins model 195, or equal. Where called out on the Plans, a hose rack shall be installed next to each hose bibb.

B. Hose bibbs for process connections shall be 1/2-inch inlet by 3/4-inch outlet, Zurn/Wilkins model 195, or equal.

2.17 WATER PRESSURE RELIEF VALVES

A. Small pressure relief valves shall be bronze body with cadmium plated steel springs. Valves shall be sized for the pressure and discharge services for the areas in which they are required. Pressure setting shall be adjustable over a 1 to 250 psi range. Valves shall be as manufactured by Lunkenheimer, Watts or approved equal.

B. PVC Pressure Relief Valves for sodium hypochlorite service:

1. Pressure relief valves shall protect as system from excessive pressure by opening at a set point to allow venting/by-pass of piping system. The valves shall be designed for a working service pressure of 150 psi. Valves shall be Plast-OMatic Valves, Inc. Series RVD, or approved equal, with the following Features.

a. Compact, PVC fabricated body with 1/2-inch threaded connections.

b. Viton ® / FKM elastomers with no wetted metal parts.

2. Valve shall be installed per manufacturer's recommendations with necessary piping, tees, and fittings to connect to system piping and discharge/by-pass location.

2.18 STRAINERS

A. Metal Strainers shall be provided ahead of any control valves, regulators and where shown. They shall have cast iron or bronze body, stainless steel screens, and screwed ends for size 3 inch and smaller, and flanged ends for size greater than 3-inch. They shall be designed for 250 psi working pressure in sizes 3-inch and smaller, and 125 psi working pressure in sizes over 3 inches. Strainers shall be Y-pattern, Armstrong Figs. 6 and 7, a similar item manufactured by Crane, or equal.

B. PVC Strainers shall be provided ahead of any control valves, regulators and where shown on the Plans. They shall have PVC body, Viton®/FKM gaskets, PVC screens and socket ends with true union connections for size 3 inch and smaller, and flanged ends for size greater than 3-inch. They shall be designed for 150 psi working pressure. Strainers shall be Y-pattern, Hayward® YS Series or approved equal.

C. PVC Basket Strainer shall be provided where shown on the Plans. They shall have PVC body, Viton®/FKM gaskets, PVC or Titanium strainer baskets and socket ends with true union connections for size 3-inch and smaller, and flanged ends for size greater than 3inch. They shall be designed for 150 psi working pressure. Basket strainers shall be inline basket strainers, Hayward® SB Series Simplex Basket Strainers or approved equal.

2.19 AIR RELEASE AND AIR/VACUUM RELIEF VALVES

A. Sewage Combination Air Release Valves:

1. Sewage combination air release valves shall allow escape of small quantities of air while under pressure, and shall allow large quantities of air to enter or escape when draining or filling the pipeline. The valves shall be designed for a working service pressure of 150 psi. Valves shall be Vent-O-Mat Series RGX, or Engineer approved equal, with the following features:

    a. Compact, tubular all stainless steel fabricated body, stainless steel top flange, stainless steel top cover and swivel flange outlet connection, and stainless-steel bolts.

    b. HDPE hollow, direct-acting float and HDPE solid orifice float.

    c. Nitrile rubber seals and natural rubber seat.

    d. Integral “anti-surge” orifice mechanism.

    e. Standard factory tests, including hydrostatic test at 1.5 times the rated working presser, low head leak test (7 psi) and small orifice function test at maximum rated working pressure.

2. Air and water from the outlet of the combination air release valve shall be plumbed through stainless steel piping to the floor drain system, as shown on the plans. Unions shall be placed in the drain line to allow disassembly of the valve and plumbing for maintenance.

3. 2-inch and smaller air valves shall be equipped with NPT inlet and outlet connections. 3-inch and larger valves shall be equipped with flanged inlet and outlet connections. Valves shall also be equipped with inlet shutoff valves in a size and type as called out on the plans.

B. Water Combination Air and Vacuum Valve:

1. Combination air release valves shall allow escape of small quantities of air while under pressure. Air/Vacuum valves shall allow large quantities of air to enter or escape. The valves shall be for service of 150 psi. The body and cover shall be cast iron, float and stem shall be stainless steel and the seat shall be Buna-N.

2. Air and water from the outlet of the combination air release valve shall be plumbed through galvanized iron piping to drain at the floor or to the floor drain system as shown on the Plans. Unions shall be placed in the drain line to allow disassembly of the valve and plumbing for valve maintenance.

3. Combination air release valves shall be APCO Series 140C or Val-Matic 200C Series, in size called out on the Plans.

4. All internals shall be easily removed through the top cover of the valve without removing the valve from the line.

5. Air valves shall be equipped with NPT inlet and outlet in the size called out on the Plans. Valves shall be equipped with inlet shutoff valve.

2.20 MICELLANEOUS VALVES

A. Where indicated on the Plans, Contractor shall furnish and install miscellaneous valves. Valves shall be first class and suitable for the indicated service.

B. All valves not designated on the Plans as to type, shall be subject to approval of the Engineer

2.21 METALLIC GATES

A. Slide gates and weir gates shall be provided as shown on the Plans. Gates shall be supplied by a single manufacturer with a minimum of five years of experience in the production of similar equipment. Gates shall be as manufactured by Golden Harvest Inc., Rodney Hunt, Fontaine, or Engineer-approved equal.

B. Gates and operators shall conform to the requirements of AWWA C561. Submit complete engineering design calculations in compliance with AWWA standards.

C. Slide gates and weir gates shall be constructed of stainless steel. All gate components shall have a minimum material thickness of 1/4-inch.

D. Frame: Gate frames shall be rigid, welded unit, composed of the guide rails, and cross bars, with a clear opening as specified on the Plans. Frames shall be flatback, spigotback, or embedded type as shown on the Plans.

E. Guides: Guide frames shall be fabricated of stainless steel and incorporate a dual slot design. The primary slot will accept the plate of the slide (disc) and the second slot will be sufficiently wide to accept the reinforcing ribs of the disc. Guides shall be provided with ultra high molecular weight (UHMW) seats on both sides of the slide. The guides shall be designed for maximum rigidity, having a weight of not less than 13 pounds, per foot. The guides will be of sufficient length to support at least two-thirds (2/3) the height of the slide, when the gate is fully open.

F. Slide: The slide shall be plate reinforced with structural stainless steel shapes welded to the plate. The slide shall not deflect more than 1/360 of the span of the gate under maximum head. Reinforcing ribs shall extend to the guides so that the seating surface of the guide is reinforced. The stem connection shall be either the clevis type, with structural members welded to the slide and a bolt to act as pivot pin, or a threaded and bolted (or keyed) thrust nut supported in welded nut pocket. The pocket and yoke of the gate shall be capable of taking at least twice the rated thrust output of the operator at 70 pounds pull.

G. Seal: Gates shall be furnished with a flush bottom seal arrangement. A resilient neoprene seal with a minimum width of exposed face of 3/4 inch shall be securely attached to the frame along the invert and shall extend to the depth of the primary slot.

Gates shall be provided with "J" bulb seals along the sides, and across the invert (weir gates) or top (standard upward opening) of the gate. When seals are required completely around opening, a flush bottom closure shall be used on the invert. Seals shall be frame mounted and shall not protrude into the specified opening of the gate.

The seating face of the frame for tapered-wedge sluice gates shall be oriented at an angle to the plane of the mounting flange to effect a wedging action upon closure.

H. Stem: Stems shall be type 303 or 304 stainless steel of suitable length and ample strength for the intended service. The stem diameter shall be capable of withstanding twice the rated output of the operator at 70 pounds pull, and shall be supported such that L/R ratio for the unsupported stem length shall not exceed 200.

Stem guides shall be fabricated of stainless steel. Stem guides shall be equipped with a UHMW bushing. Guides shall be adjustable and spaced in accordance with the manufacturer's recommendation. The L/R ratio shall not exceed 200.

I. Yoke and Pedestal: Self-contained gates shall be provided with a yoke to support the operating bench stand. The yoke shall be formed by two structural members welded at the top of the guides to provide a one piece rigid frame. Non-self-contained gates shall be provided with pedestal mounted lifts. The pedestal shall be fabricated of stainless steel. A fabricated stainless steel pedestal support wall bracket shall be provided, and shall have a horizontal plate to allow the top of wall anchorage in addition to wall anchorage.

2.22 GATE OPERATORS

A. Except where motorized operators are specified, all slide, weir, and sluice gates shall be equipped with geared operators as shown on the drawings or in the gate schedule and as detailed. Geared operators shall be the crank operated type and shall have either a single or double gear reduction, depending upon the lifting capacity required. Operators shall be furnished with a threaded bronze lift nut to engage the threaded portion of the stem. The lift unit shall be flanged and supported on non-metallic thrust washers, ball or roller bearings to take the thrust developed during opening and closing of the gate. Pedestals, where used, shall be of stainless steel with ample base area. The gear and driving unit case shall be stainless steel. Pedestal and gear unit driving case shall be water and dust tight.

B. Gears shall be provided with machine cut teeth designed for smooth operation. The gearing and lift nut shall be mounted in a housing which shall be separately supported on another structure or pedestal. Lubrication fittings shall be provided to permit lubrication of all gears and bearings.

C. Gates which have a width exceeding twice the slide height shall be furnished with tandem interconnected operators with a single input crank.

D. All operators shall be finished with a graduated, clear plastic stem cover with a counter type position indicated to show the position of the gate in tenths of an inch unless otherwise called out.

E. Gates where the operator is not mounted at a walking surface shall have extended crank stems and supports at the walkway where operation is intended, as shown on the Plans.

F. Gates where the operating level is outside of the tank wall from the gate shall have geared bench-stand type operators at the top of the wall on top of wall mounting brackets, with the operating shaft extended to outside of the wall. There the extended shaft shall be operated by either.

1. Two right angle gear boxes to a hand crank shaft lower on the wall; or by.

2. An enclosed chain drive with sprockets on the upper and lower shafts, with the lower chain sprocket driven by a horizontal crank shaft.

Crank shafts shall be located a minimum of three feet above the walking surface at the lower outside wall location, or as shown on the Plans. The shaft shall be suitable for operation by portable electric operator. Grease fittings for each of the operators shall have extended grease tubes and zirks extended to an operator accessible location outside of the basin wall.

G. Extended shafts for special lift variations shall have universal joints, as appropriate, to accommodate slight misalignment between geared operators and/or right angle gear boxes.

2.23 DISC FILTER ASSEMBLY

A. Utility Water Filter Assembly shall be a 3-inch, 3-filter, Disc-Kleen Filter, as manufactured by Netafim USA, or approved equal. Filter assembly shall be supplied with manufacturer's optional 120VAC backflush controller with differential pressure sensor.

B. The utility water filter assembly shall be a factory assembled and tested self-cleaning filter with an 80-mesh filtration size. Filtration shall be accomplished by disks stacked inside a housing. The filter shall automatically backwash based on pressure differential across the filter.

C. Filtration Process: As water travels through the filter, debris shall be captured along the filter and in the grooves of the channel in the filter elements. As pressure loss through the filter increases the backwash cycle shall begin, the backwash valve shall change position, and the outlet pressure loosens the disks. A nozzle inside the filter stack then sprays water against the loosened disks to clean them and flush away debris. When the backwash cycle is complete, the backwash valve shall return to its original position, and the inlet pressure shall recompress the discs to resume filtration.

D. Materials of Construction: Manifold – polypropylene; Filter body – glass reinforced polyamide; Spine – polypropylene; O-Rings and Seals – EPDM.

E. Inlet and outlet connections – 6-inch grooved; backflush valve port – 2-inch NPT; maximum operating pressure – 140 psi; minimum backflush pressure required – 40 psi.

PART 3 – EXECUGTION

3.01 INSTALLATION

A. All valve, gate, and control installations shall comply with the manufacturer's recommendations.

END OF SECTION 40 20 12

SECTION 40 63 43

PROGRAMMABLE LOGIC 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. Section Includes:

1. Programmable logic controller (PLC) control system(s), including:

a. Hardware, installation, field testing, and training.

B. Related Sections include the following:

1. Section 40 67 16 for control panels housing PLC equipment.

C. PLC Programming will be provided by others.

1.3 REFERENCES

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):

a. ICS 1, General Standards for Industrial Control and Systems.
b. ICS 1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid State Control.
c. ICS 4, Terminal Blocks for Industrial Use.
d. ICS 6, Enclosures for Industrial Controls and Systems.
e. Publication No.250, Enclosures for Electrical Equipment (1000 V maximum).

2. National Fire Protection Association (NFPA):

a. National Electric Code (NEC).

1.4 SYSTEM DESCRIPTION

A. Design Requirements

1. The system includes racks, central processing units (CPUs), input/output (I/O) modules, communication modules, power supplies, and associated accessory items to provide a complete and functional control system.

B. The PLCs will function to monitor and control site operation and communicate with other locations via Ethernet or a serial spread spectrum radio link.

C. Performance Requirements

1. The installed system performs the functional and operational algorithms required for control of the process.

1.5 SUBMITTALS

A. General: Submit each item in this Article as described in Section 16010 and Division 1 Specification Sections.

B. Product Data

1. Manufacturer's data sheets for each hardware component including specific model numbers for each device, and size of memory provided in each CPU.
2. Manufacturer's installation manual, operation and maintenance manual(s) for each component and/or device.

C. Shop Drawings:

1. Drawings

a. See Section 40 67 16 for requirements.

2. Schedule of system I/O including the following data:

a. I/O point, with name, tag number, and indication of type and the characteristics of the I/O signal.

3. Listing of spare parts provided with the system.

D. Operation and Maintenance Manuals:

1. See Section 01 33 00.
2. Provide specific information including:

a. Manufacturer's published operation and maintenance manual, and troubleshooting guide.
b. Information for obtaining assistance and troubleshooting, parts ordering information, and field service personnel requests.

3. Include final system drawings, and final I/O lists.
4. Include testing reports. (see Section 3.1 for further information)

1.6 QUALITY ASSURANCE

A. Refer to Section 26 05 01 paragraph 1.7.

PART 2 — PRODUCTS

2.1 MANUFACTURERS

A. For compliance with the existing telemetry system, the PLC equipment is limited to:

1. Allen Bradley: CompactLogix 5380 family of controllers

2.2 MATERIALS

A. Allen Bradley is the basis of design for this project. The Contractor shall be responsible for all costs related to providing a different system. The modules shall be equivalent to the Allen Bradley part numbers shown on the drawings.

B. Conform to NEMA ICS 1.1 for installation and application of the PLC system.

C. The equipment consists of fully integrated microprocessor units specifically designed for operation in unconditioned audible noise and high vibration areas.

1. Includes analog, digital, and communications interfaces for interface directly with ISA or other industry standard transducers, actuators, and communications equipment without the need for intervening conditioning devices.

D. Equipment operates in 32 to 140 Degrees F temperature and 0 to 95 percent relative humidity. Equipment does not require cooling fans or other heating or conditioning equipment to operate within this environmental range.

E. Include the following minimum safety measures:

1. Watchdog function to monitor:

a. Internal processor clock failure.
b. Processor memory failure.
c. Loss of communication between processor and I/O modules.
d. Failure to execute logic program.

2. Safe wiring:

a. Equipment failure mode is such that the loss of power or control signal to the equipment results in the equipment either shutting down or operating safely.
b. Stopping of equipment results from the de-energization of control circuits, rather than the energization of control circuits.

3. Monitoring of internal faults and display:

a. Internal PLC system status and faults shall be monitored and displayed on the processor module or rack. Monitored items shall include:

1) Processor ok/processor fault.
2) Battery ok/battery low.
3) Power supply ok/power supply fault.
4) Module failure.

F. Monitoring of Internal Processor Faults:

1. An internal watchdog shall time out and shut down the processor upon detection of a problem. Problems include:

a. Processor fails to correctly address input modules.
b. Processor ceases to execute the logic program.
c. Input modules fail to read current status values of inputs.
d. Processor memory failure.

G. Firmware

1. All programmable components shall use the latest, stable firmware and software versions.

2.3 COMPONENTS

A. Provide components as indicated.

B. Provide all incidental materials and equipment required for a complete, functional, and successfully operating PLC system. These items include, but are not limited to:

1. field potential distributors
2. interconnecting cables
3. terminating resistors (where necessary)
4. other items ordinarily furnished as part of a complete system

C. PLC System Central Processor Unit (CPU):

1. PLC in Telemetry Control Panel

a. Rockwell Automation CompactLogix per drawing call outs.

D. Input/output (I/O) Modules.

1. Discrete I/O modules:

a. Input modules:

1) 24 VDC input modules for typical I/O
2) 24 VDC input modules to monitor transistor inputs, for any inputs sharing conduit pathway with analog loops, or typical I/O.

b. Output Modules:

1) Relay
2) 24 VDC with interposing relays for each point.

2. Analog I/O modules:

a. Input modules.

1) 4-20 ma

b. Output modules.

1) 4-20 ma

E. Field Potential Distributors:

1. Provided as necessary to implement the interconnections depicted on the elementary wiring diagrams on the Drawings.

F. Communications Modules:

1. CPU built-in USB port for programming
2. CPU built-in Ethernet port using one of the following protocols:

a. Ethernet/IP (CIP)

2.4 ACCESSORIES

A. Provide all accessories required, whether indicated or not, for a complete PLC control system to accomplish the requirements of the Plans and Specifications.

2.5 SOFTWARE

A. Provide to the Owner the most recent versions of software required to program the PLC. Turn over to the Owner all licenses, software keys, activation codes, and any other digital usage rights identifier (including dongles, USB keys, etc.). The Owner shall retain these rights to the software in perpetuity.

B. Provide the Owner with the most recent versions of software required to program the PLC. Arrange for the Owner to receive the software and any required licenses, software keys, activation codes, and any other digital usages rights identifiers within 60 days of notice to proceed.

2.6 EXTRA MATERIALS

A. Provide the following extra materials:

1. Provide one spare processor module for each type of processor module furnished.
2. Provide one spare I/O card for every 10 cards, or fraction thereof, of each type of card installed.
3. Provide one spare field potential distributor for each type furnished.
4. Provide one spare communications module for each type of module furnished.
5. Provide one spare network adapter or specialty card for each type furnished.
6. Provide two spare cables for each type of cable furnished.
7. Provide a list of the manufacturer's recommended spares for maintenance purposes. Include in the list any special tools and test equipment necessary or recommended by the manufacturer for the maintenance of the complete system. Provide any recommended spares not supplied above along with the recommended special tools and test equipment.
8. Provide one spare chassis for each type of chassis furnished.

PART 3 — EXECUTION

3.1 TESTING

A. Shop test PLCs and Remote I/O units in the presence of the Owner prior to shipment to project site. Notify the Owner at least ten working days before testing. Testing shall be performed at the panel manufacturer's facility. The panel manufacturer shall conduct a rehearsal of the shop test prior the arrival of the Owner and shall verbally certify that they believe there are no readily apparent obstacles to performance of the test. (In this case, some examples of readily apparent obstacles would be panel mounted equipment lacking power wiring or panel mounted equipment inadvertently wired to work under either primary or backup power, but not both.)

1. Shop test shall include motor controllers provided as part of the project and shall prove communications and control capabilities of the PLC over the motor controllers.
2. Provide a test plan at time of notification of testing. Coordinate the time of testing of the panels with the Construction Schedule.
3. Each assembled panel shall be meggered and tested to be free from grounds and shorts before the shop test.
4. Controllers, circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped. Each device and control loop shall be tested and demonstrated to function properly in each mode (such as "hand", "local", "automatic"). Discrete input signals shall be tested in both the "on" and "off" state. Analog signals (4-20 milliamp, or similar type) shall each be tested at not less than three values (4.08 mA or 0.5%, 12 mA or 50%, and 19.92 mA or 99.5%). Test results shall be documented. Test discrete outputs by forcing the output on and off via the programming software. Measure the resistance (for relay outputs) or voltage (for active outputs) between the output terminals. Document proper operation of each output.
5. Test analog inputs by applying voltage or current to the input at not less than three values, including at or just above minimum range, at or just below maximum range, and midrange. Document actual register values for each applied input value at each input.
6. Provide signal generators, multimeters, and other test equipment as required to verify proper operation of the assembled panel. Simulate input signals, both discrete and analog, to verify operation of control and monitoring circuits.
7. Demonstrate that:

    a. The PLC is fully operational. The Owner shall provide the PLC testing program within one week of notification of the shop test. The Contractor shall load the PLC programs into the respective PLC and demonstrate proper operation of the PLC. In no case

shall testing be performed without an operating program functioning in the unit under test. Test discrete inputs by shorting across the input terminals. Document that each input performs properly.

b. Each I/O module is recognized by the base unit and is fully functional.

c. Communications ports on the base unit are fully functional.

8. Correct, replace, or repair panel wiring, and/or components until testing demonstrates proper operation. Do not ship control panels to the site until testing has demonstrated satisfactory operation of the PLC.
9. Provide updated and complete 'as shipped' drawings at the time of final testing. The Owner shall review the drawings against the panel construction at the time of final testing. Drawings which do not reflect the actual construction of the panel will need to be revised and reviewed again by the Owner against the actual construction prior to shipment of the panel to the job site. 'As shipped' drawings which require revisions shall be submitted to the Owner for review at testing notification, prior to the actual field review of these drawings against the panel construction. This process of revision and review of the drawings will be repeated as necessary to produce drawings which reflect the actual construction of the panel at the time of shipment. Do not ship control panels to the site until the 'as-shipped' drawings are updated, complete, and reflect the actual 'as-shipped' status of the panel.
10. Attention of the Contractor is directed to the fact that more than one shop test and/or review of the panel wiring/drawings may be required. If the first shop test is not satisfactory, or results in the need to make revisions to the panel and/or 'as-shipped' drawings that cannot be affected during the course of the shop test, then a repeat shop test and/or review of the drawings against the construction will be required. The presence of the Owner at up to two shop tests/reviews will be without cost to the Contractor. If more than two shop tests/reviews are required, then the Contractor shall be required to reimburse the Owner for the Owner's costs for the third and each subsequent shop test/review.
11. Submit the results of the test in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test
12. After each control panel has been installed at the jobsite:

    a. Conduct a field test of the panel. Testing shall be conducted by physically actuating signaling devices (where possible), installing temporary jumpers, or artificially imposing signals on the field

wiring. The purpose of the test is to establish proper operation of the field devices, the integrity of the field wiring, and proper connection of field devices to the panel. The Contractor shall coordinate with the Owner to provide for as complete a testing of the control and monitoring systems as is practical prior to placing the panel on line for actual control and/or monitoring of the process. The Contractor shall make corrections or repairs to the wiring and/or devices as necessary to provide proper operation of the system. If testing indicates that field devices require modifications to connectors or contact action, the Contractor shall make the wiring or connection modifications as necessary to coordinate with the PLC program and contract documentation.

b. If testing indicates that the equipment functions properly but that changes to the PLC program are required, the Owner will revise the program(s) and provide the new program(s) for installation in the PLC. The Contractor shall be prepared to install up to 3 revised programs into each PLC during startup/commissioning without additional cost to the Owner.

c. Submit the results of all tests in a formal document within two weeks following satisfactory performance of the test. The test results shall document all problems encountered in running the test, corrective action taken, and the detailed results of each phase of the test.

3.2 CONFIGURATION

A. Configuration of the PLC

1. Configure the IP address and network setting to allow device to be used on network. This may include configuring device in a different VLAN range than the default. IP Addresses shall be furnished by the Owner's programmer during submittal review.

3.3 INSTALLATION

A. Install PLC control system in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 40 67 16

CONTROL PANELS

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. Control panels (whether provided under Division 26, or provided, or specified to be provided, with equipment specified under other Divisions).

B. Section Includes:

1. Control panels specified under this Section include:

   a. 04CP01 (Influent Control Panel)
   b. 04RIO (Influent Remote IO)
   c. 06CP1 (Aeration Structure Control Panel 1)
   d. 06CP2 (Aeration Structure Control Panel 2)
   e. 08CP1 (UV Building Control Panel)
   f. 11CP01 (Dewatering Building Control Panel)
   g. 11CP02 (Dewatering Building Go/NoGo Control Panel)
   h. 11CP03 (Dewatering Building Drain Pump Station Control Station)
   i. 11CP04 (Sludge Holding Tank Barrier Panel)
   j. 11CP05 (Sludge Holding Tank Barrier Panel)
   k. 11CP06 (Sludge Holding Tank Barrier Panel)

2. Control panels modified under this Section include:

   a. 06RP (Aeration Structure Control Panel)
   b. UVCP (UV Control Panel)

1.3 REFERENCES

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):

   a. ICS 1, General Standards for Industrial Control and Systems.
   b. ICS 4, Terminal Blocks for Industrial Use.
   c. ICS 6, Enclosures for Industrial Controls and Systems.
   d. Publication No.250, Enclosures for Electrical Equipment (1000 V maximum).

2. National Fire Protection Association (NFPA):

   a. National Electric Code (NEC).
   b. Standard for Electrical Safety in the Workplace

3. Joint Industrial Council

    a. JIC-EMP-1.

4. International Society of Automation

1.4 SYSTEM DESCRIPTION

A. Control Panels

1. The system includes control panels for control and/or monitoring of the process equipment. Control panels shall meet the requirements of this Section.
2. The system includes remote I/O racks mounted in motor control centers.

B. Configuration of supplied components

1. Devices connected in the panel shall be configured to communicate.
2. Control systems and monitoring systems utilizing fieldbus or remote I/O type communications shall be configured to make available all the monitored data to the PLC device.

C. Modification of existing panels and enclosures

1. Existing control panels are being modified and renamed for consistency with the rest of the plant.

1.5 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.

1. The Owner shall supply the process control portions of the PLC program based upon the configurations provided by the Contractor for the shop test.
2. Provide the configuration, as required, to allow communications to fieldbus devices using digital signaling. Field devices include digital bus enabled instruments and variable frequency drives.

B. Product Data: For each type of system components 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). Including manufacturer name, catalog descriptions, ratings, wiring and piping diagrams, dimensional drawings, anchoring details, installation instruction, and test results.

C. Shop Drawings:

1. Shop Drawings shall include, but not be limited to, the following:

a. Panel Layout Drawings:

1) Shall be dimensioned and to-scale.
2) Shall include nameplate text.
3) Shall indicate conduit and wiring access locations. Enclosures which will not accept the quantities of conduits as shown on the Contract Plans will be rejected.

b. Materials of construction.
c. Elementary wiring diagrams and terminal block drawings, differentiating between panel and field wiring.
d. Bill of Materials including the reference name or number, quantity, complete English language description, manufacturer, model number, local supplier and wiring or piping reference.
e. Loop diagrams with all components connected per ISA standards.
f. The terminal designation (designations for terminals may be chosen by the panel builder unless noted otherwise on contract drawings) shall be shown on the elementary wiring diagrams, analog loop diagrams, and terminal block drawings.

D. Testing Materials and Documentation:

1. Provide configuration in electronic file format suitable for directly loading into PLC, Variable Frequency Drive, Network Switch, etc. (see Section 3.5 for further information) at least ten days prior to desired Owner witnessed test date.

a. The configuration shall include all the devices connected through field busses, including serial and Ethernet connections.

1) Devices which receive commands from the PLC (for example, VFDs, valve actuators, motor overload relays) shall each be configured with at least two PLC-to-device, “write” command registers and at least ten device-to-PLC, “read” feedback registers.
2) Devices which do not receive commands from the PLC (for example, flow meter transmitters, pH transmitters, pressure transmitters, temperature transmitter, gas detector transmitters) shall each be configured with at least four device-to-PLC, “read” feedback registers. Unless otherwise noted, it is not necessary to provide two-way communications to those devices.

2. Supply descriptions in native electronic file format.

a. The native file format shall be suitable to directly load into the devices, such as Radio, Variable Frequency Drive, Network Switch, etc. without need for transcribing or other editing.

b. The native file format shall be able to be decoded using the manufacturer's configuration software suite to a human readable format. It is acceptable to send a PDF or similar file in addition to the native file for annotations or other notes.

3. Provide register layouts detailing where each device stores data relevant to the protocol shown.
4. Provide the sequence of testing plan, including the steps noted as required and the testing steps which are a part of the control panel supplier's standard procedure.

E. 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. Component Maintenance and Repair Manuals (specified in Division 1).
2. Spare Parts List
3. Product Data
4. Record Drawings: At the completion of the project, the drawings shall be updated to reflect any changes during the course of construction.

1.6 QUALITY ASSURANCE

A. Refer to Section 26 05 01.

B. Control panels and work supplied under this Section shall be provided by a single manufacturer, except those provided with equipment specified under other Divisions. Control panel manufacturer shall be one of the following:

1. Total Energy Management (Richland)
2. Quality Controls Corporation (Lynnwood)
3. Technical Systems Incorporated (Lynwood)
4. Control Freek (Spokane)
5. VECA Electric & Technologies (Bellingham)

C. Comply with UL 508 "Standard for Industrial Control Equipment".

D. Provide control panels bearing the label of a recognized testing laboratory, or otherwise acceptable to the State of Washington Department of Labor and Industries.

E. 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 panel access locations.

F. Shop testing of the panel is required. Refer to the "Testing" section below for shop test information.

G. Product Selection for Restricted Space: Space for installation of control panels is limited. The Plans indicate typical physical sizes or dimensions for control

panels, including clearances between control panels and adjacent surfaces and items. Control panels 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 centers with larger dimensions in order to obtain approval before a change is accepted. The Supplier/Contractor shall coordinate the size of the control panels with the available space and shall verify that the proposed control panels are capable of being installed in the available space prior to making a submittal. Control panels of dimensions larger than the available space shall not be submitted. The decision of the Owner as to the acceptability of control panels 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.

H. 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 control panel 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.

1.7 STORAGE AND HANDLING

A. Store equipment per requirements of Section 26 05 02 paragraph 1.10 and as follows:

1. After completion of shop assembly and testing, enclose panels in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from dust and moisture. Place dehumidifiers inside the polyethylene covering.
2. Skid-mount the equipment for final transport. Show shipping weight on shipping tags, together with instructions for unloading, transporting, storing, and handling on job site.
3. 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 MATERIALS

A. Control panel enclosures shall be factory UL labeled enclosures fabricated into a rigid, self-supporting structure unless otherwise noted. Panels shall be of

NEMA type construction as required for the location indicated on the Plans. Free standing panels shall be provided with channel sills where shown on the Plans. Enclosure conduit entry locations shall be able to accept the quantities and sizes of conduits as shown on the Contract Plans.

1. Welded construction
2. Completely enclosed, self-supporting, and gasketed dust-tight.
3. Seams and corners welded and ground smooth.
4. Provide full length piano hinges rated for 1.5 times the weight of the door and door mounted instruments.
5. Furnish doors with keyed alike locking handles and three-point catch.
6. Provide each panel with lifting eyebolts. Furnish stainless steel base channels.
7. Provide slotted bolt holes in the base, 1 1/2 inches long for field adjustment.

B. Hinges: Stainless steel.

C. Nameplates: Phenolic.

2.2 COMPONENTS

A. Fuses

1. Control power fuses are FRN for ratings above ten amperes and FNQ for ten amperes and below. FRN fuses are mounted in phenolic blocks with a fuse puller mounted adjacent to them. FNQ fuses are mounted in a Buss CHM1I modular fuse holder with indicator light. Label all fuse holders with fuse identification number and fuse size and type. Provide three spare fuses of each type and size in each panel. Provide box mounted on panel interior marked "SPARE FUSES" to hold the spares.
2. Control power fuses connected to non-signaling circuits (for example, solenoids, actuators, relay coils, network switches, PLC power supplies) less than 10 amperes and less than 250 volts shall be 13/32” x 1-1/2” (10.3 x 38.1 mm) midget or CC type, dual element time delay, supplementary protection fuses. Cooper-Bussmann LP-CC dual element series or Littlefuse CCMR series unless otherwise noted or required by Manufacturer of connected equipment.
   Provide finger-safe modular, lever style fuse holder with blown fuse indicators, Allen-Bradley 1492-FB, Cooper Bussman EH series or equal. Plug-in fuse holders mounted to terminal blocks or lever style fuse holders are not acceptable.
3. Signal power for reference voltage (for example, PLC Input Signals, VFD control circuits, and similar) shall be fast acting fuses 1/4” x 1-1/4” AGC or 13/32” x 1-1/2” Midget MCL or CC type fuses. The ¼” x 1-¼” AGC type fuses shall be rated at a minimum of 1 amperes and meet MIL-STD-202, Method 207 (Hi Shock) standard. Fuses shall be manufactured by Cooper Bussmann or Littlefuse.

Provide finger-safe terminal block, lever style fuse holder with blown fuse indicators, or Allen-Bradley 1492-H4 or-H5 series.

4. 5mm x 20mm fuses (for example, Cooper Bussmann GAS) are not acceptable for any application.
5. Provide three spare fuses of each type and size in each panel. Provide box secured to panel door interior for signal power fuses marked "SPARE FUSES".
   Provide specialty fuse holder for fuses, Cooper Bussmann 5TPM or similar for control power fuses. Mount to panel door interior. Label above each position the ampere rating of the fuse.

B. Pilot devices (control units and stations): heavy duty, oil-tight type per NEMA ICS-1; pilot lights push-to-test universal voltage, LED type.

1. Allen-Bradley
2. Cutler-Hammer
3. General Electric
4. Square D

C. Relays

1. Control relays for switching 120 VAC power circuits or motor starting circuits shall be electro-mechanical machine tool, heavy-duty type per NEMA ICS Standard with 120 VAC coils and a minimum of SPDT contacts rated B-300 by NEMA standards: Allen-Bradley 700 N, General Electric CR 120, Square D Company Class 8501, Type G or equal, Eaton. Equip relays with surge suppressers. IEC rated relays are not permitted. Provide SPDT, DPDT, or 4PDT sets of contacts as required to install circuits as shown on drawings.
2. Control relays for logic control circuits shall be permitted to be mini-ice cube style type relays. Coils shall be rated 120 VAC or 24 VDC (as required). Relays shall provide minimum SPDT contacts which shall be rated B300 by NEMA standards. The coil terminals and contact terminals shall be on opposite sides of the relay base. Relays shall have indicator flags, screw clamp terminals and surge suppressors or Zener diodes across the coil. Provide Allen-Bradley 700-HK series, or equal. Provide SPDT, DPDT, or 4PDT sets of contacts as required to install circuits as shown on drawings.
3. Time delay relays shall be electronic type Allen Bradley 700 Series or equal.
4. Intrinsically safe relays shall be fixed sensitivity type U/L approved for use with a remote pilot device (dry contact) located in Class I, Division 1, Group C and D area. ISR units shall be as manufactured by GEMS, Stahl, or equal.
5. Relay bases shall have all terminals for relay coils located on opposite side of the base as all terminals for contacts.

D. Terminals:

1. Provide DIN rail mounted terminal blocks with screw clamp connections. The terminal blocks shall be Entrelec MA 2.5/5 or equal.
2. Provide all accessories such as jumper bars, end stops, and end sections needed for a complete and functional system of terminal blocks.
3. 4-20 mA analog signals shall utilize a “knife-disconnect” terminal blocks on the signal terminal connected to the PLC input card’s positive input. The terminal blocks shall be Entrelec MA2.5/5.SNB or equal.

E. Power supplies

1. 120VAC to 24 VDC: shall be 120 VAC input, with adjustable 24 VDC output. The DC Common bus shall be suitable to connect to the panel ground.
    a. Phoenix Contact 2903149 or equal.
2.
3. 24 VDC, Class 2 power supply shall accept 24 VDC and provide 24 VDC output power unless otherwise noted. Power supply shall have NEC Class 2 rating and shall be SELV rated.
    a. Phoenix Contact 2903147 or equal.
4.

F. Uninterruptible Power Supplies (UPS) shall be Phoenix Contact 2905909, or equal.

1. UPS shall supply at least three C-Form (common, normally open and normally closed) dry contacts to indicate at least a “low battery”, “on battery” and “UPS or battery failure”.
    a. Supply a Network Management Card with SNMP via 10 Base T / 100 Base TX Ethernet Port.
2. 24VDC UPS shall be Pheonix Contact Quint 4 (2907066), OR EQUAL.

G. Loop Indicators

1. shall be Panel Mount with a NEMA 4X/IP65 Sealed Front Bezel
2. shall have a operating ambient temperature range of at least 0° to 50° C.
3. shall be suitable for use with power available in the panel in which the indicator is installed.
4. shall have an isolated 4-20 ma current loop input
5. shall have provisions to adjust the minimum and maximum engineering units
6. shall be a Precision Digital PD6600 series or equal

H. Conductors:

1. Class C stranded copper conductors of SIS or MTW insulation (for 120 VAC or 24 VDC power or discrete signal circuits).
2. Stranded #18 AWG copper conductor with thermoplastic insulation, foil or stranded wire shielding, and overall gray PVC jacket (for analog instrumentation circuits).

I. Wireways

1. shall be a minimum of one inch wide and three inches deep
2. shall have removable snap on covers and perforated walls for easy wire entrance
3. shall be constructed of non-metallic materials with a voltage insulation in excess of the maximum voltage carried therein.
4. shall be Panduit Type G, Panel Channel, or equal.

J. Rack Mount Angles

1. Provide rack mount angles in each communications enclosure for mounting of 19" communications equipment. Hoffman A90RP24F5, or equal.

K. Surge Protective Device shall be DIN rail mountable without a separate kit, shall have a listed surge current capacity of 45,000 amps, provide transient protection in all modes for a 20 ampere, 120 volt alternating current power circuit, and provide a form C relay output to signal surge arrestor problem. Provide Sola/HEVI-Duty STFE Elite DIN Rail STFE200-10N or equal.

L. 110VAC Receptacle (for UPS) shall have duplex NEMA 5-15R power receptacle and be DIN rail mountable without a separate kit. Provide Weidmuller DRAC DP 15 or equal.

M. Miniature VAC Circuit Breakers

1. Provide Phoenix Contact TMC 81C series, Rockwell Automation 1492-SPM series, or equal, sized per drawings or appropriately for the loads to be protected.

N. Miniature VDC Circuit Breakers

1. Provide Phoenix Contact PTCP E1 series or equal, sized per drawings or appropriately for the loads to be protected.

A. Network Switch. Provide at least as many 10/100/1000 base TX ports with as are shown on Control Panel EWDs. Provide DC power converter for auxiliary power input of switch to connect to control panel power supply. Provide DIN Rail mounting adapter.

1. Provide at least one small form pluggable (SFP) optical transceiver for each SFP port on each switch. Provide SFP modules as manufactured by switch manufacturer. "Compatible" or other modules not made by

switch manufacturer are not acceptable. Unless otherwise noted, provide 1 Gb Single Mode (1310 nano-meter wavelength) SFP modules with diagnostic reporting capacity.

2. Provide at least 3 years of warranty with 8x5 Next Business Day response for each network switch provided.
3. If any part, module, or service specified is listed as end of life by switch manufacturer, provide manufacturer suggested replacement product identified as current lifecycle. End of life shall mean any part after the announced end of product date for that part.
4. Network switches shall be as called out on drawings.

B. Control Panel Mounted PC.

1. 15.6” Capacitive touch screen with High Brightness, 1920x1080 resolution
2. 16 GB DDR4 RAM (2x8GB, single channel shall be rejected)
3. Intel Core i3-N305 CPU or greater
4. 1TB or larger M.2 primary storage
5. 2 Ethernet ports, rated at 2.25Gbe
6. Ubuntu Desktop 24.04 LTS 64-Bit OS (or approved alternative)
7. Provide Onlogic Tacton TC401 series, or approved equal

2.3 ACCESSORIES

A. Panel Nameplates and Identification:

1. Identify each item on the control panel with rectangular nameplates.
2. Provide nameplates of rigid phenolic plastic laminate with engraved lettering or engraved metal plate with filled lettering. Use black background with white lettering.
3. Minimum letter height is ½ inch for instrument description and ¼ inch height for instrument tag number.
4. Provide each panel with a 2" by 10" (minimum) main nameplate with1 inch high lettering with panel identification.
5. Abbreviations are not permitted unless approved by the Owner or specifically shown on the nameplates, schedules, or drawings.
6. Install nameplates plumb and parallel to the lines of doors or structure to which they are attached. Attach to the sheet metal structure by a thin coat of adhesive and sheet metal screws. Make adhesive and screw application in a manner to avoid buckling or distorting nameplates due to use of excessive adhesive or over tightening of screws.

B. Provide SELV or NEC Class 2 power supplies for devices shown mounted within or connected to the Control Panel for devices specified without a NRTL listing.

PART 3 — EXECUTION

3.1 FABRICATION

A. General:

1. Control panels shall be factory or shop fabricated units completely assembled, wired and tested before shipment to the job site.
2. Panel construction, in general, shall meet JIC EMP-1 standards and applicable NEMA and IEEE standards.
3. The panels shall be constructed in accordance with electrical testing laboratory standards and shall be so labeled (the standards of a recognized electrical testing laboratory).
4. Size panels for the enclosed equipment and the available space for mounting of the panel, but not smaller than as shown on the Contract Documents.
5. Panels shall be descaled, cleaned and primed in preparation for painting. Painting shall consist of one coat of flat white enamel in the interior and two coats of hard finish exterior enamel, gray in color for the exterior. Paint shall be suitable for field touch-up. Spare paint (one quart) shall be provided for touch-up purposes.

B. Component Installation.

1. Minimize welding to panel fronts and avoid distortion of panel metal.
2. Reinforce around areas of the enclosure weakened by openings or mounting of heavy equipment/components.
3. Accurately and cleanly cut or nibble cut-outs, and finish free of sharp edges or burrs. Make cutouts plumb, level, and on-line vertically or horizontally within 1/32 of an inch where components are in rows or columns.
4. Provide minimum 1-5/8 inches spacing between horizontal rows of externally mounted components; 1-1/2 inches minimum between vertical columns of components.
5. The distance from the bottom row of components to the floor shall be not less than 36 inches, unless specifically shown as less. In general, all indicating lights, pushbuttons, and similar control devices, shall be mounted in accordance with the sequence of operation from left to right and top to bottom.
6. Provide minimum 1/4 inch spacing between components mounted on the panel sub-plate, Provide minimum spacing between the component and the wire duct of 1-1/2 inches above and one inch below. Provide additional space if required to access terminals, adjusting screws, and similar items.
7. Components mounted in the interior shall be fastened to an interior subpanel using machine screws plus adhesive to insure vibration-free attachment.

8. Interior component mounting and wiring shall be grouped as much as possible by function and then by component type. Interiors shall be so arranged that control relays, terminal blocks, fuses, etc., can be replaced or added without disturbing adjacent components.

C. Panel Wiring:

1. Color coding of insulation shall be black for power, white for 120V neutrals, red for AC controls which derive their source from within the panel, yellow for AC controls which derive their source external to the panel, blue for low voltage DC controls, green for grounding conductors.
2. Shop or factory wire panels to identified terminal blocks equipped with screw type lugs.
3. Raceways for panel wiring.
    a. Size raceways per the requirements of NEC.
    b. Provide panel wireways between each row of components, and adjacent to each terminal strip.
4. Provide wire bending space per NEMA ICS 6.
5. Label wiring within the panel with wire numbers and run in wiring duct neatly tied and bundled with tie wraps or similar materials. Identify each wire termination, including all jumpers, with permanently marked, heat shrink type wire markers. Arrange wire labels to permit reading of identification when installed. Apply heat per manufacturer's instructions to create a tight fit of the label to the wire.
6. Connect wiring internal to the panel to the "inside" of the terminal strip. Connect field wiring to the "outside' of the terminal strip. Wires to enclosure door mounted components are considered as internal wires. Connect no more than two wires to any one control terminal point. Provide terminal jumpers where more than two wires terminate at the same point.
7. Arrange wiring inside the panel to separate low voltage control signals of the milliamp, millivolt or other low energy type from inductive power circuits.
8. Connect grounds and shields of circuits which derive power internal to the panel to a panel common ground bus which shall be grounded by the electrical contractor in the field.
9. Physically separate signals entering controllers for amplification as control outputs from all line voltage wiring and shield with continuous foil shielding or enclose them in metal raceway.
10. Provide necessary power supplies for control equipment.
11. Termination requirements:
    a. Terminate panel wiring on device or terminal block screw terminals using slip-on spade tongue insulated crimp (compression) terminators, slip-on stud insulated crimp

(compression) terminators, or stripped and tinned conductor ends. Stranded conductors shall not be terminated bare to terminals or devices.

b. Provide terminal strips for the termination of panel wiring not directly connected to panel mounted devices.

c. Terminals shall facilitate wire sizes as follows:

   1) VAC applications: Wire size 12 AWG and smaller.
   2) Other: Wire size 14 AWG and smaller.

d. Label each I/O terminal to indicate tag number of the conductor and connected device. Locate terminals for termination of multiconductor shielded cables adjacent to each other to minimize lengths of unshielded conductor at the terminations.

e. Provide terminals for individual termination of each signal shield. Locate the terminal adjacent to the terminals for the signal conductors.

f. Provide 20 percent excess terminals for future expansion.

g. In general, mount terminal strips on the bottom horizontal edge of the sub-plate. Mount additional terminal strips, if required, on a thirty-degree angle bracket at the bottom of the sub-plate. Where terminal strips are mounted side-by-side, elevate one set of terminals 1-1/2 inches above the sub-plate to allow wire to pass underneath.

h. Provide a minimum of two inches between terminal strips and wireways or between terminal strips.

i. Shielded cables used for analog signals shall be terminated with not greater than 2 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.

3.2 SOURCE QUALITY CONTROL

A. Control Panel Testing

1. The entire assembled panel shall be meggered and tested to be free from grounds and shorts.

2. Circuits and interlocks shall be rung out and tested to assure that they function correctly before the panel is shipped.
3. Revise all drawings upon completion of the work to show "as shipped" condition of the panel.

3.3 INSTALLATION

A. Install free-standing panels on concrete pads where shown on the Plans. Install with channel sills where shown on the Plans. Provide stainless steel shims to level units.

B. Install wall or stanchion mounted panels level and plumb.

C. Anchor panels rigidly in place with approved anchorage devices.

3.4 TESTING

1. See section 40 63 43 for testing requirements.

3.5 STARTUP

1. The Control Panel Fabricator shall provide a minimum of 10 man-days on site time for startup of the control system prior to, during and following the Contractor's installation and testing. On site time shall be coordinated with the Owner on site time during startup, but may include additional time when the Owner is not present.
2. Revise all drawings upon completion showing "as built" conditions including the labeling of field wiring connections.
    a. Submit primary copy of these drawings for inclusion into the Operations and Maintenance Manual.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of control panels. Vacuum interior and wipe clean all interior surfaces. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 40 70 11 – INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this section includes furnishing, installing, testing, startup, training, and warranty support for all process system instrumentation, including flow meters and pressure transmitters, and all required appurtenances, complete and operable, as specified and shown on the Plans.

B. Electrical wiring and equipment with electrical connections and control and safety devices shall be Recognized Electrical Testing Laboratory (RETL) listed and labeled, or the manufacturer shall obtain approval from the Washington State Department of Labor and Industries.

C. All process system instrumentation and appurtenances for this project shall be the products of a single manufacturer, unless otherwise noted.

1.02 RELATED SECTIONS

A. Section 01 33 00 – Submittal Procedures

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 46 76 27 – Screw Presses

1.03 SUBMITTALS

A. Refer to Section 01 33 00 – Submittal Procedures, for general submittal requirements.

B. Submit manufacturer's complete descriptive product data and specification sheets for all process system instrumentation and appurtenances. Clearly identify all accessories and options being provided, as specified.

C. Submit a copy of the manufacturer's written warranty, as specified.

D. Submit operation and maintenance manuals in accordance with Section 01 78 00 – Operation and Maintenance Manuals.

E. Following successful installation and startup of all actuators, submit a copy of the manufacturer's field startup report.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver process system instrumentation to the job site at appropriate time for installation. All equipment and materials shall be crated and/or packaged with protective wrappings to prevent damage during delivery, storage and handling.

B. Store all equipment and materials above ground and in weather tight enclosures. Keep all equipment and materials dry and protect from excessive heat or cold.

1.05 STARTUP SERVICE

A. The manufacturer or manufacturer's qualified representative shall provide a minimum of two (2) days of startup service to inspect the installation of all components, confirm proper setup and operation of all process system instrumentation, and instruct the Owner and Engineer in operation and maintenance of all equipment. Refer to part 3 of this section for additional requirements.

1.06 TOOLS AND SPARE PARTS

A. Provide any other special tools or spare parts as recommended by the manufacturer.

B. Spare parts shall be properly packaged and labeled for easy identification without opening and protection for long term storage.

1.07 WARRANTY

A. All process system instrumentation supplied under this section shall be warranted to be free from defects in workmanship, materials and design for a period of one (1) year from the date of substantial completion.

PART 2 – PRODUCTS

2.01 GENERAL

A. All process system instrumentation shall be adequately supported and securely mounted in locations shown on the Plans and as specified herein. Devices specified to have remote-mounted transmitters/signal converters shall be provided with additional support brackets and/or hardware necessary to securely mount them in locations as directed by the Engineer. Coordinate installation with other equipment, piping, and electrical system installations.

B. All process system instrumentation shall be suitable for indoor and outdoor use, and capable of functioning in ambient temperatures ranging from -20 ºF to 140 ºF, and a relative humidity up to 100%. Devices located in process tanks, flumes, trenches, vaults, or any other locations susceptible to flooding or immersion, shall be watertight and adequately protected for use in such environments. Devices located in hazardous areas shall meet the area classification identified.

2.02 MANUFACTURERS

A. Subject to compliance with these specifications, all flow meter and pressure transmitter process instrumentation shall be the products of the following manufacturer:

1. Endress+Hauser, Inc., 2350 Endress Place, Greenwood, IN 46143; Phone: (888) 363-7377; www.us.endress.com.

B. Submersible level transducers for wastewater applications shall be as manufactured by Siemens Water Technologies (U.S. Filter Control Systems), 1239 Willow Lake Boulevard, Vadnais Heights, MN 55110; Phone: (800) 224-9474; Fax: (651) 766-2701.

2.03 ELECTROMAGNETIC FLOW METERS

A. General

1. Electromagnetic type flow meters shall be provided and installed in piping as specified and shown on the Plans. Flow meter design, including the flow sensor, transmitter/signal converter, display, and appurtenances, is based upon Endress+Hauser Promag W series flow sensor with a Promag 400 series transmitter.

2. Flow meters shall be of the pulse DC type, volumetric liquid flow rate detector. Magnetic flow meters shall be of low frequency electromagnetic induction type and shall produce a DC pulse signal directly proportional and linear to the liquid flow rate.

3. Meter accuracy shall be 0.5 percent of the flow rate between 10 percent and 100 percent of the range setting. Below 10 percent of the range setting, accuracy shall be diminished no more than a flow rate equal to 0.1 percent of the range setting.

4. Meters shall be sized to maintain the specified accuracy for the anticipated full range of flow with velocities between 3 and 10 ft/s, or as recommended by the manufacturer.

B. Power Supply

1. The flow meter sensors and transmitters shall be designed for operation on a 24VDC power supply, as shown on the Plans. The flow meter transmitter shall be a microprocessor based signal converter, and shall include a magnetic driver to power the magnetic coils of the flow sensor in addition to the transmitter. Sufficient interconnecting manufacturer's cable shall be supplied for remote mounted transmitter installations.

C. Flow Sensor

1. The meter body and flanges shall be constructed of carbon steel and have a two-component epoxy, polyurethane, or baked-on enamel coating. Flanges shall be standard ANSI class 150 lb. drilled. Meters shall be clearly marked with engraved tags connected to the meter indicating meter number and source of water or other medium flowing through meter. Tags shall be attached to the meter by adhesive or screws and shall be visible and readable from a distance of at least 10 feet.

2. Provisions for grounding to the liquid and to a positive ground shall be provided and installed with each meter. The grounding electrode shall be constructed of Hastelloy C, stainless steel, or other material as approved by the Engineer. The grounding electrode shall be built in to the meter or separate grounding ring(s) supplied. A grounding lug shall be provided on the meter/meter head for connection to the building grounding system. Grounding connections shall be made in accordance with the manufacturer's instructions. During startup the manufacturer's representative shall confirm adequate grounding.

3. The metering tube/measuring pipe shall be constructed of stainless steel. Meter liners shall be suitable for the medium being metered. For water, sewage, and sludge applications the meter liner shall be ebonite hard rubber or other material as approved by the Engineer. For chemical solution applications the meter liner shall be Teflon or other material as approved by the Engineer. Epoxy coating liners will not be accepted.

4. The meter terminal box shall be constructed of polycarbonate, fiberglass reinforced polyamide, or other material as approved by the Engineer. Terminal boxes for meters located in process tanks, flumes, trenches, vaults, or any other locations susceptible to flooding or immersion, shall be NEMA 6P rated, supplied with manufacturer's optional potting kit or otherwise sealed and watertight.

D. Transmitter

1. The flow meter transmitter shall produce a 4-20 mA DC signal proportional to flow through the meter for transmitting to a PLC and for other receivers as shown on the Plans. A 30VDC, 250 mA (maximum) signal (pulse) shall be produced for every measured flow of a preconfigured volume. These pulses shall be suitable for use with the discrete cards used in the PLC, and shall be configured so that the minimum pulse width is at least 100 ms.

2. Flow meter transmitters shall be integral to the meter tube or remote mounted on a wall or support adjacent to the meter tube at a location and height as shown on the Plans, or directed by the Engineer. Meters located in process tanks, flumes, trenches, vaults, or any other locations susceptible to flooding or immersion, shall have remote-mounted transmitters. Provide the manufacturer's optional wall-mount bracket and terminal box cover for remote-mounted installations. Sufficient interconnecting manufacturer's cable shall be provided to run from the flow sensor to the transmitter without splicing.

3. Transmitters for both integral and remote mounted installations shall be NEMA 4X/6 rated and constructed of polycarbonate, fiberglass reinforced polyamide, or other material as approved by the Engineer. Transmitters shall be provided with a two-line minimum backlit liquid crystal display (LCD), one line showing gallons per minute (GPM) and the other showing cumulative gallons. The display shall be scaled in GPM for the calibration range of the meter.

2.04 PRESSURE TRANSMITTERS

A. Pressure transmitters shall be provided and installed in piping as specified and shown on the Plans. Transmitters shall be two-wire, capacitance-based analog devices capable of measuring gauge pressure or level. Pressure instrumentation specified are based upon Endress+Hauser Cerabar M PMP51 series sensor and transmitter.

B. Transmitters shall have a liquid crystal display (LCD) with 4-20 mA analog output, suitable for operation from a 24VDC power supply. The transmitter housing shall be dual-compartment design, constructed of powder coated die-cast aluminum with 1/2-inch NPT conduit connections. Wetted parts of the transmitter shall be constructed of Type 316 stainless steel. Enclosures shall have a NEMA 4X rating. Transmitters located in hazardous (classified) areas shall have explosion proof enclosures or be certified intrinsically safe, and shall be suitable for installation in the area classification specified or identified on the Plans.

C. Pressure transmitters shall meet the following performance criteria:

1.	Total Accuracy Performance:	±0.34% of URL
2.	Long Term Stability (1-year):	±0.1% of URL
3.	Long Term Stability (5-year):	±0.2% of URL
4.	Total Error:	±0.35% of URL/year

D. All transmitters shall be installed with and isolation valve at the process connection for ease of maintenance, as shown on the Plans. Size and type of valve shall be as specified and shown on the Plans, minimum 1/2-inch NPT. Transmitters for clean water installations shall be supplied with a factory assembled block and bleed valve. Transmitters for sewage and sludge installations shall be supplied with a threaded diaphragm seal directly connected to the transmitter and constructed of Type 316 stainless steel with a Teflon lined diaphragm and a minimum 1/4-inch NPT diameter flushing connection. A stainless-steel nipple and isolation valve shall be installed on the flushing connection.

E. Pressure transmitters shall be mounted at a location as shown on the Plans, or directed by the Engineer. Transmitters shall be installed so the display can be easily read from the finish floor level. Remote diaphragm seals shall be provided where required, or where indicated on the Plans, for process connections that are greater than 5 feet above the finish floor elevation. Remote seals shall be constructed of Type 316 stainless steel, in a size and style as shown on the Plans. Provide sufficient stainless-steel capillary tubing and silicone filling liquid between the remote seal and transmitter. Provide fill and drain ports with valves as required for proper installation and maintenance.

F. Optional mounting brackets and hardware shall be supplied with each transmitter, type to fit the location and mounting requirements as shown on the Plans.

2.05 SUBMERSIBLE LEVEL TRANSDUCERS

A. Submersible level transducers for wastewater applications shall be two-wire, loop powered instruments that use a gauge pressure piezoresistive sensor element to measure hydrostatic head-pressure that is proportional to the height of the liquid above the sensing diaphragm, which is converted to a 4-20mA output signal that spans the full pressure range of the transducer. Transducers shall be model A1000i, as manufactured by Siemens Water Technologies (U.S. Filter Control Systems).

B. The submersible transducer housing shall be constructed of Teflon coated Type 316 stainless steel, with a large diameter protruding Teflon coated Buna-N sensing diaphragm that isolates the sensor element from the media. The transducer housing shall have a minimum 1-inch NPT diameter support connection. The transducer shall be suitable for operation from a 24VDC power supply. Transducer accuracy shall be ±0.25% of full scale with long term stability of 0.2% of full scale per year.

C. The transducer cable shall be constructed of heavy-duty polyethylene with a vent tube and shielded 18 AWG conductors. Sufficient length of manufacturers vented cable shall be supplied as required for the installation plus an additional 5 feet, minimum. The transducer shall be barometrically compensated via a rigid breather tube connected to a panel mounted sealed breather assembly. The manufacturer's optional terminal connection junction box with hinged and gasketed cover and built-in breather assembly kit shall be supplied with each transducer. Junction boxes shall be NEMA 3/4X rated, constructed of Type 304 stainless steel, and shall be sufficiently sized to house the termination board(s), breather tube, bellows, and excess vented cable. Where required or shown on the Plans, an intrinsically safe barrier between the transducer and junction box shall be provided to make the level transducer system suitable for use in a Class I, Group D, Division 1 or 2 classified location.

D. Submersible level transducers shall be suspension cable supported. Provide the manufacturer's optional cable suspension mounting kit, including a 2-foot long 1-inch NPT Type 316 stainless steel pipe with coupling, bolt, cable clamps, hardware, and sufficient length of 1/8-inch diameter stainless steel cable. The pipe connection shall be slotted for the vented cable to pass through. Provide a stainless-steel mounting bracket at the top of the structure to support and secure the suspension cable and vented transducer cable.

2.06 RADAR LEVEL SENSORS

A. General:

Non-contact liquid level measurement devices for wet wells, tanks, and open channels shall be free-space radar type, unaffected by changing media, temperature, gas blankets or vapors. Devices specified herein are based on Endress+Hauser Micropilot Series FMR 20, and shall the following minimum features:

1. The pulsed time of flight radar transmitter shall operate at 26 GHz using 2-wire technology for level measurement and/or open channel flow measurement.

2. Accuracy shall be ±0.08-inches and maximum measuring distance shall be 0 to 66 feet.

3. The radar shall have CSA C/US General purpose approvals as required. The radar unit shall be rated for IP66/68, NEMA4X/6P. The radar sensor body shall be constructed of PVDF and shall have hermetically sealed wiring and fully potted electronics, eliminating water ingress.

4. The radar unit shall be suitable for operation in a process temperature range of -40 to 176 degrees F, and a pressure range of -14.5 to 43 psi.

5. The unit shall provide diagnosis information according to NAMUR NE107, with clear text messages to remedy. It must be possible to view a graphical representation of the actual signal and envelope curve on the display.

6. The process connection shall be 1-inch NPT, with 1/2-inch NPT female conduit connection.

7. The radar output signal shall be 4-20 mA dc loop powered.

8. The radar device shall have Bluetooth wireless technology interface that can be operated and configured via this interface using the manufacturer's app. The range under reference conditions shall be 33 feet. The Bluetooth connection shall have both encrypted communication and password encryption for security purposes. The Bluetooth wireless technology interface shall be capable of being deactivated. The radar device shall be capable of being configured with 4-20mA/Hart, remote RIA 15 display, or Bluetooth as options.

9. The radar signal on alarm shall be 22.5mA.

10. The radar shall have a linearization function with up to 32 value pairs entered allowing conversion of the measured value into any unit of length, weight, flow or volume.

11. The radar unit shall be rated for IP66/68, NEMA4X/6P.

12. The radar unit shall be supplied with an optional adjustable mounting bracket constructed of Type 316L stainless steel.

13. Where required or shown on the Plans, an intrinsically safe barrier between the radar and junction box shall be provided to make the level sensor system suitable for use in a Class 1, Group D, Division 1 or 2 classified location.

PART 3 – EXECUTION

3.01 INSTALLATION AND STARTUP

A. Install process measurement devices and appurtenances in accordance with the manufacturer's instructions. Coordinate installation with installation of equipment, piping, electrical systems, and other related construction.

B. The manufacturer or manufacturer's representative shall provide a minimum of two (2) days of onsite startup, testing and verification of installation for all process measurement devices and appurtenances. All construction, including assembly, installation, electrical and process connections, adjustment and calibration shall be complete and ready for operation, prior to scheduling the services of the manufacturer.

C. For flow meters, the manufacturer's representative shall certify in writing to the Engineer that proper grounding installation has been achieved.

D. Following successful startup and testing of the process system instrumentation, the manufacturer's representative shall submit a detailed field report confirming proper installation and successful operation of instruments, and conformance of the process system instrumentation with the Plans and Specifications. A copy of the field report shall also be included in the project O&M manuals.

E. The manufacturer or manufacturer's representative shall provide a minimum of one (1) day of onsite instruction and training to the Owner and Engineer in the operation and maintenance of all process system instrumentation and appurtenances.

END OF SECTION 40 70 11

SECTION 40 73 11 – PROCESS CONTROL SWITCHES AND GAUGES

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this section includes furnishing, installing, testing, startup, training, and warranty support for all process control switches and gauges, including float switches, pressure switches and gauges, and all required appurtenances, complete and operable, as specified and shown on the plans.

B. Electrical wiring and equipment with electrical connections and control and safety devices shall be Recognized Electrical Testing Laboratory (RETL) listed and labeled, or the Contractor shall obtain approval from the Washington State Department of Labor and Industries.

1.02 RELATED SECTIONS

A. Submittals 01 33 00 – Submittals Procedure

B. Sectopm 01 78 00 – Operation and Maintenance Manuals

C. Division 26 – Electrical

D. Section 40 20 11 – Process Piping

E. Section 40 70 11 – Instrumentation for Process Systems

1.03 SUBMITTALS

A. Refer to Submittals 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit manufacturer's complete descriptive product data and specification sheets for all process control switches, gauges, and appurtenances. Clearly identify all accessories and options being provided, as specified and shown on the plans.

C. Submit operation and maintenance manuals in accordance with Section 01 78 00 – Operation and Maintenance Manuals.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver process control switches and gauges to the job site at appropriate time for installation. All equipment and materials shall be crated and/or packaged with protective wrappings to prevent damage during delivery, storage and handling.

B. Store all equipment and materials above ground and in weather tight enclosures. Keep all equipment and materials dry and protect from excessive heat or cold.

1.05 TOOLS AND SPARE PARTS

A. Provide special tools and spare parts as recommended by the manufacturer.

B. Spare parts shall be properly packaged and labeled for easy identification without opening and protection for long term storage.

1.06 WARRANTY

A. All process gauges shall have a ten (10) year system warranty from the date of substantial completion.

PART 2 – PRODUCTS

2.01 GENERAL

A. All process control switches and gauges shall be adequately supported and securely mounted in locations shown on the plans and as specified herein. Coordinate installation with other equipment, piping, and electrical system installations.

B. All process control switches and gauges shall be suitable for indoor and outdoor use, and capable of functioning in ambient temperatures ranging from -20ºF to 140ºF, and a relative humidity up to 100 percent, unless otherwise specified. Switches and gauges located in process tanks, flumes, trenches, vaults, wet wells, or any other locations susceptible to flooding or immersion, shall be watertight and adequately protected for use in such environments. Switches and gauges located in hazardous areas shall meet the area classification identified.

2.02 FLOAT SWITCHES

A. Liquid level switches shall be hollow-body, hermetically sealed, rigidly molded in abrasion and corrosion resistant polypropylene, with a mercury free SPDT switch. The switch shall be cushioned and mounted along the main axis at about a 65-degree inclination. A three-conductor oval cable of sufficient length shall serve to convey electrical signals and provide support for the unit. The cable shall be heavily sheathed in PVC for resistance to immersion, corrosion and abrasion. The cable shall be assembled into the small end of the sensor. The sensor body shall also contain and eccentric metal weight to cause pivoting of the sensor body between two stable positions, with the sensor immersed or non-immersed. Switches shall be as manufactured by Dwyer Instruments, Inc., SJE-Rhombus, Gems Sensors and Controls, or approved equal.

B. The elevation of liquid level switches shall be adjustable without special tools. The liquid level switches shall be suspended within the vault/wet well so that they do not interfere with access to the vault/wet well floor, other equipment, or the operation of other instruments.

C. A float mounting bracket shall be provided as shown on the Plans. Provide strain reliefs that support and hold the level control cables. The cables shall be continuous to the control junction box. No splices shall be made in the wiring inside the vault/wet well. Sufficient cable length shall be provided to allow for full adjustment of the floats for the entire vault/wet well depth.

D. Multi-level float switches shall be Madison M-Series or approved equal with stainless steel floats and float guide, suitable for operation from a 24VDC power supply. Number of floats and length of float guide shall be as shown on the Plans and suitable for the application.

E. Float switches shall be UL listed and suitable for installation in a Class I, Group D, Division 1 classified area where required.

2.03 PRESSURE GAUGES

A. General: Provide a pressure gauge on the suction and discharge side of each pump and at all other locations shown on the Plans. The range of all gauges shall be approximately two times the normal system pressure so that when the system is operating, the pressure gauge will read near center scale or as indicated on the Plans. Gauges on suction side of pumps shall be compound direct reading type. Anticipated required gauge pressure ranges shall be as follows:

Location	Quantity	Service Type	Pressure Range
Drain Lift Station Discharge	2	Sludge	0-30 psi
Influent Lift Station Discharge	2	Sewage	0-30 psi

The above list does not include all gauges required for the project. Refer to the Plans and other specification sections for process gauges required for packaged process equipment, and to provide a complete installation of all equipment and materials.

B. All gauges and appurtenances specified herein shall be process gauges as manufactured by Ashcroft, Marsh, REOTEMP, or Engineer approved equal.

C. Clean/Utility Water and Air Service Gauges

1. Gauges for clean water service shall be 4-1/2-inch dial; stem mounted black phenolic case; high impact, non-cracking plastic lens; bourdon tube assembly; glycerin-filled gauge mechanism and case, suitable for a process temperature range of -40 to 200 degrees F; white dial background with black numerals and gradations; accuracy of ±0.5 percent of full scale; 1/2-inch NPT connection; pulsation dampener; maximum pointer; red set hand; and under/overload stop protection.

D. Sewage/Sludge Gauges

1. Gauges for sewage, sludge and scum service shall be the same as specified above for clean water gauges, except they shall be provided with a 300 series stainless steel clean out type diaphragm with a 1/2-inch NPT female process connection and 1/2-inch NPT female gauge connection. Diaphragm shall have a 1/4-inch NPT female flushing connection. Diaphragm shall be Ashcroft® Type 101, or approved equal, with optional 316 stainless steel top and bottom housing and diaphragm, 300 series SS clamps rings and clamping bolts.

2. Tubing between diaphragm and wall-mounted gauge (where applicable) shall be flexible spiral armor, stainless steel capillary tube. Entire diaphragm, tube and gauge assembly shall be assembled and fill with liquid at the factory. It shall be the responsibility of the Contractor to provide the gauge supplier with necessary data on individual locations for length of tube, pressure range, etc.

E. Chemical Gauges

1. Gauges for chemical service shall be the same as specified above for clean water gauges, except they shall be provided with a 1/2-inch NPT diaphragm seal. Diaphragm seal shall be Ashcroft® Type 200, or approved equal, with PVC housing, Teflon diaphragm, 316 SS top housing, and 300 series SS clamps rings and clamping bolts.

2.04 PRESSURE SWITCHES

A. Pressure switches shall be diaphragm piston actuator design with SPDT contacts, water tight enclosure, 1/4-inch NPT process connections, 1/2-inch NPT conduit connection, field-adjustable for a pressure range as required for the application, Ashcroft® B-series, or approved equal. Switches shall be UL listed and suitable for operation on a single phase, 240 VAC, 60 Hz power supply. Switches shall be suitable for installation in a Class I, Group D, Division 1 classified area where required.

B. Switches for pump service control shall be general purpose type with adjustable pressure differential between 20 psi minimum and 40 psi maximum.

C. Switches for low/high pressure cut-out applications shall be set to break on rising or falling pressure, as required. An optional manual reset trip lever shall be provided.

D. Pressure switches for sewage, sludge, or scum service shall be provided with a cleanout type diaphragm seal. Diaphragm seal shall have 1/2-inch NPT process connection, 1/4-inch NPT instrument connection, and 1/4-inch NPT flushing connection, Ashcroft® Type 101, or approved equal, with optional 316 stainless steel top and bottom housing and diaphragm, 300 series SS clamps rings and clamping bolts.

E. Anticipated required pressure switches and setting ranges shall be as follows:

Location	Quantity	Service Type	Pressure Range
Mixing Tank and Sludge Feed Pump Discharge	3	Sludge	30 psi nominal. Set at 15 psi; adjustable from 10-20 psi.

PART 3 – EXECUTION

3.01 INSTALLATION AND STARTUP

A. Install all process control switches, gauges, and appurtenances in accordance with the manufacturer's instructions. Coordinate installation with installation of equipment, piping, electrical systems, and other related construction.

END OF SECTION 40 73 11

SECTION 40 78 00

PANEL MOUNTED 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 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 26 05 02 for additional materials and installation information.

1.3 SUBMITTALS

A. General: Submit each item in this Article as described in Section 26 05 01 and Division 1 Specification Sections.
B. 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. In addition to the requirements of 26 05 01 and Division 1 Specification sections, submit only one manufacturer for each product type. Multiple manufacturers for the same product will be rejected.

C. For each type of control station

1. Pilot Devices
2. Enclosures
3. Auxiliary Components

D. Operation and Maintenance Manual: At the completion of the project, the operating and maintenance information shall be updated to reflect any changes made during the course of construction. The 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 26 05 01 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 26 05 01 paragraph 1.11.
B. Remove equipment protection only after equipment is safe from hazards such as dirt, 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.

i. Dry and indoor locations: standard contact blocks rated for 10 A continuous current.
ii. 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.

        i. Dry and indoor locations: standard contact blocks rated for 10 A continuous current.
        ii. 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

        i. LED, or incandescent type.
        ii. Allows replacement of lamp without removal from enclosure.
        iii. 24 volt lamp
        iv. Push to test type.
        v. Glass lens
        vi. 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.

D. Multi-status indicator lights shall consist of multi-color LED indicators group mounted in a single enclosure.

1. 24 VDC
2. Red/Blue/Amber LED light
3. Suitable for Class 1 Division 2 locations
4. Programmable flash rate to differentiate status urgency.

    a. Red – 240 FPM
    b. Amber - 120 FPM
    c. Blue – Steady

5. Edwards Signaling model 105XBRiRBA24D
6. Accessories:

    a. Mounting bracket: 105BM
    b. Outlet box attachment: 105BX

E. Alarm Horns shall be

1. Indoor horns - Edwards 875-G, or equal.
2. Outdoor horns - Edwards 877-G, or equal.

F. Momentary Push Button shall consist of a normally open, protruding center, and spring return.

1. White
2. AC or DC
3. Edwards Signaling model 695-W
4. Accessories:

    a. Mounting plate: 147-1

G. Held Push Button shall consist of a normally closed and normally open contacts as required, turn to reset.

1. Polycarbonate housing
2. Rounded cover to prevent inadvertent activation.
3. Safety Technology International (STI) model SS2xx1ZA-EN,

    a. Color noted on plans
    b. Message noted on plans

4. Accessories:

    a. Weatherproof shield: STI-6517

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. Utilize manufacturer’s accessory mounting devices appropriate for mounting location designated on the Plans.
B. Mount 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

DIVISION 43 – PROCESS GAS AND LIQUID HANDLING EQUIPMENT

SECTION 43 21 39 – SUBMERSIBLE LIQUID PUMPS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this section includes furnishing all labor, materials and equipment required to supply and test pumps and appurtenances as specified in this section. The scope of work shall also include delivery, installation assistance, inspection, certification of installation, functional testing, startup and job site training.

B. The equipment and products specified in this section and shown on the Plans are based upon the "basis of bid" manufacturer indicated. Substitute or alternate manufacturers must be approved in accordance with the procedures specified in Section 01 25 50 - Substitutions of Major Equipment Items and Products, and by written approval of the Engineer.

1.02 RELATED SECTIONS

A. Section 01 25 50 - Substitution of Major Equipment Items and Products

B. Section 01 33 00 – Submittals Procedure

C. Section 01 78 00 – Operation and Maintenance Manuals

D. Division 26 - Electrical

E. Division 40 – Process Interconnections

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM).

B. Hydraulic Institute (HI).

C. National Electrical Manufacturers Association (NEMA).

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit manufacturer’s product data and shop drawings of all pumps and appurtenances. Shop drawing submittals shall be complete with one submittal for each model of pump. Individual manufacturer's submittals for portions of the pump unit will not be accepted. Drawings shall show general dimensions of the pumps and accessories and confirm the size of the pump, openings, connections, construction details of the equipment, panel (interior, exterior, bill of materials, and functional description), wiring diagrams, piping drawings, and weights of major components

C. Submit performance curves showing capacity in GPM, NPSH, head, and pump horsepower from 0 GPM to 110 percent of design capacity. For variable speed pumps, a family of curves shall be provided for 150 RPM increments.

D. Submittal data and performance curves for motors.

E. Submit a copy of the manufacturer’s written warranty, as specified.

F. Submit operation and maintenance manuals in accordance with Section 01 78 00 – Operation and Maintenance Manuals. Include a copy of the startup report.

G. Prior to shipment, submit certified factory performance test results in accordance with Hydraulic Institute Standard 11.6, latest edition.

H. Following successful installation and startup of all pumps, submit a copy of the manufacturer's field startup report.

1.05 QUALITY ASSURANCE

A. Manufacturers shall be of established good reputation regularly engaged in the fabrication of such equipment. Unless otherwise noted, any equipment offered shall be current models which have been in successful regular operation under comparable conditions.

B. Manufacturer shall have a parts warehousing facility and persons qualified in problem troubleshooting and repair of pumps permanently located within 250 mile radius of the City of Grandview.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver pumps and appurtenances to the job site at appropriate time for installation. All equipment and materials shall be crated and/or packaged with protective wrappings to prevent damage during delivery, storage and handling.

B. Store all equipment and materials above ground and in weather tight enclosures. Keep all equipment and materials dry and protect from excessive heat or cold.

1.07 STARTUP SERVICE

A. The manufacturer or manufacturer's qualified representative shall provide a minimum of two (2) days in two (2) trips of startup service to inspect and certify the installation, assist with startup and performance testing of all pumps and appurtenances, and instruct the Owner and Engineer in operation and maintenance of all equipment. Refer to Part 3 of this section for additional requirements.

1.08 TOOLS AND SPARE PARTS

A. Spare parts kit. There shall be furnished the following minimum spare parts for each pump model:

1. Two (2) sets of wear rings.

2. Two (2) sets of impeller clearance adjustment shims.

3. Two (2) sets of bearings.

4. Two (2) sets of mechanical seals.

B. Provide any other special tools or spare parts as recommended by the manufacturer.

C. Spare parts shall be properly packaged and labeled for easy identification without opening and protection for long term storage.

1.09 WARRANTY

A. All equipment furnished under these specifications shall be guaranteed against defects in material and workmanship for a period of two (2) years from the date of successful completion of the dewatering system commissioning or thirty (30) months from delivery to the project site, whichever occurs first. Submit a copy of the manufacturer's written warranty for the pump, bearings, seal assembly, and motor. In the event any equipment is found defective, the Contractor shall furnish and install replacement equipment including removal, reinstallation, startup, testing and calibration, as necessary.

PART 2 – PRODUCTS

2.01 GENERAL

A. Pumps will be located as shown on the Plans. Submersible non-clog centrifugal pumps and guiderail system shall be as manufactured by Flygt or equal.

B. Influent Lift Station: Pumps shall have capacity, head, and motor characteristics as required for the operating conditions. This specification is based upon providing three (3) Flygt model NP 3153 submersible pumps for the influent lift station. The anticipated operating conditions for the influent lift station pumps are each 800 gpm @ 47 feet of TDH.

C. Drain Lift Station: Pumps shall have capacity, head, and motor characteristics as required for the operating conditions. This specification is based upon providing two (2) Flygt model NP 3102 submersible pumps for the drain lift station. The anticipated operating conditions for the influent lift station pumps are each 600 gpm @ 15 feet of TDH.

2.02 PERFORMANCE TESTING

A. All submersible pump units shall be factory performance tested to verify guaranteed flow, head, and efficiency conditions in accordance with Hydraulic Institute (HI) Standard 11.6, latest edition. Hydrostatic test acceptance grade shall be 1B. In addition to the hydrostatic test, motor integrity and vibration shall also be tested in accordance with HI 11.6.

B. A test certificate for each pump, including certified performance curves, shall be submitted to the Engineer, certifying that the hydrostatic test was carried out in accordance with HI Standard 11.6, and that the specified acceptance criteria have been met.

C. Prior to conducting a pump test, notification of such test and a list of test equipment and test procedures shall be forwarded to the Engineer at least two weeks before scheduled test date. All electronic transducers, meters, gauges, and other test instruments shall be calibrated in accordance with the requirements of the Hydraulic Institute. Copies of calibration data shall be submitted, if requested by the Engineer.

D. If any tested pump fails to meet the specified performance requirements, it shall be modified until it meets all requirements. The Engineer shall be notified immediately prior to any modifications being made to the tested pump(s). If any tested pump fails to meet the guaranteed efficiency at the specified flow and head conditions, and all reasonable attempts to correct the inefficiency are unsuccessful, the pump(s) shall be replaced with units that meet the specified requirements.

2.03 PUMP CONSTRUCTION

A. General

1. Major pump components shall be constructed of grey cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. The lifting handle shall be constructed of stainless steel. All exposed nuts and bolts shall be stainless steel. All metal surfaces, other than stainless steel or brass, shall be protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

2. Sealing design shall incorporate metal-to-metal contact between machined surfaces. Critical mating surfaces where watertight sealing is required shall be machined and fitted with nitrile rubber o-rings. Fittings will be the result of controlled compression of rubber o-rings in two planes and o-ring contact of four sides without the requirement of a specific torque limit. Rectangular cross sectional gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical o-rings, grease or other devices shall be used.

3. Pump data plates shall be stainless steel suitably attached to the pump. Data plates shall contain manufacturer's name, pump size and model, serial number, speed, impeller diameter, capacity and head rating, and identification of frame and bearing numbers.

B. Impeller

1. The pump impeller shall be constructed of hard-iron, ASTM A-536 (Alloy III A), 25 percent chrome cast iron, 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 Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 5 percent sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by means of a single trim screw. The impeller shall be locked to the shaft, held by an impeller bolt and shall be coated with alkyd resin primer.

C. Volute

1. The pump volute shall be a single piece grey cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable suction cover ring in which are cast spiral-shaped, sharp-edged groove(s). The spiral groove(s) shall provide trash release pathways and sharp edges across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The insert ring shall be cast of hard-iron, ASTM A-536 (Alloy III A), 25 percent chrome case iron, and provide effective sealing between the multi-vane, semi-open impeller and the volute housing.

D. Shaft

1. The pump and motor shaft shall be a single piece unit. The pump shaft is an extension of the motor shaft. Shafts using mechanical couplings shall not be acceptable. The shaft shall be stainless steel, ASTM/AISI 420. Shaft sleeves will not be acceptable.

E. Bearings

1. The integral pump/motor shaft shall rotate on two bearings. The motor bearings shall be sealed and permanently grease lubricated with high temperature grease. The upper motor bearing shall be a two row angular contact ball bearing. The lower bearing shall be a two row angular contact ball bearing to handle the thrust and radial forces. The minimum L10 bearing life shall be 50,000 hours at any usable portion of the pump curve.

F. Mechanical Seals

1. Each pump shall be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two (2) seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, shall contain one stationary and one positively driven rotating corrosion and abrasion resistant silicon-carbide ring. The upper secondary seal, located between the seal chamber and the seal inspection chamber shall be a leakage-free seal. The upper seal shall contain one stationary and one positively driven rotating corrosion and abrasion resistant silicon-carbide seal ring. The rotating seal ring shall have small back-swept grooves laser inscribed upon its face to act as a pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. All seal rings shall be individual solid sintered rings. Each seal interface shall be held in place by its own spring system. The seals shall not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs shall be isolated from the pumped media to prevent materials from packing around them, limiting their performance.

2. Each pump shall be provided with a lubricant chamber for the shaft sealing system. The lubricant chamber shall be designed to prevent overfilling and shall provide capacity for lubricant expansion. The seal lubricant chamber shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication.

3. The area about the exterior of the lower mechanical seal in the cast iron housing shall have cast in an integral concentric spiral groove. This groove shall protect the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal due to centrifugal action.

4. A separate seal leakage chamber shall be provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage shall not contaminate the motor lower bearing. The leakage chamber shall be equipped with a float type switch that will signal if the chamber should reach 50 percent capacity.

G. Motor

1. The pump motor shall be a NEMA B design, induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings shall be insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator shall be 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 motor shall be inverter duty rated in accordance with NEMA MG1, Part 31. The motor shall be capable of operating from a 480 V, 3-phase, 60 Hz power supply.

2. The stator shall be heat-shrink fitted into the cast iron stator housing. The use of multiple step dip and bake-type stator insulation process is not acceptable. The use of pins, bolts, screws or other fastening devices used to locate or hold the stator and that penetrate the stator housing are not acceptable. The motor shall be designed for continuous duty while handling pumped media of up to 104°F. The motor shall be capable of no less than 30 evenly spaced starts per hour. The rotor bars and short circuit rings shall be made of aluminum.

3. Three thermal switches shall be embedded in the stator end coils, one per phase winding, to monitor the stator temperature. These thermal switches shall be used in conjunction with and supplemental to external motor overload protection and shall be connected to the motor control panel.

4. The junction chamber shall be sealed off from the stator housing and shall contain a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable. The motor and the pump shall be produced by the same manufacturer.

5. The motor service factor (combined effect of voltage, frequency and specific gravity) shall be 1.15. The motor shall have a voltage tolerance of +/-10 percent. The motor shall be designed for continuous operation in up to a 40°C ambient and shall have a NEMA Class B maximum operating temperature rise of 80°C. A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

6. Motor horsepower shall be sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out. The motor and cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

H. Cooling System

1. Each unit shall be provided with an integral motor cooling system. A stainless steel motor cooling jacket shall encircle the stator housing, providing for dissipation of motor heat regardless of the type of pump installation. An impeller, integral to the cooling system and driven by the pump shaft, shall provide the necessary circulation of the cooling liquid through the jacket. The cooling liquid shall pass about the stator housing in the closed loop system in turbulent flow providing for superior heat transfer. The cooling system shall have one fill port and one drain port integral to the cooling jacket. The cooling system shall provide for continuous pump operation in liquid or ambient temperatures of up to 104°F (40°C.). Operational restrictions at temperatures below 104°F are not acceptable. Fans, blowers or auxiliary cooling systems that are mounted external to the pump motor are not acceptable.

I. Motor Protection

1. Each pump motor stator shall incorporate three thermal switches, one per stator phase winding and be connected in series, to monitor the temperature of the motor. Should the thermal switches open, the motor shall stop and activate an alarm. A float switch shall be installed in the seal leakage chamber and will activate if leakage into the chamber reaches 50% chamber capacity, signaling the need to schedule an inspection.

2. The thermal switches and float switch shall be connected to a Mini CAS control and status monitoring unit. The Mini CAS unit shall be designed to be mounted in the pump control panel.

J. Power and Control Cables

1. The power cable shall be sized according to the NEC and ICEA standards and shall be of sufficient length to reach the junction box without the need of any splices. The power cable shall be of a shielded design in which an overall tinned copper shield is included and each individual phase conductor is shielded with an aluminum coated foil wrap. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet or greater.

2. The cable entry seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall consist of dual cylindrical elastomer grommets, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter. The grommets shall be compressed by the cable entry unit, thus providing a strain relief function. The assembly shall provide ease of changing the cable when necessary using the same entry seal. The cable entry junction chamber and motor shall be sealed from each other, which shall isolate the stator housing from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered equal.

K. Discharge Base

1. Pumps shall be supplied with a cast iron mating discharge base connection and be automatically and firmly connected to the pump discharge connection. Sealing of the pumping unit to the discharge connection shall be accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, o-ring, or profile gasket will not be acceptable. No portion of the pump shall bear directly on the sump floor.

2. The discharge base elbow shall support the total weight of the pumping unit. The base shall be securely bolted directly to the sump floor. The base discharge shall have 125 pound ANSI flange, discharging vertically.

L. Guide Rail/Bracket

1. The sliding bracket assembly shall be part of the pumping unit, constructed so that when lowered to the discharge base a watertight seal is achieved as described above.

2. A minimum of two guide rails shall be provided to guide the pump when being raised and lowered into the wet well. The rails shall extend from the top of the station to the discharge connection. There shall be no need for personnel to enter the wet well. Cable guide systems are not acceptable. An upper rail guide bracket shall be furnished to support and align the rails at the top of the wet well. The entire guide rail system shall be constructed of stainless steel.

3. Each pump shall be fitted with a minimum of 20 feet of stainless-steel lifting chain or cable. The working load of the lifting system shall be 50 percent greater than the weight of the pump unit.

PART 3 – EXECUTION

3.01 INSTALLATION AND STARTUP

A. Installation of pumps and appurtenances shall be in strict accordance with the manufacturer’s instructions and recommendations in the locations specified and shown on the Plans.

B. The Contractor shall employ qualified competent personnel for the installation, testing, and startup of all pumps and controls. Contractor shall include as part of the contract, the services of a field representative from the Manufacturer or certified manufacturer's representative for a total of two (2) days in two (2) trips to inspect the installation, carry-out the equipment startup procedures, and provide training to the operators in how to effectively operate and maintain the equipment.

1. The first trip shall be to inspect the installation and perform startup services. The second trip shall be allocated solely to instruction of plant personnel in operation and maintenance of the equipment. The instruction period shall be scheduled at least 10 days in advance with the Owner and shall take place prior to acceptance by Owner.

C. Upon completion of the installation, the Contractor shall submit a certificate from the Manufacturer stating that the installation of the pumps is satisfactory, that the pumps are ready for operation, and that the personnel have been suitably instructed in the operation, lubrication and maintenance of each unit.

3.02 FIELD TESTING

A. Prior to pump submergence and field testing, the Contractor shall at a minimum check all power cables, seal lubrication, rotation, power supply voltage, motor operating load and no load current.

B. Each pump shall run submerged in water. Motor and cable insulation shall be tested for moisture content or insulation defects.

C. In addition to testing that may be required by codes and requirements to verify proper installation and operability, the Contractor shall perform a test duplicating all normal operating modes. The motor service factor shall be checked during the test. All pump tests shall be included in the contract price for the particular pump system.

D. The Contractor shall notify the Engineer or Owner a minimum of one week in advance of running any tests unless otherwise specified and no tests shall be accepted unless the Engineer or a representative of the Owner is present, unless otherwise directed by the Engineer. Should test indicate unsatisfactory operation, conditions shall be corrected and test repeated at Contractor's expense.

E. Upon completion of the installation of the pumps, the Contractor and manufacturer's representative shall conduct, in the presence of the Engineer, such tests as are necessary to indicate that pump efficiency and discharge capacity conform to the specifications. The Engineer shall be notified of such testing a minimum of 5 days in advance, unless otherwise specified.

F. If the pump performance does not meet the Specifications, corrective measures shall be taken by the Contractor, or the pump shall be removed and replaced with a pump that satisfies the specified conditions. A 24-hour operating period of the pumps will be required before acceptance. During this 24-hour operating period, the Contractor shall supply all personnel, power, tools, equipment and incidentals necessary. This operating period and pump acceptance, in no way relieves the Contractor of the warranty period specified.

G. Upon completion of successful performance testing by the Contractor/Manufacturer's representative, a written report of the in-field performance test results shall be submitted to the Engineer for review and approval. The report shall include the manufacturer's published performance data and indicate any deviations from in-field test results. Recorded test data shall be included in both tabular format and plotted against the manufacturer's performance curve. Both electrical and hydraulic test results shall be included in the report.

END OF SECTION 43 21 39

DIVISION 46 – WATER AND WASTEWATER EQUIPMENT

SECTION 46 24 16 – SLUDGE GRINDER CONTROL PANEL REPLACEMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work included in this section consists of furnishing, installing, testing and placing in operation one (1) replacement local control panel for the existing sludge grinder (Muffin Monster comminutor, 5hp) shown on the Drawings and specified herein. Work shall include removal and disposal of the existing local control panel, reconnection to the existing grinder motor and control circuits, modifications required for a complete operating system, and all controls and testing necessary for installation in operating condition.

B. The replacement panel shall be fully compatible with the existing sludge grinder, existing grinder motor, existing interlocks with sludge feed pumps, and the control functions indicated on the Drawings.

1.02 GENERAL DESCRIPTION

A. The existing sludge grinder is provided to grind raw or stored raw primary and secondary sludge from a municipal wastewater treatment plant prior to pumping by the sludge feed pumps to the dewatering press. The replacement control panel shall be designed for the existing grinder service and shall maintain the operational intent of the original installation.

B. The replacement panel shall be a factory-wired, wall-mounted, NEMA 4X control panel for a single grinder motor and shall provide local manual control, remote control, automatic jam clearing by motor reversal, motor overload protection, motor over-temperature monitoring where furnished with the motor, dry contacts for run and failure status, and restart behavior consistent with the Drawings.

C. The control panel shall be suitable for the existing grinder motor and available power supply. Contractor shall field verify voltage, phase, horsepower, full load current, locked rotor current if available, thermostat availability, and all terminal designations prior to fabrication. Unless otherwise noted on the Drawings, the existing grinder motor is 5 HP, 460 volt, 60 Hz, 3-phase.

1.03 MANUFACTURERS

A. Manufacturers shall be of established good reputation, regularly engaged in the manufacture of wastewater grinder controls or industrial control panels for comparable service. Equipment offered shall include current modifications and accessories and shall have been in operation under comparable conditions.

B. The control panel shall be manufactured by JWC Environmental, or by a control panel fabricator authorized by the grinder manufacturer and providing written certification that the proposed panel, control philosophy, and wiring are fully compatible with the existing Muffin Monster sludge grinder and motor.

1.04 CONTROL REQUIREMENTS

A. The replacement control panel shall provide control functions generally consistent with the existing installation and the control panel drawings. Panel operation shall include local operation, remote operation, grinder jam reversal, motor protection, and run/fail indication for interlock with associated equipment.

1.05 MANUFACTURER SERVICES

A. Installation. Services of a manufacturer's representative shall be provided to instruct, assist and check Contractor installation. Manufacturer's representative shall certify that the installation is in compliance with the manufacturer's recommendations, approved submittals and these Specifications. Representative shall be present at startup.

B. Testing. Manufacturer's representative shall conduct field-testing procedures to demonstrate proper operation and compliance with these Specifications. Representative shall be on site a minimum of four (4) hours, or longer if necessary.

C. Operating Instruction. Manufacturer's representative shall conduct operator instruction at time of startup and testing for a minimum of four (4) hours, or longer if necessary. This time shall be in addition to time indicated for testing.

1.06 SUBMITTALS

A. Shop drawings shall include, as a minimum:

1. Front-of-panel layout and internal component layout.
2. Elementary schematic and interconnection diagram.
3. Panel bill of materials identifying manufacturer and catalog number for major components.
4. Enclosure type, dimensions, short-circuit current rating, nameplate schedule, and terminal block schedule.
5. Control schematic and description of the proposed sequence of operation.
6. Recommended power supply and branch circuit protection requirements.

1.07 SPARE PARTS AND TOOLS

A. The control panel shall be provided with only those spare parts and/or tools, if any, that are normally supplied with the equipment by the manufacturer, except as further required by this Specification Section or elsewhere in the Contract Documents.

B. Provide one complete spare set of control fuses for each panel, stored inside the control panel in a clearly labeled container. If the panel uses replaceable plug-in control relays, provide one spare relay of each type.

C. The manufacturer shall furnish a list of recommended spare parts and/or tools with submittals for review by the Owner.

PART 2 – PRODUCTS

2.01 GENERAL

A. The control panel shall be factory assembled, factory wired and factory tested prior to shipment.

B. Panel assembly shall be based on the control philosophy shown on the control panel drawings for the existing Muffin Monster grinder controller and shall be suitable for a single grinder motor installation.

C. Short circuit protection in the upstream disconnect switch or feeder breaker may be provided by others where indicated. Panel manufacturer shall clearly state the required branch circuit protection and conductor size for the actual field conditions.

D. Control panel shall be suitable for wall mounting in the sludge dewatering building near the grinder location as shown on the Drawings.

2.02 ENCLOSURE

A. Enclosure shall be NEMA 4X, fiberglass reinforced polyester resin or stainless steel, suitable for the wet and corrosive wastewater environment. Hinges and latches shall be corrosion resistant.

B. Unless otherwise approved, the replacement panel shall utilize a NEMA 4X stainless steel or FRP enclosure with hinged cover, stainless steel pull latches, mounting feet and interior back panel. Enclosure size shall be not less than 16 inches by 14 inches by 8 inches unless additional space is required for code-compliant wiring and component clearances.

C. Control devices shall be mounted in the front panel of the enclosure and shall be clearly identified with engraved or printed nameplates.

2.03 CONTROL DEVICES AND COMPONENTS

A. Control devices and components shall include, as a minimum, the following:

1. Selector switches, pilot lights, relays, starters, terminal blocks, and other components required for a complete operating system.
2. Local controls and indication to generally match the existing panel functions shown on the Drawings.
3. Motor starting, reversing, and overload protection suitable for the existing grinder motor.
4. Control power components, relays, and internal wiring required for a complete panel.
5. Run and fail contacts for interlock with associated equipment where shown.

B. Pilot devices shall be heavy-duty NEMA 4/4X/13 type. Pilot lights shall be LED type rated for long service life.

C. All relays, contactors, overload devices and terminal blocks shall be industrial-duty components by a recognized manufacturer.

D. All internal wiring shall be neatly bundled, permanently identified, and color coded in accordance with the manufacturer's standards and the approved wiring diagrams.

E. All external field connection points shall be permanently identified to correspond with the final wiring diagrams.

2.04 CONTROL FUNCTIONS

A. The control panel shall provide the control functions indicated on the Drawings and required for proper operation of the existing sludge grinder. Final sequence details shall be as recommended by the grinder manufacturer for the existing equipment.

1. POWER ON pilot light illuminated when control power transformer is energized and control fuses are intact.
2. RUN pilot light and run relay energized whenever the grinder motor forward contactor is energized in ON or REMOTE mode.
3. JAMMED pilot light illuminated when a jam condition is set by the controller.
4. MOTOR FAULT pilot light illuminated when either a motor overload fault or motor over-temperature fault occurs.
5. OFF/RESET position shall de-energize the grinder motor, de-energize run indication, and clear alarm conditions after the fault is corrected.

B. The control functions shall be furnished complete and operational and coordinated with the existing grinder and associated controls.

2.05 FACTORY TESTING

A. The completed panel shall be inspected and functionally tested at the factory prior to shipment.

B. Factory tests shall verify, as a minimum, correct operation of selector switch functions, pilot lights, run relay, fail relay, forward/reverse contactor logic, overload trip status, motor thermostat input status, and remote start/stop logic.

2.06 SPARE PARTS

A. Provide the following spare parts for each panel:

1. One full spare set of control fuses.
2. One spare plug-in relay of each type used in the panel, if plug-in relays are provided.

B. Spare parts shall be packaged in containers suitable for long-term storage and shall bear labels clearly designating the contents and the equipment for which they are intended.

PART 3 – EXECUTION

3.01 EXAMINATION AND FIELD VERIFICATION

A. Prior to fabrication, Contractor shall field verify the existing grinder nameplate data, motor voltage, full load current, thermostat leads if provided, available incoming power, existing control interlocks, and space available for panel installation.

B. Any discrepancy between field conditions and the Drawings shall be brought to the attention of the Engineer prior to fabrication.

3.02 REMOVAL OF EXISTING PANEL

A. Existing local control panel shall be removed and disposed of in accordance with applicable regulations unless otherwise directed by the Owner.

B. Removal and replacement work shall be coordinated to minimize process downtime. Contractor shall protect existing grinder, motor, conduits, and control wiring to remain.

3.03 INSTALLATION

A. All equipment in this section shall be installed in accordance with the manufacturer's instructions, approved submittals, and the Drawings.

B. Install replacement panel plumb and level, anchored to the supporting surface, and provide all wiring, terminations, identification, and adjustments required for a complete operating installation.

C. Reconnect existing grinder motor leads, control leads, remote start/stop circuit, interlock circuits, and run/fail status outputs. Replace damaged terminals, lugs, or short sections of conductor as required to provide a reliable installation.

D. Interlocks with existing associated equipment shall be reconnected and restored to operation.

3.04 FIELD TESTING AND STARTUP

A. Field testing shall be performed in the presence of the manufacturer's representative after installation is complete.

B. Field tests shall demonstrate proper operation of the replacement panel, including local and remote control functions, indication, interlocks, and protective features.

C. Protective device settings shall be adjusted during startup to suit the actual installed equipment.

D. Startup services shall be in accordance with Paragraph 1.05.

END OF SECTION – 46 24 16

SECTION 46 66 23 – CLOSED VESSEL MEDIUM PRESSURE ULTRAVIOLET TREATMENT EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Furnish and install a complete closed vessel, medium pressure, high intensity, ultraviolet (UV) disinfection system as described in this specification and as shown on the drawings. The Contractor shall be responsible for equipment installation per the project specifications and drawings and any additional instructions provided by the Manufacturer during the submittal phase. The Manufacturer shall be responsible for verification of system installation, startup, testing, and operation and maintenance training of the Owner's personnel.

B. The Manufacturer shall guarantee that the system shall be capable of disinfecting a flow of 2.25 MGD with the characteristics as defined in Section 2.03 Operating Parameters.

C. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment application. It is, however, intended to cover the furnishing, delivery, complete installation and field testing of all materials, equipment, and all appurtenances required to complete the work of this section, whether or not specifically mentioned in the project specifications or drawings.

D. The equipment and products specified in this section and shown on the Plans are based upon the "basis of bid" manufacturer indicated. Substitute or alternate manufacturers must be approved in accordance with the procedures specified in Section 01 25 50 - Substitution of Major Equipment Items and Products, and by written approval of the Engineer.

1.02 RELATED SECTIONS

A. Section 01 25 50 - Substitution of Major Equipment Items and Products

B. Section 01 33 00 – Submittals Procedure

C. Section 01 78 00 – Operation and Maintenance Manuals

D. Division 26 – Electrical

E. Division 40 – Process Interconnections

1.03 REFERENCE STANDARDS

A. IP Code, International Electrotechnical Commission (IEC)

B. National Electrical Manufacturers Association (NEMA)

1.04 SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit manufacturer's product data and shop drawings of all equipment and appurtenances in one complete submittal. Drawings shall show general dimensions of the equipment and accessories and confirm the size of the UV disinfection system, connections, construction details, wiring diagrams, and weights of major components.

C. Submit a copy of the manufacturer's written warranty, as specified.

D. Submit operation and maintenance manuals in accordance with Section 01 78 00 – Operation and Maintenance Manuals. Include a copy of the startup report.

E. Following successful installation and startup of all UV equipment, submit a copy of the manufacturer's field startup report.

1.05 QUALITY ASSURANCE

A. Manufacturers shall be of established good reputation regularly engaged in the fabrication of such equipment. Unless otherwise noted, any equipment offered shall be current models which have been in successful regular operation under comparable conditions.

B. The UV equipment specified herein shall be the design and fabrication of a single manufacturer which shall have sole source responsibility for said equipment. The manufacturer shall have UV equipment of this principal design and of comparable capacity in successful operation in the field for a minimum period of 5 years.

C. Manufacturer shall have a parts warehousing facility and persons qualified in problem troubleshooting and repair of UV equipment permanently located within 250 mile radius of the City of Grandview.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver UV equipment and appurtenances to the job site at appropriate time for installation. All equipment and materials shall be crated and/or packaged with protective wrappings to prevent damage during delivery, storage and handling.

B. Store all equipment and materials above ground and in weather tight enclosures. Keep all equipment and materials dry and protect from excessive heat or cold.

1.07 STARTUP SERVICE

A. Manufacturer's representative shall as a minimum perform the following tasks:

1. Inspect, test and adjust the equipment after installation to verify mechanical, structural and electrical integrity and conformance to the equipment specifications. This task shall be scheduled for two (2) trips requiring up to four (4) days on site.

2. Prior to startup, the Manufacturer shall inspect the installed UV disinfection system for proper alignment, correct operation, proper connections, and satisfactory function of all components.

3. Instruct Owner's personnel in the proper operation and maintenance of the equipment.

4. Provide additional services at no cost to the owner to correct any operational problems due to the design and/or fabrication of the UV equipment.

1.08 TOOLS AND SPARE PARTS

A. The following spare parts shall be supplied with the equipment:

1. Four (4) UV lamps

2. Four (4) Quartz sleeve/thimbles

3. Four (4) Sets of quartz sleeve/thimbles seals

4. Four (4) Wiper rings

1.09 WARRANTY

A. The Manufacturer shall furnish a written warranty that provides for:

1. Full replacement of all defective lamps within the first 2,000 hours of operation provided that the system is operated continuously and the system is being operated and maintained per the directions of the Manufacturer.

2. Full replacement of components against defects in materials and workmanship for a period of one (1) year from date of startup not to exceed 18 months from date of shipment.

3. Performance as outlined in Section 2.03 Operating Parameters.

PART 2 - PRODUCTS

2.01 GENERAL

A. The Contractor shall furnish and install a complete medium pressure, high intensity UV disinfection system as described herein. The system shall include, but is not limited to, a stainless steel disinfection chamber and associated power and control equipment. The Contractor shall provide the power source, electrical conduit, field wiring, and equipment base supports. The Contractor shall physically install the disinfection chamber and power and control cabinets according to the project specifications and drawings and any additional information provided by the Manufacturer during the submittal phase. The Manufacturer shall be responsible for verification of installation, startup, testing, and operation and maintenance instruction of the Owner's personnel.

2.02 MANUFACTURERS

A. Only companies with a history of successful closed vessel medium pressure, high intensity UV systems will be considered. In addition to a successful installation base, the Manufacturer shall have been fabricating UV systems for a minimum of five (5) years with more than 1000 UV systems manufactured.

B. Design is based on equipment manufactured by Engineered Treatment Systems (ETS), LLC. The basis of design for the ultraviolet disinfection equipment shall be Model UVLW, as manufactured by Engineered Treatment System (ETS),

C. All piping, structural, and electrical adjustments necessary for use of alternate UV systems shall be the responsibility of the manufacturer and coordinated by the Contractor, at the Contractor’s cost.

2.03 OPERATING PARAMETERS

A. The UV system shall be designed based on the following parameters:

1. Maximum Flowrate: 2.25 MGD

2. Average Flowrate: 2.25 MGD

3. Minimum Flowrate: 1.5 MGD

4. Transmittance: >55 % in a 1 cm quartz cell @ 253.7 nm

5. Total Suspended Solids: <30 mg/l

6. Iron Concentration: <0.1 mg/l

7. Influent Fecal Coliform Count: <75,000 fc/100 ml

8. Effluent Fecal Coliform Count: <200 fc/100 ml

9. Maximum Allowable Head Loss: <6 in (@ 2.25 MGD (per chamber))

10. Operating Pressure: 5 ft @ 2.25 MGD

2.04 ULTRAVIOLET DISINFECTION CHAMBER

A. Chamber

1. The UV system shall consist of two UV chambers. The chambers shall be capable of disinfecting up to 2.25 MGD of wastewater of characteristics described in Section 2.03 Operating Parameters. Maximum design flowrate per chamber shall be 2.25 MGD. Open channel systems or closed vessel systems using low pressure, low pressure high output, or low pressure amalgam lamps will not be acceptable.

2. The chambers shall have the dimensions as depicted on the drawings. Any chambers that require piping modification will be subject to Engineer review and approval or rejection.

3. Each chamber shall have isolation valves (furnished and installed by contractor) installed upstream and downstream of the UV system so that the flow can be isolated during times of maintenance.

4. The chambers shall be constructed of 316L SS. All wetted parts shall be stainless steel, high purity quartz, Viton, or other UV resistant material.

5. UV lamp orientation shall be parallel to the flow. Lamps shall be protected from contact with the water by high purity quartz sleeves/thimbles. The lamps shall be removed from the motor side of the chamber.

6. The chambers shall be designed in such a way that when properly installed and operated there is no possibility of direct operator exposure to UV light from the UV lamps.

B. UV Lamps

1. Only low pressure, high intensity ultraviolet lamps shall be provided for disinfection. Maximum power consumption for each UV chamber shall be 16 kW. Maximum power consumption includes lamp power, power supply losses, cooling fans, and all other appurtenances.

2. The power/control operation shall allow for multiple lamp power levels to extend their operating life. Output of lamps shall vary from 30 to 100% and shall automatically adjust based on lamp intensity and flowrate (4-20 mA signal shall be coordinated with Division 26 - Electrical).

3. Germicidal UV output from the lamps shall not be affected by temperature. Any type of low pressure lamp will be affected by temperature variances in the wastewater and shall not be acceptable.

4. The lamp connections shall be quick disconnect type and have a failsafe mechanical interlock to prevent lamp removal without disconnecting power. If the lamp is disconnected when live the design should be such that operators are protected from the live terminals.

5. Lamp design shall be a water tight design.

C. UV Intensity Monitor

1. One lamp in each chamber shall be equipped with a UV monitor, which measures the UV intensity of that lamp, providing continuous performance verification.

2. The monitor shall be fitted with a filter, which allows measurement of UV energy between 220 and 290 nm wavelengths.

3. The monitor shall be unaffected by static, electromagnetic fields, or short wave radio emissions that comply with current FCC regulations.

4. The monitor shall produce a 4-20 mA signal, which shall be sent to the power/control module.

5. The monitor shall have an IP67 rating and shall be removable without draining the chamber (dry connection).

D. Cleaning Mechanism

1. For periodic cleaning of the quartz sleeves/thimbles and UV monitor probe, the chamber shall be fitted with an automatic/mechanical cleaning mechanism, consisting of a SS yoke and molded Viton wiper rings which fit over the quartz sleeves/thimbles. Wiper rings shall be replaceable. Wiper rings manufactured of steel will not be acceptable.

2. The cleaning mechanism shall be electrical/mechanical and shall be operated by means of a 24V DC fractional horsepower motor and a lead screw. Pneumatic or hydraulic cleaning mechanisms or motors that require voltages greater than 24 V will not be acceptable.

3. The cleaning mechanism shall operate by pulse technology which will stop the wiping mechanism before it reaches the end of the chamber or through the use of limit switches (external or internal) which will stop the wiping mechanism before it reaches the end of the chamber.

4. The cleaning cycle shall be field adjustable.

E. Temperature Sensor

1. A temperature sensor shall be fitted to the chamber for protection against heat buildup under low or no flow conditions. The UV system shall shut down and alarm in event of heat buildup in the chamber

F. Access Hatch

1. A circular access hatch shall be provided on top of the chamber to allow easy, simple access for visual lamp and/or sleeve/thimble inspection and/or removal of foreign debris from the chamber without removing the lamps or quartz sleeves/thimbles. The profile of the hatch shall be designed to eliminate flow disruptions and air pockets.

2.05 ELECTRICAL/INSTRUMENATION AND CONTROLS

A. General

1. The quantity and size of power/control cabinets are designated on the electrical drawings.

2. Cabinets shall conform to NEMA12, suitable for indoor installation in an environmentally controlled room (32 to 113 deg F and 15 to 90 percent relative humidity).

3. Cabinets shall be fan cooled with louver covers and replaceable filters.

4. Cabinets shall be constructed of epoxy coated steel.

5. The door shall be electrically interlocked so that it is de-energized when opened.

6. All wiring within the cabinets shall be harnessed or enclosed in wire channel.

7. Incoming circuits shall be protected by circuit breakers.

B. Power Requirements

1. 480V 3-phase, 3 wire, 60 Hz

C. Power/Control Cabinets

1. Each of the cabinets shall power and control the required number of lamps to treat the water as specified in Section 2.03 Operating Parameters.

2. The power/control cabinets shall contain a 7 inch resistive touch HMI for operator interface mounted at eye level. The incorporation of a resistive touch HMI interface, allows the system to be controlled without having to remove gloves.

3. All information, warnings, and alarms shall be presented on the HMI for ease of operation and fault finding. The HMI shall display a minimum of the following:

a. UV dose

b. UV intensity (percent and mw/cm2)

c. Lamp current

d. Flowrate

e. Chamber temperature

f. Operation hour meter

g. Lamp fault

h. Low UV alarm

i. High temperature alarm

j. Ground fault trip

k. Wiper fault

l. System spares listing

m. On screen trending

2.06 MONITORING/INTERFACING AND CONTROL REQUIREMENTS

A. The control module shall contain the following system interface controls:

1. Local/Remote operation.

2. Process interrupt (from valves and/or flowmeter).

3. Low UV dose (configurable to shutdown or alarm only).

4. Flowmeter input.

5. Automatic restart.

6. Half to full power UV setting.

7. Variable power control.

8. Dose pacing interface.

9. Selectable custom inputs and outputs.

10. Monitor through Internet.

11. Interface with SCADA through MODBUS via Ethernet/IP (CIP)

2.07 QUALITY RECORDS

A. The controls shall have a built in data logging capability (retrievable through a PC or laptop) that shall log the following parameters:

1. UV intensity required (set point)

2. UV intensity measured

3. Lamp current

4. Chamber temperature

5. Flowrate (if flowmeter is connected)

6. Time and date stamp

7. All alarms generated.

PART 3 - EXECUTION

3.01 FABRICATION

A. The UV disinfection system specified herein should be factory assembled, to the largest extent possible, complete with all components specified.

3.02 INSTALLATION

A. The Contractor shall install the UV equipment based upon the project Plans and specifications and Manufacturer's submittal.

3.03 CERTIFICATION

A. The Manufacturer shall provide a written certification that the UV system and controls were properly installed according to Manufacturer's directions and recommendations for the intended operation of the equipment, and that the system is operating satisfactorily.

3.04 TESTING

A. After startup and as part of the equipment certification process, the Owner shall submit to the Manufacturer one month of collected data as indicated below. This information will be used by the Manufacturer to provide feedback to the systems operation.

1. Monthly operator's reports for 30 days following startup.

2. Daily values for:

a. Plant flow (at time sample was collected)

b. Number of units in operation

c. Power level

d. Lamp intensity and/or dose

e. Time sample was collected

f. Fecal count/100 ml (influent and effluent)

g. Transmittance

h. TSS

i. Sample collected by

END OF SECTION 46 66 23

SECTION 46 73 23 – HYPERBOLIC MIXERS

PART 1 – GENERAL

1.01. DESCRIPTION OF WORK

A. The work of this section includes furnishing and installing hyperbolic mixers to be used in a municipal activated sludge treatment process, to provide complete mixing of the sludge storage tanks.

B. The equipment and products specified in this section and shown on the Plans are based upon the "basis of bid" manufacturer indicated. Substitute or alternate manufacturers must be approved in accordance with the procedures specified in Section 01 25 50 - Substitution of Major Equipment Items and Products, and by written approval of the Engineer.

1.02. RELATED SECTIONS

A. Section 01 33 00 – Submittals Procedure

B. Section 01 78 00 – Operation and Maintenance Manuals

C. Section 03 30 00 – Cast-In-Place Concrete

D. Section 05 50 11 – Miscellaneous Metals

E. Division 26 – Electrical

F. Division 40 – Process Interconnections

1.03. REFERENCE STANDARDS

A. Anti-Friction Bearing Manufacturers Association (AFBMA).

B. American Gear Manufacturing Association (AGMA).

C. American Society of Mechanical Engineers (ASME).

D. American Standards for Testing and Materials (ASTM).

E. American National Standards Institute (ANSI).

F. Institute of Electrical and Electronics Engineers (IEEE).

G. National Electrical Manufacturers Association (NEMA).

1.04. SUBMITTALS

A. Refer to Section 01 33 00 – Submittals Procedure, for general submittal requirements.

B. Submit manufacturer's technical product data, including product description, technical data, and installation instructions.

C. Submit shop drawings showing complete dimensions and details of construction of mixer equipment including anchoring, connections, and weights of major components. Shop drawings shall also include tank arrangement and dimensions as shown on the Plans, installation details, and all other pertinent information necessary to confirm design and coordination with other items of work.

D. Submit electrical load calculations, rated power, rated input power, shaft power curve and its relationship to percent solids, recommended position and depth of the mixers in the tank, minimum distances from tanks walls and bottom requirements.

E. Submit bearing life calculations.

F. Submit operation and maintenance manuals in accordance with Section 01 78 00 – Operation and Maintenance Manuals, for all equipment included under these specifications. The maintenance instructions shall include trouble shooting data and full preventative maintenance schedules and complete spare parts lists with ordering information. Manuals shall be prepared with descriptions, etc., that are required to instruct operation and maintenance personnel unfamiliar with such equipment.

G. Upon completion of installation and successfully startup, testing and operation, submit manufacturer's certification of proper installation, testing and instruction. Submit manufacturer's startup and testing report, including all in-field performance test data. Startup reports shall include all pertinent data to confirm that successful startup and operation has been achieved for each unit. The manufacturer's certification, startup and testing report(s) shall be included in the operation and maintenance manuals.

H. Submit manufacturer's written warranty for warranty period specified.

1.05. QUALITY ASSURANCE

A. All equipment in this Section shall be furnished by or through a single supplier. The Contractor shall be responsible for the coordination and proper operation of the entire system. Equipment shall be fabricated, assembled, erected and placed in proper operating condition in full conformity with the Drawings, Specifications, instructions and recommendations of the equipment manufacturer.

B. Qualifications of Manufacturer: The manufacturers shall be experienced in the design and construction of equipment for this purpose, and shall have furnished such equipment and can prove that it has performed successfully for a period of not less than five (5) years.

1.06. DELIVERY, STORAGE AND HANDLING

A. The Contractor shall be responsible for coordinating and scheduling deliver, installation, pre-start-up testing and performance testing, as specified in this section and required by the manufacturer.

B. The Contractor shall be responsible for unloading, handling and storage of all equipment and materials, in accordance with the manufacturer's requirements. Upon delivery, the contractor shall carefully inspect all equipment and materials for any damage and to verify general compliance with the Plans and Specifications.

1.07. STARTUP SERVICE

A. A trained instructor, with complete knowledge of proper operation and maintenance for all major components, shall be provided for a minimum of two (2) days in two (2) trips to instruct representatives of the Owner and the Engineer on proper operation and maintenance. With the Owner's permission, this work may be conducted in conjunction with the inspection of the installation and test run as provided under PART 3. If there are difficulties in operation of the equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.08. SPECIAL TOOLS AND SPARE PARTS

A. One (1) set of special tools required for normal operation and maintenance of equipment shall be provided. All such tools shall be furnished in a suitable case for storage and easy identification.

B. Spare parts shall be supplied as recommended by the manufacturer and shall include the following minimum parts:

1. One set of rubber buffers per installed mixer type.

2. One shaft holder for each shaft diameter supplied.

3. All lubricating oils required for the first year of operation shall be provided. The products supplied shall be factory prefilled, in accordance with manufacturer's recommendations.

4. Spare parts shall be identical to and interchangeable with similar parts installed.

C. Spare parts shall be properly packaged and labeled for easy identification without opening and protection for long term storage.

1.09. WARRANTY

A. All equipment supplied under this section shall be warranted for a period of one (1) year from the date of substantial completion. Distributor warranties will not be accepted.

B. The equipment shall be warranted to be free from defects in workmanship, design and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.

C. The manufacturer’s warranty period shall run concurrently with the Contractor’s warranty period. No exception to this provision will be allowed.

PART 2 – PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The basis of design for hyperbolic mixers specified herein is the HyperClassic Series, Evolution 6, Model 2500, as manufactured by Invent Environmental Technologies Inc., Cedar Grove, NJ 07009; Phone (973) 571-2223; Fax (973) 571-2474; http://www.invent-et.com.

B. Mixers shall be of the non-clogging, vertical shaft, hyperbolic-body type. Each mixer assembly shall consist of a dry installed heavy-duty speed reducer with hollow shaft, electric gearmotor, baseplate, composite FRP shaft, and composite hyperbolic mixer body. The mixer should have a steady stationary flow pointed downward parallel to the mixer shaft. The highest speeds and turbulent fluctuations should be produced in the bottom area. On the water surface, no or little surface turbulence should appear.

C. The mixer and its appurtenances shall be specifically designed for continuous duty operation in a submerged application sludge holding tank with variable operating levels. The mixers shall not overload the motors at any point within the operating limits recommended by the mixer manufacturer.

D. The mixer shall be designed as a vertical shaft mixer with a dry installed motor. The entire weight of the mixer shall be supported by a bridge/walkway as shown on the Plans. During operation, the mixer should not generate any upward forces on the bridge construction.

E. All anchor bolts and fasteners shall Type 316 stainless steel unless otherwise indicated. Refer to Section 05 50 11 – Miscellaneous Metals, and elsewhere within this section for additional fastener requirements.

2.02 SERVICE CONDITIONS AND PERFORMANCE REQUIREMENTS

A. The mixers shall be capable of completely mixing the equalization tanks under the following conditions, and meeting the following performance requirements:

SERVICE CONDITIONS AND PERFORMANCE REQUIREMENTS		
Number of Mixers Total	2	4
Mixer Type	Hyperbolic	Hyperbolic
Tank Contents	Waste Activated Sludge	Waste Activated Sludge
Type of Tank	Concrete, Open Top	Concrete, Open Top
Basin Dimensions (each)	50 ft Diameter	30 ft x 90 ft
Water Depth	6.0 - 18.0 ft (varies)	6.0 - 18.0 ft (varies)
Tank Floor Configuration	Sloped	Sloped
Nominal Mixer Speed	21.9 RPM	30.5 RPM
Motor Horsepower	5 hp	10 hp
Motor Speed	1,800 RPM	1,800 RPM
Motor Driver	VFD	VFD

2.03 MIXER DRIVE

A. Drives shall be rated for continuous 24 hours per day operation in accordance with the latest applicable AGMA standards for enclosed gear drives. The thermal rating of the speed reducer shall exceed the design mechanical rating to eliminate the need for external coolers. External cooling devices are not acceptable. The manufacturer shall certify, in writing, that the speed reducer is designed to the applicable AGMA Standards.

B. The gear drive assembly for each mixer shall consist of parallel-shaft helical gearmotor as designed by SEW Eurodrive, or approved equal.

C. The gear drive assembly shall have a high-quality corrosion protection coating, robust weather protective hood, and PTC resistor for thermal protection of the motor.

D. The gear box housing shall be cast iron covered with an acrylic coating, having a thickness of at least 6.0 mil. The gear box shall be connected to the mounting base using a flange connection with 316 additional stainless steel nuts and bolts.

E. The gear box speed shall not exceed 60 rpm. The calculated lifetime L10 of the bearings shall exceed 100,000 hours.

F. The drive motors shall be a squirrel cage induction motor, 460 V, 3 phase, 60 Hz, 1,800 RPM, Class F insulation. Motors shall be equipped with a weather protection hood and integral thermal overloads mounted in the motor windings.

2.04 MOUNTING BASE

A. The mounting base of each mixer shall consist of a gear base plate mounted in rubber buffers connected permanently to the bridge/supports by bolted connection. The plate shall be able to be leveled using the threaded bolts, which can be adjusted in height.

B. The rubber buffers shall absorb start-up torque, prevent any transfer of vibrations to the bridge and constitute the galvanic separation of the mixer from its surroundings.

C. The mounting base shall be supplied with a fastening set for connection to the bridge/walkway as shown on the Plans.

2.05 SHAFT

A. The drive shaft of the mixer shall be made from FRP.

B. At the top end of the mixer shaft, there shall be a tappet for the connection to the gear hollow shaft.

C. At the lower end there, shall be a flange connection to the mixer body itself.

D. All bolted connections shall utilize 316 stainless steel hardware.

2.06 HYPERBOLIC MIXER BODY

A. Each hyperbolic mixer body shall be manufactured of FRP and be a streamlined stress-free body without any mounted or fitted parts.

B. The transport ribs which accelerate the flow shall be integrated in the mixer body (INVENT - Evolution 6 design).

C. The mixer body shall be coated with a special gel coat to provide a polished surface.

D. The hyperbolic mixer shall have laminated stainless steel insert nuts.

2.07 FACTORY PERFORMANCE TESTING

A. The hyperbolic mixer manufacturer shall perform the following inspections and tests on each unit before shipment:

1. Hyperbolic mixer body diameter, motor rating, and electrical connections shall be checked for compliance with contract requirements.

B. Certified copies of all test procedures and results shall be provided to the Engineer prior to shipment.

2.08 PREPARATION FOR SHIPMENT

A. All gears and bearings shall be protected from rusting while being stored by the application of shop-applied protective coatings. Each reducer interior shall be sprayed with a vapor phase inhibitor to further guard against internal corrosion. In addition, a specifically prepared paper treated with vapor phase inhibitor and covered with water repellent tape shall be applied to all external couplings and bearings that could be exposed to corrosion. All openings in the equipment shall be covered with the vapor phase inhibitor impregnated paper and water repellent tape. Water repellent tape and vapor phase inhibitor treated paper will be applied over any adapter sleeves, locknuts, dipsticks, breather assemblies, and other areas or openings requiring special protection.

PART 3 – EXECUTION

3.01 INSTALLATION

A. The equipment shall be installed where indicated on the Plans, in accordance with the manufacturer's written instructions and under the supervision of the manufacturer's representative.

B. Upon completion of the installation, the Contractor shall submit a certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the equipment is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication and care of each unit.

3.02 FIELD INSPECTION AND TESTINGS

A. General

1. Field tests shall not be conducted until such time that the entire installation is complete and ready for testing and the manufacturer’s certification of proper installation has been received.

B. Field Inspection and Owner Instruction

1. The Contractor shall furnish the services of the manufacturer’s field service technician, who has complete knowledge of proper operation and maintenance of the equipment, for a period of not less than two (2) days in two (2) trips to inspect the installed equipment, supervise the initial test run, and to provide instruction to the plant personnel. The first visit shall be checking and inspecting the equipment after it is installed and supervise the initial field test. The second visit will be for training.

2. At least one (1) of the two (2) days shall be allocated solely to instruction of plant personnel in operation and maintenance of the equipment. The instruction period shall be scheduled at least 10 days in advance with the Owner and shall take place prior to acceptance by Owner.

C. Field Tests

1. In the presence of the Engineer such tests as necessary to indicate that the equipment conforms to the operating conditions specified shall be performed. Each unit shall be run to demonstrate its ability to operate without overheating, jamming or excessive vibration during normal operation. A 30-day operating period of the equipment will be required before acceptance. If performance does not meet the specified requirements, corrective measures shall be taken.

2. All operating settings, alarms, controls, and shutdown devices shall be calibrated and tested during the field tests.

3. The Contractor shall furnish all power, water, facilities, labor, materials, supplies and test instruments required to conduct field test.

4. Deliver to the Engineer, upon completion of satisfactory testing of the equipment, reports as specified in Part 1.

D. Field Electric Control System Tests

1. The electric control system shall be test operated for proper functioning prior to the equipment test. The control system shall be checked out using simulated operating signals as per equipment manufacturer’s recommendations.

2. The Contractor shall check all drives for correct clearances, alignment and lubrication in accordance with manufacturer's instructions. The Contractor shall check direction of rotation of all motors and reverse connections if necessary.

E. Field Alarm System Testing

1. Check each alarm and detection device for proper operation.

END OF SECTION 46 73 23

SECTION 46 76 27 – SLUDGE DEWATERING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This section includes supply and installation of three (3) sludge dewatering screw press systems and appurtenances, including polymer make-down, dewatered sludge conveying equipment, flocculation tanks and mixers, access stairway/platforms, polymer injection ring and mixing valve assembly, control panels, and instrumentation, as shown on the drawings and described in the specifications.

B. The equipment and products specified in this section and shown on the Plans are based upon the “basis of bids” manufacturer indicated. Substitute or alternate manufacturers must be approved in accordance with the procedures specified in Section 01 25 50 – Substitution of Major Equipment Items and Products, and by written approval of the Engineer.

C. The entire sludge dewatering screw press system and appurtenant equipment shall be designed, selected, coordinated, and supplied by one manufacturer, unless otherwise noted. The equipment manufacturer shall take sole responsibility for all materials and equipment supplied.

1.02 RELATED SECTIONS

A. Section 01 25 50 – Substitution of Major Equipment Items and Products

B. Section 01 33 00 – Submittals Procedure

C. Section 01 78 00 – Operation and Maintenance Manuals

D. Division 26 - Electrical

E. Division 40 - Process Interconnections

1.03 REFERENCE STANDARDS

A. Anti-Friction Bearing Manufacturers Association (AFBMA)

B. American Gear Manufacturers Association (AGMA)

C. American Institute of Steel Construction (AISC)

D. American Society for Testing and Materials (ASTM)

E. American Welding Society (AWS)

F. National Electrical Code (NEC)

G. National Electrical Manufacturers Association (NEMA)

H. Underwriters Laboratory Standards (UL)

1.04 SUBMITTALS

A. The following information shall be submitted to the Engineer. In accordance with Section 01 33 00 – Submittals Procedure, copies of all materials required to establish compliance with this Section. Submittals shall include the following:

1. Product Data:

a. Descriptive literature, brochures, catalogs, cut sheets and other detailed descriptive material of the equipment.

b. Motor characteristics and performance information.

c. Gear reducer data including service factor, efficiency, torque rating, and materials.

d. Parts list including a list of recommended spare parts.

2. Shop Drawings:

a. Manufacturer's installation drawings.

b. Wiring and schematic diagrams.

3. Structural Calculations:

a. Structural anchor points to concrete foundation.

b. Seismic loads on frame and anchor bolts.

4. Product data and shop drawings of all auxiliary equipment specified under other sections.

5. Operations and Maintenance Manual: Refer to Section 01 78 00 – Operation and Maintenance Manuals. Include a copy of the field startup report.

6. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.

7. Equipment weights and lifting points.

8. Factory test results.

9. Recommendations for short- and long-term storage.

10. A copy of the manufacturer's warranty.

11. List of any design modifications to accommodate the equipment proposed.

12. Design calculations.

1.05 DELIVERY, STORAGE AND HANDLING

A. All parts shall be properly protected so that no damage or deterioration will occur during shipment or a prolonged delay from the time of shipment until installation is completed and the units and equipment are ready for operation.

B. Equipment shall be shipped and delivered fully assembled, except where partial disassembly is required to conform to transportation regulations or for the protection of components. The manufacturer shall clearly identify in the installation instructions which components will require field assembly. Factory assembled parts and components not clearly identified for field assembly shall not be dismantled for shipment unless permission is received in writing from the Engineer.

C. Contractor shall be responsible for offloading and handling dewatering skids and appurtenances and shall have equipment on-site at the time of delivery permitting proper hoisting and handling.

1.06 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of five (5) years of experience in the design and manufacturing of sludge dewatering screw press equipment and shall be able to demonstrate this experience by providing a reference list of at least ten (10) installations using similar sized equipment as detailed in the specifications.

B. Manufacturer shall provide screw press, dewatered sludge (cake) conveyor, polymer systems, motors, gear reducers, meters, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.

C. The screw press equipment shall be manufacturer's standard product and only be modified as necessary to comply with the Plans, Specifications, and specified service conditions.

D. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service prior to delivery, except as required for testing.

E. The screw press equipment, controls, and auxiliary equipment shall be fully assembled, and shop tested to confirm fit and function of the entire units. A certificate of the shop tests shall be submitted to the Engineer for review and approval prior to shipment. A copy of the shop test results shall be supplied with the shipping documents.

F. All welding shall be performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code, or equivalent.

G. All stainless-steel components and structures shall be submerged in a chemical bath of nitric acid and hydrofluoric acid (pickling bath) to remove any residues that may be present on the material because of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. In lieu of a pickling path submergence, the manufacturer may complete passivation of all welds and clearcoat stainless steel components with a urethane top coat after media blasting all structural stainless steel.

H. Each major component of equipment shall have the manufacturer's name, address and product identification on a nameplate securely affixed to the equipment.

I. Pre-assemble and factory test polymer systems to ensure compliance with pressure and operational requirements. The approved systems shall produce a completely homogenous polymer and water solution free of visible polymer agglomerations, or "fish-eyes."

1.07. STARTUP SERVICE

A. A factory trained representative, with complete knowledge of proper operation and maintenance of all system components, shall be provided for a minimum of ten (10) days in two (2) trips to inspect the installation, supervise initial operation of the equipment, and instruct representatives of the Owner and the Engineer on proper operation and maintenance, and provide process assistance as provided under PART 3. If there are difficulties in operation of the system components and equipment due to the manufacturer's design or fabrication, additional service shall be provided at no cost to the Owner.

1.08. SPECIAL TOOLS AND SPARE PARTS

A. One (1) set of special tools required for normal operation and maintenance of equipment shall be provided. All such tools shall be furnished in a suitable case for storage and easy identification.

B. Spare parts shall be supplied as recommended by the manufacturer and shall include the following minimum parts:

1. One (1) set of manufacturer's recommended spare parts, including rotors, rubber stators, and mechanical seals.

2. Neat polymer pump spare parts kit.

C. Spare parts shall be properly packaged and labeled for easy identification without opening and protection for long term storage.

1.09 WARRANTY

A. All sludge dewatering screw press equipment and materials supplied under these specifications shall be warranted for a period of one (1) year from the date of substantial completion of the installation. The manufacturer's warranty shall include labor. Distributor warranties will not be accepted.

B. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the system and equipment should fail during the warranty period, it shall be replaced, and the system shall be restored to service at no expense to the Owner. The cost for removal (disposal) and reinstallation of any defective parts during the warranty period shall be fully born by the manufacturer.

C. Warranty period for ancillary equipment (polymer blending and feed system, meters, etc.) shall be as specified in those sections.

PART 2 - PRODUCTS

2.01 SCREW PRESS GENERAL REQUIREMENTS

A. Sludge dewatering screw press equipment provided shall be a fully enclosed, automatic, self-cleaning system that includes a shafted helical screw inside a cylindrical perforated plate dewatering basket built in removable sections, for easy servicing without removal of the screw.

B. Cleaning of the screw press shall be accomplished with a fixed spray bar system capable of covering the entire screen basket area and interior of the screw press housing to effectively clean the screen and housing assembly, while minimizing wash water consumption. Wash water systems shall be supplied with means to clean spray nozzles without removal of components from service.

C. The general layout of the screw press equipment shall be as shown on the Plans. Sufficient room for inspection, maintenance, repair, and adjustment of all components shall be provided. All components shall be arranged so that they can be serviced from the operating floor.

D. All parts shall be designed and manufactured to handle the forces that may be exerted on the screw press during fabrication, shipping, erection, and proper operation according to the O&M manual.

E. All components shall be balanced so that jamming at any point will not result in structural failure but will cause the drive motor to stall. All components, including the gear reducer, shall be designed to withstand, without damage or permanent distortion, the full stalling torque of the drive motor.

F. Materials of Construction: All screw press components shall be constructed from AISI Type 304 stainless steel shapes (rods, angles, and channels), pipes, and sheets, including screw, screw basket, shaft, spray wash components, supports, fasteners, and anchor bolts, unless otherwise specified. Covers shall be constructed of Type 304 stainless steel or fiber-reinforced plastic (FRP). Access platforms and press equipment support platforms/framing not in contact with sludge and water process waste streams may be constructed of steel, hot-dip galvanized after fabrication or aluminum. Bearings, electrical devices, motors, and gear reducers shall be of the manufacturer's standard materials, as specified elsewhere.

G. Shop Surface Preparation/Coating: All welds shall be cleaned to remove weld spatter, slag and discoloration using glass bead blasting or mechanical cleaning process. All stainless-steel components shall be acid passivated. Bearings, electrical devices, motors, and gear reducers shall be provided with the manufacturer's standard coating system. In lieu of a pickling path submergence of stainless steel components, the manufacturer may complete passivation of all welds and clearcoat stainless steel components with a urethane top coat after media blasting.

H. The sludge dewatering screw press system shall consist of the following major components:

1. Screw Press
2. Sludge Cake Conveyor with Discharge Chute
3. Polymer Blending and Feed System
4. Flocculation Tank and Mixer
5. Flow Meter
6. Electrical Controls and Instrumentation
7. Skid, Supports, Access Ladders, and Platforms
8. Polymer Injection Ring, and Mixing Valve Assembly

I. All electrical wiring and equipment with electrical connections, including motors, and control and safety devices, shall be Recognized Electrical Testing Laboratory (RETL) listed and labeled, or the manufacturer shall obtain approval from the Washington State Department of Labor and Industries for the electrical portions of the equipment.

2.02 MANUFACTURERS

A. The basis of design for the sludge dewatering screw press system equipment and components specified herein is Model BHX 1100 x 6000L, as manufactured by FKC Co., LTD., 2708 West 18th Street, Port Angeles, WA 98363; Phone: (360) 452-9472; Fax: (360) 452-6880; www.fkcscrewpress.com.

2.03 SERVICE CONDITIONS AND PERFORMANCE REQUIREMENTS

A. The screw press system equipment shall be designed for dewatering municipal waste activated sludge (WAS), and shall be capable of operating continuously under the following conditions, and meeting the following performance requirements:

SERVICE CONDITIONS AND PERFORMANCE REQUIREMENTS	
Number of units	3
Influent Type	Waste Activated Sludge
Feed Solids Concentration	0.5 – 1.5%
Volatile Solids Concentration	45%
Maximum Hydraulic Loading Rate, Each	140 gpm
Maximum Dry Solids Loading Capacity	700 lbs/hr
Discharge Cake Solids Concentration	>15%
Solids Capture Rate	>95%
Maximum Polymer Usage	30 lb. active/dry ton
Maximum Wash Water Rate, Each	120 gpm
Wash Water Pressure	40 psi
Wash Water Source	Plant Effluent
Wash Water Quality (at maximum flow rate)	80 Mesh (200 µm)

2.04 SCREW PRESS DESIGN

A. The screw press shall be installed flat or on an incline, as recommended by the manufacturer. Dewatering of the sludge shall take place in a basket, which consists of a minimum of three sections of perforated plate screens, each 20 to 40 inches in length. The overall basket length shall be 80 inches or longer. The basket diameter shall be 18 inches or larger.

B. Each section of the basket shall be split in half along the length of the basket to allow for easy separation of the basket into halves. The basket shall be fastened together using bolt fasteners made of stainless steel. The bottom half of the basket shall remain inside of the machine during servicing for ease of maintenance. Designs which require the bottom half of the basket to be removed from the machine for servicing will not be accepted.

C. A screw shall be installed inside of the screen basket. The screw transports the sludge from the inlet to the discharge area at the end of the pressure zone. The shaft diameter shall be conical towards the discharge section of the machine.

D. The screw shall be shafted and shall be made of stainless steel. A shaft-less screw is not acceptable. A bearing shall support the discharge end of the screw shaft. Wear strips are not acceptable.

E. The screw drive maximum nominal motor power shall be 3.0 HP. Nominal motor speed shall be 1,800 RPM. The motor speed shall be controlled with a variable frequency drive (VFD). The drive unit shall be directly coupled to the screw shaft through a cyclo gearbox. The maximum output speed of the gear reducer shall be 1.0 rpm at a frequency of 60 Hz. Drive motor requirements shall be as specified in paragraph 2.08. Chain-drives, belt drives, hydraulic drives or a separate upper bearing for the transport screw will not be acceptable for this project.

F. A pressure sensor and level transmitter shall be installed at the inlet head box of the screw press. The pressure sensor provides a signal which is used to control the speed of the auger. The pressure in the inlet box shall automatically adjust the speed of the screw via the control system and the range for the pressure shall be adjustable at the operator interface. Designs which do not control the screw speed based on the inlet pressure are not acceptable. The headbox shall have a cover with a hinged inspection door to allow for easy visual inspection. Pressure and level transmitters shall be as specified in Section 40 70 11 - Process Measurement Devices.

G. The screw press shall be completely enclosed to prevent odor emission. The whole dewatering section and basket area shall be easily accessible through removeable access panels on both sides of the unit. Panels shall be provided with inspection doors to view system operation. Air intake and vent connections shall be provided at the top of the screw press cover, head box, and mixing/flocculation tank.

H. Cleaning of the screen from the outside shall be performed by a fixed spray bar washing system made of stainless-steel piping and brass spray nozzles. The spray wash system shall be designed to cover the entire area of the basket and provide washing of entire interior area of the screw press housing/covers. Solenoid valve(s) shall be provided to control flow to each section of the spray bar washing system. Water supply piping and manual isolation valves shall be provided to manifold the spray wash system to a single-point wash water connection. All solenoid and manual valves shall be factory installed as part of the manifold system.

I. Spray bar washing systems shall be designed to minimize wash water consumption while optimizing system performance by providing quick wash abilities and/or separate wash water zones.

J. Spray wash system shall be capable of operation at or below the maximum water supply rate and pressure specified in paragraph 2.03. If spray wash system requires additional pressure, manufacturer shall provide a wash water booster pump system. Wash water booster pumps shall include the pump driver and all controls required for a complete and operable constant pressure system. The wash water booster pump shall be controlled through a VFD located in the screw press control panel. A pressure transmitter shall be provided for installation in the discharge piping for control of the VFD and pump operation.

K. A pressure cone that serves for adjusting the pressure in the pressure zone shall be provided at the discharge end of the screening basket.

L. Sludge cake shall be automatically discharged through a rectangular sludge discharge opening. The discharge opening connection shall be a minimum of 42 inches above the floor level to allow for installation of sludge cake conveyor beneath the unit, and to provide access to the filtrate outlet piping connection.

2.05 SLUDGE CAKE CONVEYOR – SHAFTLESS SCREW

A. The sludge cake conveyor shall be of the shaftless screw type, capable of handling dewatered screw press sludge loadings as specified in paragraph 2.03, and shall have the following design characteristics:

CONVEYOR DESIGN REQUIREMENTS	
Number of units	1
Approximate Length	30 ft.
Minimum Flight Outside Screw Diameter	12 in.
Installation Angle (maximum)	30 degrees
Drive Configuration	Pulling
Drive Motor Size	3 HP
Nominal Motor Speed	1,800 RPM

B. The conveyor shall be capable of processing spherical objects with a diameter of 3-1/8 inches. Such objects shall be conveyed through the auger and shall be discharged with the sludge.

C. Operation of the screw conveyor shall be automatically initiated when a call to run signal is received. The sludge shall be transported up the screw conveyor and shall be discharged outside the building.

D. To minimize odors and nuisance, the conveyance shall be completely enclosed.

E. The control system shall be designed such that the operating characteristics of the screw conveyor can be changed via the programmable controller. Systems which do not offer this feature will not be acceptable for this project.

F. The conveyor shall be equipped with a safety stop switch with orange vinyl cable mounted along the periphery of the conveyor. The conveyor shall also be equipped with a zero-speed switch.

G. Materials of Construction: Unless otherwise specified, all conveyor components, including the inlet hopper, trough, discharge chute, covers, and support structure, shall be manufactured from AISI Type 304 stainless steel. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation according to the O&M manual.

H. The spiral shall be constructed of high strength steel with minimum 220-brinnell hardness, epoxy primer coated. Minimum outer flight thickness shall be 3/4-inch. Inner spiral flight shall be 1/2-Inch minimum thickness. The spiral flight shall have sufficient stability to prevent distortion and jumping in the trough.

I. The conveyor trough shall be U-shaped, fabricated from a minimum 11-gauge thickness Type 304 stainless steel. The trough shall be equipped with inlet and discharge connections, as recommended by the manufacturer, compatible with the equipment orientation shown on the Plans. Outlet openings in the trough bottom shall be sized to prevent screw conveyor plugging. A wear liner shall be provided for the trough. The wear liner shall be made of 3/8-inch minimum thickness UHMW polyethylene.

J. The entire length of the screw conveyor, except for the filling chute, shall be covered by a bolted cover. Covers shall be manufactured from minimum 12-gauge Type 304 stainless steel. The covers shall be manufactured in sections with a maximum of 4-foot lengths to allow for easy access.

K. The discharge chute and exterior portion of the screw conveyor shall be fitted with a temporary 120V, single-phase, 60Hz, self-regulating heat tracing wire and removable insulation blanket to prevent freezing, if operation occurs from November 1 to March 31. Wiring from the heat trace cable shall terminate in a factory mounted junction box for field connection by others. The screw press control panel shall include integrated heat trace circuits rated for the appropriate wattage as determined by the manufacturer. A GFCI circuit breaker shall be added to the control panel to power the heat tracing circuit(s). An ambient temperature thermostat shall be provided to control power to the heat trace cable. The thermostat shall be 120V, single-phase, 60Hz, with a NEMA 4x housing suitable for outdoor installation. The temperature set point shall be selectable by an adjustable dial.

L. The conveyor shall be furnished complete with supports suitable for mounting as shown on the Plans and as required by the supplier's design. The supports shall be shop fabricated from Type 304 stainless steel structural shapes and plates. At a minimum, each screw conveyor trough shall have supports at the drive end and discharge end of the trough plus intermediate supports at a maximum of 12-foot intervals. The supports shall be designed to avoid interference with other equipment or equipment supports. The supports shall be designed to prevent excessive vibration of any portion of the conveyor unit under all loading conditions.

M. The screw conveyor shall be driven by a shaft mounted gearbox and motor assembly. The maximum nominal motor power shall be as specified in paragraph 2.05 A. The motor speed shall be controlled with a motor starter. The gear reducer shall be bolted to a machined flange welded to the upper end of the conveyor trough. Drive motor requirements shall be as specified in paragraph 2.08. Chain-drives, belt drives, hydraulic drives or a separate upper bearing for the transport screw will not be acceptable for this project.

N. Two (2) conveyor filling chutes shall be provided with the screw conveyor. One shall be provided to accommodate solids discharge into the conveyor during temporary/phased operation, which is discharged in-line with the screw press orientation. The second chute shall be fabricated from 304 stainless steel, and shall be provided to accommodate solids discharge into the conveyor for permanent installation, which is rotated 90 degrees from the screw press outlet.

2.06 SLUDGE CONVEYOR - HORIZONTAL DISTRIBUTION

A. General

1. Furnish one horizontal flight-type distribution conveyor complete with housing, chain and flights, drive assembly, discharge openings, actuated knife gates, supports, and accessories as required for a complete operating installation.

2. Conveyor shall receive dewatered sludge cake from the upstream belt conveyor and distribute material to the receiving containers as shown on the Drawings.

3. The basis of design for the conveyor system equipment and components specified herein is Model-FD as manufactured by Serpentix Conveyor LLC, 11821 Huron St, Westminster, CO 80234; Phone (303) 430-8427; www.serpentix.com. Equivalent products by other manufacturers will be considered, provided the equipment meets the material, dimensional, performance, and service requirements of the Contract Documents and fits the arrangement shown.

B. Performance Requirements

1. Conveyor shall be nominal 24 inches in width with centerline length as shown on the Drawings.

2. Conveyor shall be designed to handle dewatered sludge cake at a minimum rate of 20 tons per hour. Wet sludge varies from 12% to 18% solids content.

3. Conveyor operating speed shall be approximately 23 feet per minute, unless otherwise required by the manufacturer to meet the specified duty.

4. Conveyor shall be suitable for intermittent or continuous service in a municipal wastewater sludge dewatering application.

C. Construction

1. Conveyor housing shall be Type 304 stainless steel and shall include removable top covers and removable bottom sections to permit inspection and maintenance.

2. Housing sides and bottom shall be not less than 7-gauge stainless steel. Top covers shall be not less than 14-gauge stainless steel.

3. Conveyor shall be provided with hardened steel chain and UHMWPE flights. Flight support angles shall be Type 304 stainless steel, minimum 10-gauge.

4. Conveyor bottom shall be fitted with a minimum 1/2-inch-thick UHMWPE wear plate. Return chain supports shall include replaceable UHMWPE wear surfaces.

5. Drive and tail sprockets shall be designed for the conveyed material and service. Shaft bearings shall be external pillow-block type suitable for wastewater dewatering service.

6. Exposed fasteners, nuts, bolts, and washers furnished with the equipment shall be Type 304 stainless steel unless otherwise approved by the Engineer.

D. Drive Assembly

1. Conveyor drive shall include a TEFC motor, gear reducer, torque arm or other positive anti-rotation device, drive shaft, and bearings sized by the manufacturer for the specified service.

2. Motor shall be 2 horsepower minimum, 230/460 volt, 3-phase, 60 hertz, unless a different size is required by the manufacturer to satisfy the specified duty and is approved through the submittal process.

3. Tension end shall include adjustable bearings or other approved means for chain take-up and tensioning.

E. Discharge Openings and Knife Gates

1. Conveyor shall be provided with three discharge openings at locations shown on the Drawings.

2. Each discharge opening shall be flanged and furnished with an electrically actuated knife gate for directing sludge cake to the selected receiving location.

3. Knife gate frames and blades shall be Type 304 stainless steel.

4. Knife gate actuators shall be 24-VDC linear type and shall include open and closed position indication. Control functions, interlocks, and panel requirements shall comply with Paragraph H of this Section and the Drawings.

5. Provide all control devices furnished with the equipment, including motor-mounted accessories, position switches, actuator controls, junction boxes, and related appurtenances required for a complete operating control system. Coordinate all control and power requirements with the control panel supplier and the requirements shown on the Drawings.

F. Supports and Finish

1. Equipment supports furnished with the conveyor shall be structural steel conforming to ASTM A572, Grade 50, or stainless steel as recommended by the manufacturer for the installation shown.

2. Carbon steel supports shall be hot-dip galvanized after fabrication in accordance with ASTM A123.

3. Stainless steel surfaces shall retain mill finish unless otherwise specified. Manufacturer's standard shop finish shall be provided on purchased components.

4. Anchorage hardware and field supports not specifically furnished by the equipment manufacturer shall be provided under other applicable sections.

G. Accessories and Spare Parts

1. Provide one complete set of replaceable slider wear plates and two chain master link assemblies.

2. Provide manufacturer's recommended lubricants, if any, required for startup.

H. Control System

1. Furnish a complete conveyor control system, based on the manufacturer's standard design for the specified equipment, including main control panel, local control station, control power distribution, motor starting equipment, knife gate actuator controls, relays, terminals, and interfaces required for a complete operating installation.

2. Provide a wall mounted Conveyor Main Control Panel (CMCP), rated 480-volt AC, 3-phase, 60 hertz input power, NEMA 4X Type 304 stainless steel enclosure, UL 508A labeled.

3. Provide a Conveyor Local Control Station (CLCS), wall mounted at location shown, in NEMA 4X Type 304 stainless steel enclosure, with control power as required by the manufacturer, but not less than 120-volt AC single-phase and/or 24-volt DC as required for the specified control functions.

4. Control system shall include a main circuit breaker with external operator mechanism and control power equipment sized for all connected loads, including transformer(s) and 24-VDC power supply as required.

5. Conveyor motor starter shall be solid-state reduced-voltage soft-start type with integral bypass and protective functions including, at a minimum, phase reversal, phase loss, phase imbalance, SCR overtemperature, SCR shorted condition, and overload protection.

6. Main control panel operator devices and indication shall include, at a minimum: emergency-stop pushbutton, automatic mode indicating light, conveyor running indicating light, conveyor overload indicating light, conveyor fault indicating light, and fault reset pushbutton.

7. Local control station operator devices and indication shall include, at a minimum: emergency-stop pushbutton, conveyor running indicating light, conveyor fault indicating light, hand-off-auto selector switch, start pushbutton, stop pushbutton, and spring-return selector switches for opening and closing each knife gate.

8. Provide external control interfaces for coordination with the plant and dewatering control systems, including discrete inputs for system enable and run command, and discrete outputs for auto mode status, emergency-stop status, and common fault status, unless otherwise shown on the Drawings.

9. Control system functional requirements shall include the following: in Hand, conveyor operation shall be independent of external run interlocks; in Auto, conveyor shutdown shall be delayed by adjustable timer to allow material to clear; emergency-stop activation or system fault shall stop conveyor operation regardless of mode; and manual reset shall be required following a fault before restart.

10. Provide factory quality control for the control system including inspection of panel assembly, component ratings, labeling, and workmanship, together with point-to-point continuity checks and functional testing of the control circuit prior to shipment.

I. Manufacturer Services

1. Manufacturer shall provide shop drawings, product data, and operation and maintenance information in accordance with Division 01 and the requirements of this Section.

2. Manufacturer's representative shall inspect the completed installation, verify readiness for operation, assist with startup, provide field testing services, and provide operator instruction.

3. Field testing shall include, at a minimum, verification of chain tension and alignment, operation of the conveyor drive, operation and position indication of each actuated knife gate, and demonstration of proper material discharge to each designated receiving location.

4. Upon completion of startup and field testing, manufacturer's representative shall submit a written field service report identifying installation conditions observed, tests performed, and any recommended corrective actions.

5. Equipment shall be furnished with the manufacturer's standard warranty, but not less than 12 months from startup or 18 months from shipment, whichever occurs first.

2.07 SLUDGE CAKE CONVEYOR - SERPENTINE BELT

A. General

1. Furnish one serpentine belt conveyor complete with modular belt pans, chain, track, supports, drive station, tension station, skirt boards, drip pans, safety and monitoring devices, control system, and accessories as required for a complete operating installation.

2. Conveyor shall receive dewatered sludge cake from the dewatering presses and convey material to the discharge location shown on the Drawings.

3. The basis of design for the conveyor system equipment and components specified herein is PATHWINDER Model P2 as manufactured by Serpentix Conveyor LLC, 11821 Huron St, Westminster, CO 80234; Phone (303) 430-8427; www.serpentix.com. Equivalent products by other manufacturers may be considered, provided the equipment meets the material, dimensional, performance, control, and service requirements of the Contract Documents and fits the arrangement shown.

B. Performance Requirements

1. Conveyor shall be incline type with horizontal offset, with centerline length approximately 71 feet 4-3/8 inches, as shown on the Drawings.

2. Conveyor shall have nominal 26-inch-wide belt pans and shall operate at approximately 35 feet per minute, unless otherwise required by the manufacturer to satisfy the specified duty.

3. Conveyor shall be designed to handle dewatered sludge cake at a minimum rate of 20 wet tons per hour. Wet sludge varies from 12% to 18% solids content.

4. Conveyor shall be suitable for intermittent or continuous service in a municipal wastewater sludge dewatering application.

C. Conveyor Construction

1. Conveyor shall have a watertight modular conveying surface with a nominal 20-degree troughed cross section at the outside edges of the belt width.

2. Conveying surface shall consist of individually replaceable modular belt pan sections molded of moldable plastic rubber, with permanently molded cleat-like convolutions not less than 1-1/2 inches high and nonmetallic stiffeners molded into each section to achieve troughing.

3. Belt pans shall be attached at intervals not exceeding 8 inches and supported by nylon attachments and plastic guide and wear blocks bolted to the conveyor chain.

4. Conveyor chain shall be case-hardened alloy steel, closed-link type, with alternating horizontal and vertical links to permit horizontal and vertical turns. Chain shall have 4-inch pitch and minimum breaking strength of 35,000 pounds.

5. Guide blocks shall operate in a UHMWPE track system consisting of base, side members, and top containment angles. Conveyor shall be designed so that moving parts, other than the drive and tension station components, pass a single designated point along the conveying path to facilitate maintenance and service.

6. Conveyor track structure shall be fabricated around a Type 304 stainless steel I-beam frame not less than 1/8 inch thick. Required track sections shall be shop fabricated and prepared for field splice-bolting.

7. Exposed nuts, bolts, and washers furnished with the equipment shall be Type 304 stainless steel unless otherwise approved by the Engineer.

D. Supports and Appurtenances

1. Conveyor supports shall be structural steel conforming to ASTM A572, Grade 50. Carbon steel supports shall be hot-dip galvanized after fabrication in accordance with ASTM A123. Shop welding shall conform to AWS standards.

2. Angled skirt boards shall be provided at conveyor loading areas. Skirts shall be not less than 3/8 inch HDPE supported by Type 304 stainless steel brackets.

3. Open-end drip pans shall be provided below the conveyor where shown, fabricated from 16-gauge galvanized sheet steel with Type 304 stainless steel hanger brackets, sloped as indicated on the Drawings.

4. Anchorage hardware and field support connections not specifically furnished by the equipment manufacturer shall be provided under other applicable sections. Anchors, suspended supports, and connection details shall be as shown on the Drawings and approved shop drawings.

E. Drive and Tension Assemblies

1. Conveyor drive station shall include a 3-horsepower minimum, 230/460-volt, 3-phase, 60-hertz, TEFC motor, gear reducer, V-belt drive, sheaves, chain drive, steel sprockets, shafting, and bearings sized by the manufacturer for the specified service.

2. Drive shall be arranged to provide the specified belt speed and shall permit speed adjustment by means of interchangeable sheaves. Direct-coupled drive motor and gear reducer assemblies will not be acceptable.

3. Drive assembly shall include a mechanical ratcheting clutch, adjustable and factory set for the conveyor application, to protect the drive from overload or jamming conditions.

4. Tension station shall include a durable corrosion-resistant UHMW polyethylene chain sprocket and constant-pressure spring-loaded chain tensioner adjustable by a single ratchet, all furnished in a structural frame ready for installation.

F. Safety and Monitoring Devices

1. Provide flag-arm safety pull-cord switches on both sides of the conveyor for the full conveyor length. Switches shall be NEMA 7 explosion-proof type, rated 20 amperes at 125, 250, or 480 volts AC, single-pole double-throw, or equal.

2. Provide a zero-motion speed switch at the tension station, hardwired to the conveyor control circuit, with isolated contact output and start-up time delay. Basis of design is Electro-Sensors Model SCP 1000 with explosion-proof housing and magnet pulsar wrap, or equal.

3. Provide a 120-volt AC solenoid chain oiler at the tension station, hardwired to the control panel and energized whenever the conveyor motor is operating.

4. Provide a pretensioned belt scraper at the conveyor discharge with replaceable rubber blade not less than 1/4 inch thick and UHMWPE backing plate to continuously remove material from the conveying surface.

G. Spare Parts

1. Provide one spare parts set consisting of 5 belt pans, 10 guide blocks, 5 chain attachments, and 6 rubber scraper blades.

H. Control System

1. Furnish a complete conveyor control system based on the manufacturer's standard design for the specified equipment, including conveyor main control panel, motor starting equipment, control power distribution, relays, terminals, wiring, and accessories required for a complete operating installation.

2. Provide a Conveyor Main Control Panel, wall mounted at the location shown on the Drawings, rated for 480-volt AC, 3-phase, 60-hertz incoming power, furnished in a NEMA 4X Type 304 stainless steel enclosure, and UL 508A labeled.

3. Control panel shall include a main circuit breaker with external operator mechanism and a 480/120-volt AC control power transformer sized for all connected control loads.

4. Conveyor motor starter shall be solid-state reduced-voltage soft-start type with integral bypass and protective functions including phase reversal, phase loss, phase imbalance, SCR overtemperature, SCR shorted condition, and overload protection.

5. Main control panel operator devices and indications shall include, at a minimum: emergency-stop pushbutton, automatic mode indicator light, conveyor running indicator light, emergency-stop activated indicator light, conveyor zero-speed fault indicator light, conveyor overload indicator light, conveyor fault indicator light, fault reset pushbutton, hand-off-auto selector switch, start pushbutton, and stop pushbutton.

6. Provide external control interfaces including discrete inputs for enable interlock from the plant SCADA system and run command interlock from the dewatering controls, and discrete outputs for conveyor auto mode status, emergency-stop status, and common fault status.

7. Control system functional requirements shall include the following: in Hand, conveyor shall operate regardless of external interlock conditions; in Auto, run command shall initiate operation and shutdown shall be delayed by adjustable timer after the run command is removed to allow material to clear; emergency-stop activation and system faults shall stop conveyor operation regardless of selected mode; and manual fault reset shall be required prior to restart following any system fault.

8. Provide factory quality control for the control system including inspection of panel assembly, component ratings, labeling, and workmanship, together with point-to-point continuity checks and functional testing of the control circuit prior to shipment.

I. Manufacturer Services

1. Manufacturer shall provide shop drawings, product data, and operation and maintenance information in accordance with Division 01 and the requirements of this Section.

2. Equipment shall be installed by the Contractor in accordance with the manufacturer's detailed written instructions, approved submittals, and the Contract Documents.

3. Manufacturer's representative shall make one trip to the site and be present for not less than 2 days during initial startup and operational testing to inspect the completed installation, verify readiness for operation, assist with startup, and provide operation and maintenance instruction for Owner's personnel.

4. Field testing shall include, at a minimum, verification of conveyor alignment and chain tension, operation of the drive assembly, operation of the safety pull-cord switches, operation of the zero-motion speed switch, operation of the chain oiler, and demonstration of proper conveyor performance under operating conditions.

5. Upon completion of startup and field testing, manufacturer's representative shall submit a written field service report identifying installation conditions observed, tests performed, and any recommended corrective actions.

6. Equipment shall be furnished with the manufacturer's standard warranty, but not less than 12 months from startup.

2.08 MOTORS

A. Motors shall be NEMA Premium® efficient, 3-phase squirrel cage induction type, NEMA design B, connected and rated for operation on a 480-volt, 60 Hz, AC power supply. Conductors shall be copper. Premium efficient motors shall meet or exceed the published guaranteed minimum efficiency value and the tested efficiency shall be in accordance with IEEE Standard 112, test method B. Motors shall also be severe duty rated, meeting or exceeding the requirements of IEEE Standard 841.

B. Motors shall be capable of successful operation in an ambient temperature range of -20 °C to 50 °C (minimum 50 °C ambient temperature nameplate rating), and relative humidity of 100%. Motors shall also be capable of successful operation with voltage variations to 10% of the nameplate rating and frequency variations to 5% of the nameplate rating.

C. Motors shall have Class H insulation, rated on a Class B temperature rise, with a minimum service factor of 1.15 for sine wave current protection, and minimum service factor of 1.0 for inverter operation. The allowable temperature rise shall conform to NEMA standard MG1.

D. Motors for use with VFDs (inverter operation) constant torque applications shall be inverter duty. Motors shall also be equipped with an optional shaft grounding kit, AEGIS™ or Engineer approved equal.

E. Motors shall be provided with optional snap-action, bimetallic, temperature actuated, normally closed winding thermostats for thermal protection. A minimum of one thermostat shall be provided for each phase. Thermostat lead wires shall be routed to the main conduit box main conduits for motor leads and thermostats.

F. Motor enclosures shall be totally enclosed fan cooled (TEFC). TEFC motors shall be provided with drilled and tapped holes to drain cavities within the motor. Automatic breather drain devices shall be provided. Motor frames, end shields and conduit boxes shall be constructed of cast iron. Built-in lifting lugs, or drilling, tapping, and lifting eye bolts shall be provided. Motors frame sizes shall be NEMA standard, suitable for the application specified.

G. Motor bearings shall be anti-friction type AFBMA standard sizes. Bearings shall be selected to provide minimum L10 bearing life of 17,500 hours for belted applications and 100,000 hours for flexible or direct-coupled applications. All motors shall have thrust ratings not less than the combined static and dynamic loads to be imposed. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent re-lubrication. Facilities shall be provided for adding new grease and draining out old grease without major motor disassembly. The bearing housing shall have long, tight, running fits or rotating shields to protect against the entrance of foreign matter into the bearings, or leakage of grease out of the bearing cavity.

H. Motor leads into the conduit box shall have the same insulation class as the winding. Leads shall be marked throughout the entire length to provide identification after terminals are taped or clipped. Leads insulated with glass braid shall be furnished with a metal marker on the lead.

I. Motor nameplates shall be stainless steel. Nameplates shall be engraved or stamped and shall be fastened to the motor frame with stainless steel screws or drive pins. Nameplates shall clearly indicate all items of information enumerated in NEMA standard MG1. Connection diagrams shall also be permanently attached to the motor, either inside the conduit box or on the motor in a location readable from the conduit box side.

J. Each motor shall be tested to determine that it is free from electrical or mechanical defects, and to provide assurance that it meets the specifications. The routine test(s) shall conform to applicable NEMA and IEEE standards. Copies of test reports will not be required unless actual operation after installation suggests the motor's performance should be verified, in which case copies of the test report shall be submitted upon the Engineer's request.

K. Subject to compliance with these specifications, motors shall be as manufactured by Baldor, TECO, GE, Toshiba or Engineer approved equal.

2.09 POLYMER BLENDING AND FEED SYSTEM

A. The equipment manufacturer shall supply three (3) complete polymer blending and feed systems designed for the preparation, aging and dosing of polymer solution suitable for the specified type of sludge, maximum capacity and polymer consumption specified in paragraph 2.04. Each Polymer Feed System shall be capable of automatic preparation of polymer solution from liquid concentrate (neat or emulsified polymer) and automatic metering of the polymer solution to the application point. The preparation system shall feed polymer solution to the sludge dewatering screw press, as shown on the Plans.

B. The equipment manufacturer shall be responsible for proper sizing of polymer blending and feed equipment, as required to meet the specified performance requirements.

C. The basis of design for the polymer activation, dilution, and feed system equipment and components specified herein is FKC Polymer Makedown system, Model PMS-M-3-P-120-R, manufactured by FKC Co., LTD., 2708 West 18th Street, Port Angeles, WA 98363; Phone: (360) 452-9472; Fax (360) 452-6880; www.fkcscrewpress.com.

D. Service Conditions and Performance Requirements

1. Control panel supply voltage shall be: 120 VAC.
2. The polymer dilution/feed system shall be capable of producing polymer solution with active polymer-to-water solution concentrations between 0.25% and 1.0%, or as recommended by the screw press system equipment manufacturer.

3. Maximum polymer usage for the sludge dewatering screw press shall be 30 lbs. active polymer per dry ton of solids. Refer to Section 46 76 27 – Sludge Dewatering for additional requirements.

4. Maximum dilution water capacity shall be 1800 gph (30 gpm) at 70 psi. Water source will be plant effluent, filtered to 80 Mesh (200 µm).

E. Mixing Chamber

1. The polymer mixing chamber shall have a confined inversion zone wherein the oil phase continuous emulsion is injected, stripping the oil from the polymer molecules, partially hydrating the solution. The solution then passes from the confined space without recirculation through that confined space to the activation zone consisting of a minimum of three baffled zones creating a plug flow for the solution exposing it to mild turbulence with low shear to complete the hydration process. There shall be no recirculation of the initially inverted neat polymer.

2. The system shall have a minimum of two mixing zones designed to strip the oil from the emulsion and allow hydration of the polymer molecule without damaging the polymer's molecular structure, regardless of flow rate.

3. The systems mixing energy shall be variable in intensity. Mixing energy must be variable by VFD control to handle the wide range of polymers available. Mixer motor shall be wash down duty, 1/3 hp, TEFC, 1800 rpm, 56C frame for polymer solution flow rates up to 40 gpm.

4. The mixing chamber shall include a flushing provision for the mechanical seal utilizing incoming water flow to continuously flush the seal area when in operation. A secondary lip seal shall be installed between the mixing chamber mechanical seal and the mixer motor. A weep hole shall be located between the mechanical seal and lip seal to provide additional protection for the mixer motor in the event of a mechanical seal failure. The system shall also be equipped with a seal failure detection system to indicate an alarm on the control panel when the seal fails.

5. Provide a neat polymer check valve specifically designed to isolate neat polymer from dilution water. The valve shall be designed with an open, unobstructed path to the valve seat. The valve body shall be constructed of Stainless Steel with viton seals. The plug and spring shall be stainless steel. The spring shall be located outside the mixing chamber for simple adjustment. The valve shall be readily accessible for cleaning, shall be easily disassembled and reassembled and shall not require tools for removal, cleaning or replacement.

F. Dilution Water Control

1. The dilution water flow rate shall be monitored by a Rotameter type flow meter. Unions shall be provided on the inlet and outlet of the Rotameter to allow easy removal for cleaning.

   a. Materials of Construction: Metering Tube – Machined Cast Acrylic; Internal Components – Type 316L Stainless Steel; Fitting – PVC; Elastomers – Buna-N.

2. Unit shall have an electric solenoid valve for on/off control of total dilution water flow.

   a. Materials of Construction: Brass body, NBR Seal.

   b. Manufacturer: Parker Skinner Valve or equal.

   c. The valve shall be rated NEMA 4X.

3. The dilution water flow rate shall be manually adjusted through a flow control valve connected directly to the mixing chamber. Valve shall be constructed of PVC body, SS needle, and brass seat.

4. Dilution water differential pressure shall be monitored by an industrial duty differential pressure switch rated NEMA 4X with a range of 0-90 psi. Pressure switches with plastic construction or fittings and mechanically actuated switches shall not be acceptable. United Electric model J21K-254-M900 or equal.

5. A suitably sized pressure reducing valve shall be supplied for installation in the dilution water line. Pressure reducing valve shall be constructed of bronze with adjustable output pressure of 25-75 psi to reduce incoming line pressure variations.

G. Polymer Metering Control

1. Unit shall have a neat polymer metering pump. Pump shall be a four (4) stage positive displacement, progressive cavity type. Rotor shall be Type 316 stainless steel. Stator shall be fluoroelastomer. Pump shall have a packing seal.

2. Pump shall be driven by a 1/4 HP (minimum), TEFC, 0-90VDC motor. Variable speed capability shall be provided by an SCR controller. Maximum speed of the pump shall not exceed 650 RPM.

3. Provide a metering calibration assembly rigidly mounted to the system frame and sized to provide a one-minute drawdown at 100 percent pump capacity. The column shall be graduated in increments of 0.1 gallons/10mL. Supporting the calibration column with the polymer piping is not acceptable

4. Each metering pump shall be protected with a thermal type loss of flow sensor, rated NEMA 4 with local and remote indication of alarm on low/loss of flow. Pressure switches or mechanical or reed type switches shall not be acceptable. IFM Efector model SI-1000 or equal.

H. Controls: Polymer system controls shall be integrated into the dewatering skid controls or provided in a separate NEMA 4X enclosure constructed of FRP. Polymer system control components shall include the following:

1. Switches, relays, indicator lights, digital displays, and controllers as required herein. Switches and indicator lights shall be Allen Bradley series 800E. All skid-mounted electrical components interconnected to control panel shall terminate on terminal blocks. Terminal blocks shall be sized for 14-gauge wire with terminal block numbers and a legend. Wires shall be neatly run through wire race-way and numbered with adhesive type labels. Control panel shall have a short circuit current rating of at least 6,000 amps.

2. Control Devices:

   a. Main Power/System ON-OFF-REMOTE selector switch.

   b. NEMA 4X, panel-mounted potentiometer for local control of pump speed.

   c. Alarm reset Push-Button.

3. SCR Controller:

   a. Input Voltage: 115/230 VAC.

   b. Output Voltage: 0-90 VDC or 0-180 VDC.

   c. HP Rating: 1/8-1 @ 90 VDC, 1/4-2 @ 180 VDC

   d. Signal Input: 4-20mA or 0-10VDC, selectable.

   e. Max Output Current: 10 Amps.

   f. Adjustable min speed, max speed, current limit, IR compensation and signal input adjust.

   g. 3 percent linearity through 60:1 speed range

   h. Manufacturer: Minarik, model PCM23001A.

4. Indicators:

    a. System running indicator, white full voltage pilot light.

    b. Low water differential pressure alarm.

    c. LCD display of pump rate.

    d. Low polymer flow alarm.

5. Inputs (by others):

    a. 4-20mA metering pump pacing signal.

    b. Contact Closure (maintained) for remote starting/stopping of polymer system.

6. Outputs:

    a. System "Running" status, dry contact

    b. System in "Remote mode" status, dry contact.
    c. Low Water Pressure Alarm, dry contact.

    d. Low Polymer Flow Alarm, dry contact.

7. Alarms:

    a. Loss of Dilution Water Flow Alarm, Differential Pressure Type. Metering pump goes to stand-by mode when low dilution water pressure occurs. The pump automatically restarts when pressure returns.

    b. Loss of Polymer Flow Alarm, thermal sensor type. System goes on standby when low/loss of polymer flow occurs, requires manual restart. An adjustable 0 to 60 second time delay relay shall be provided to prevent nuisance alarms from occurring.

I. Maintenance:

1. Unit shall be open frame design to allow easy access to all components.

2. Mixing chamber shall be easily disassembled and reassembled to allow access to all parts exposed to neat polymer.

3. Polymer check valve shall be readily accessible. Check valves installed inside mixing chamber shall not be acceptable.

J. Material Specifications

1. Connections – Plumbing:

    a. Dilution water inlet, 1-inch FNPT.

    b. Neat polymer inlet, 1-inch FNPT.

    c. Solution discharge, 1-1/2-inch FNPT.

2. Connections – Electrical

a. Standard, grounded male plug - 120/1/60, 15 amps max.

b. Terminal blocks for interconnecting all skid-mounted electrical devices.

c. Terminal blocks for all remote input and output signals.

3. Dimensions: The overall system dimensions shall not exceed 32” H x 26” D X 30” W.

4. Feed Unit Construction:

a. The system's frame shall be of rugged Type 304 stainless steel construction. No mild steel shall be used. The skid shall be constructed of 3/16-inch minimum Type 304 stainless steel. The frame shall be constructed of 3/16-inch angle or structural stainless steel tubing. The panel supporting the control panel shall be a minimum of 12-gauge. Vertical frame members shall be gusseted. All pipe supports shall be stainless steel. The skid shall be designed for fork-lifting and shall have holes for mounting to concrete pad. The systems frame shall be designed for an integral dilution water booster pump in the event the plant’s hydro-pneumatic system is incapable of providing sufficient dilution water. Maximum system dimensions shall be per schedule above. Control panel shall be mounted in vertical position and at 60 inches high. Pump suction shall not exceed 18 inches from the skid.

b. Piping and valves shall be mounted with rigid pipe clamps. Fasteners required to mount components to system frame shall be minimum 1/4-20.

c. Dilution water plumbing shall be schedule 80 PVC. Hose shall be braided vinyl. Hose fittings shall be schedule 80 PVC. No nylon fittings shall be used.

d. Mixing chamber – PVC Sch 80.

K. Accessories

1. Horizontal Tote/Drum Adapter Kit: Provide tote/drum suction kit with a 2-inch NPT connection, isolation ball valves, 1-inch quick disconnect adapter, vent connection and 10 feet of 1-inch clear, braided, PVC tubing.

2.10 POLYMER INJECTION AND MIXING SYSTEM

A. A polymer injection and mixing system shall be supplied by the screw press equipment manufacturer. The injection and mixing system shall include a polymer injection ring, mixing valve, static mixer, or dynamic mixing/flocculation tank, or a combination of these, as recommended by the manufacturer. All design components required for a complete polymer injection and mixing system shall be coordinated and supplied by the screw press equipment manufacturer, including interconnecting piping and appurtenances.

B. The pipe or tank flocculator shall be provided with a minimum retention time of two minutes under the average design flow rate, or as recommended by the manufacturer for the specified sludge type and maximum polymer dosage. The manufacturer recommended size of piping needs to consider maximum capacity, loading rate, and minimum velocity in piping to avoid sedimentation and conditions which do not negatively impact the flocculation process.

C. For pipe polymer injection and mixing systems, the static mixer shall be constructed of clear piping or the system shall be provided with a site glass for visual inspection of the mixing process and resulting floc condition.

D. For dynamic mixing/flocculation tank designs, the tank and appurtenances shall be constructed of Type 304 stainless steel. The tank shall be supplied with a flanged inlet located at the bottom of the tank. A tee and isolation valve shall be provided at the tank inlet to allow for draining and cleaning without removal of the process connections. Conditioned sludge shall overflow from a discharge pipe located near the top of the tank. Provide a 6-inch minimum discharge pipe stub with flexible rubber hose sleeve connection. A cover with a hinged inspection door shall be provided to allow for easy visual inspection of the floc. The tank shall be supplied with a Type 304 stainless steel agitator. The agitator drive shall be a helical gear speed reducer with a nominal 1,800 rpm motor. Maximum nominal motor size shall be 1.5 HP, or as recommended by the manufacturer. Agitator speed shall be adjusted manually at the flocculation tank. A high-level conductivity switch shall be supplied by the manufacturer for shutdown of the sludge feed pump and prevention of flocculation tank overflow. Flocculation tank, agitator, and agitator drive shall be designed to handle the entire flow capacity range of the screw press.

2.11 FLOW METERS

A. Electromagnetic flow meters shall be supplied by the screw press equipment manufacturer for control and monitoring of feed sludge flow rate and volume. Electromagnetic flow meters shall be as specified in Section 40 70 11 – Instrumentation for Process Systems.

2.12 ELECTRICAL CONTROLS AND INSTRUMENTATION

A. The entire control system shall be provided and installed by the screw press equipment manufacturer on the dewatering skid, including all interconnecting power and control wiring, conduits, and supports between all system components to minimize field assembly.

B. The main control panel shall be suitable for operation from a single-point 480 VAC, 60 Hz, 3-phase power supply.

C. The screw press dewatering system shall be fully automatic and include the following major control components:

1. Main control panel for screw press, sludge cake conveyor, wash water system, and mixing/flocculation tank.

2. Polymer blending and feed system control panel.

D. The 480V main control panel shall be provided in a NEMA 4X rated Type 304 stainless steel enclosure. The enclosure shall be a rigid self-supporting structure suitable for free standing installation on the dewatering skid, and shall include the following features:

1. Main power disconnect with through door interlock handle.

2. Step down control transformer and disconnect.

3. Branch circuit protection (circuit breakers).

4. Transient voltage surge arrestor.

5. Drive motor VFDs, including over-current and over-heat protection, and 5% impedance line reactor for the following:

    a. Screw press main drive.

    b. Sludge cake conveyor.

    c. Mixing/flocculation tank drive.

    Constant torque VFDs shall be provided for all constant torque loads (i.e. screw press, conveyor, sludge feed pump, and mixing/flocculation tank drive). Provisions shall be made for motor controllers to accept drive motor winding thermostat wiring as specified.

6. Reversing drive motor starter with over-current and over-heat protection for wash water spray drive (if used).

7. HOA control switches for the following devices (minimum):

    a. Screw drive, including FOR selector switch.

    b. Wash water solenoid valve(s).

    c. Wash water booster pump (if used).

8. Emergency stop pushbutton.

9. Hour meter for all motors.

10. Run and Off indicating lights.

11. Control power on indicating light.

12. Alarm light indicating over current, and starter overload.

13. Alarm reset pushbutton.

14. Control system reset pushbutton.

15. Ethernet switch with spare port for connection to the plant control system.

16. Programmable logic controller (PLC) Allen Bradley CompactLogic with on-board Ethernet. The PLC shall have the capability to work as a data logger. The data logger shall document all important process parameters, but not limited to the following:

    a. Operation mode: OFF, dewatering, back wash, shutdown.

    b. Drive operation: forward, reverse.

    c. Sludge flow and volume, GPM/gallons.

    d. Screw Speed.

    e. Polymer pacing signal.

    f. Polymer solution flow and volume, GPM/gallons

    g. Screw press inlet pressure and/or level.

h. Motor amperage draw.

i. Set points: feed solids, polymer consumption, solids loading.

17. Operator Interface (OIU), Allen Bradley PanelView Plus 7 with 15-inch color touch screen display and Ethernet communication. In addition to displaying the process parameter data listed above, the OIU shall also display text messages of the following (at a minimum):

a. Over-current indications.

b. Spray bar washing system on.

c. Polymer blending and feed system status.

18. Spare terminals (power and control) shall be provided to accommodate remote control operation and to interface with other equipment components such as the polymer blending and feed system, sludge feed pump, wash water booster pump, flow meters, etc.

19. Run and alarm auxiliary contacts for use by the customer.

20. Panel enclosure air conditioner, Hoffman PROAIR Harsh Environment Series, or Engineer approved equal. Provide with optional NEMA 4X rated stainless steel enclosure. Cooling capacity as recommended by the control panel manufacturer.

21. Panel enclosure shall have lifting eyebolts and slotted holes in the base for field adjustment.

22. Enclosure shall have horizontally opening door with full length piano hinge(s), keyed locking handle(s), and three-point catch(es).

23. Laminated plastic nametags shall be provided for the name of the control panel and all disconnects, switches, lights, and meters.

24. UL Label.

25. Short circuit current rating of at least 6,000 amps.

E. Control Devices: All control devices shall be UL listed and supplied with NEMA 4X enclosures, suitable for installation in outdoor and wet locations. The following control devices shall be provided and factory mounted by the equipment manufacturer:

1. Pressure and/or level transmitter at the inlet of the screw press: 4-20 mA signal is sent to the PLC. The transmitter shall also have a discrete relay output, freely adjustable at the sensor, indicating high pressure conditions at the screw press inlet.

2. Conductivity switches for headbox and mixing/flocculation tank high level.

3. Solenoid valve(s) to control flow to the spray wash assemblies. Valves shall have brass body.

4. Conveyor safety stop and zero speed switch.

5. Resistance temperature detector (RTD) shall be mounted on the housing of the sludge feed pump to measure the temperature of the stator. A temperature controller with a high temperature switch shall be provided and installed in the screw press control panel for integration with the existing Gorman-Rupp T4A3-B sludge feed pumps.

6. Other devices as specified in other sections, including control devices for the polymer blending and feed system.

2.13 ANCHOR BOLTS AND FASTENERS

A. Anchor Bolts: The equipment manufacturer shall furnish all anchor bolts of ample size and strength required to securely anchor each item of equipment. All anchor bolts, hex nuts, and washers shall be Type 304 stainless steel. Anchor bolts shall be wedge or epoxy type.

B. Fasteners: All fasteners shall be Type 304 stainless steel. The equipment manufacturer shall furnish all fasteners required for the assembly of the equipment.

PART 3 - EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Equipment manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect equipment and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all equipment serial numbers and parts lists with shipping documentation. Notify the manufacturer's representative of any unacceptable conditions noted with shipper.

3.02 INSTALLATION, STARTUP AND OPERATOR TRAINING

A. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. The Owner's installation contractor will install the anchor bolts in accordance with the manufacturer's recommendations.

B. Manufacturer shall furnish the services of a factory-trained service technician for a minimum of ten (10) days in two (2) trips to inspect the installation, carry-out the equipment startup procedures, and provide training to the operators in how to effectively operate and maintain the equipment. Manufacturer field services shall include the following:

1. One (1) trip with five (5) days of service to inspect the installation and perform functional/operational testing.

2. One (1) trip with five (5) days of service to complete performance testing and provide training to the operators.

3. Additional trips resulting from failed tests shall be the sole responsibility of the manufacturer.

C. The Contractor shall be responsible for coordination and scheduling of startup and training with the manufacturer, Owner, and Engineer. All field testing shall be witnessed by the Owner and Engineer.

D. Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the manufacturer's representative/service technician present.

E. Manufacturer shall inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up.

F. Perform start-up and functional testing for entire dewatering system, with all units operating in AUTO mode. The Contractor shall complete all electrical/instrumentation and loop testing prior to functional performance testing.

G. Guaranteed Performance Testing:

1. Include the minimum number of trips and duration of service as previously indicated.

2. Include demonstration that dewatering system meets minimum specified performance requirements of this specification.

3. Manufacturer's representative shall supervise all performance testing and be solely responsible for operating the dewatering and ancillary equipment (e.g., sludge and polymer feed systems). Manufacturer shall provide certified test reports.

4. After adjustments are made to achieve the operating requirements, the dewatering system will be operated at the design conditions to demonstrate consistent performance. Samples of feed, filtrate, and cake shall be collected by manufacturer's representative. The test will be deemed successful if average test results meet or exceed those specified.

5. Sample testing and analysis costs shall be the responsibility of the manufacturer.

6. Polymer shall be as selected by the manufacturer's representative and supplied in quantities sufficient for startup and testing.

7. Data collected during each test run used to complete guaranteed performance testing shall include, as a minimum:

    a. Run number
    b. Date
    c. Time
    d. Feed sludge percent total solids, %TS
    e. Sludge feed rate, gpm
    f. Polymer name
    g. Polymer percent active, %
    h. Polymer feed rate (neat), gph
    i. Screw press speed, rpm
    j. Amperage draw by screw press drive
    k. Cake percent solids, %TS

8. Provide calculated values for the following:

    a. Solids throughput, lbs TS/hr

9. Solids concentration shall be determined using "Standard Methods."

10. Guaranteed Performance Test Runs:

    a. Test runs shall consist of two 5-hour steady state runs performed on two consecutive days. Maintain the minimum design solids throughput of 600 dry pounds per hour throughout the test runs. Inlet sludge for test runs shall be 1.3% or greater.

    b. All test data and values and previously described and required to demonstrate compliance shall be recorded at the start of each run and every hour thereafter. The averaged results for each sample shall meet or exceed the minimum and guaranteed performance standards.

    c. The units shall be operated in AUTO mode at all times during the Guaranteed Performance test runs.

d. Should the installed equipment fail to meet the specified minimum performance requirements, the manufacturer shall within 30 days make all necessary changes to the equipment and/or operation at no cost to the Owner. The equipment shall be retested using the same procedure indicated above. If after the second test the equipment still does not meet the minimum performance requirements and/or guaranteed performance standards, damages will be assessed and/or equipment replaced. If assessed, damages will be limited to ten percent (10%) retention if performance requirements are not met.

e. The screw press dewatering system shall meet every item of the performance criteria as specified prior to acceptance of the Owner.

11. The manufacturer shall provide and submit a written report documenting the test data listed above. Include a computer spreadsheet compatible with Microsoft Excel (latest version) with the test data listed above. A copy of the final written startup and testing report shall be included with the final Operation and Maintenance manuals.

H. Training:

1. Provide operator for at least one (1) day on site by the factory trained representative. Operator training shall include:

a. Operations and inspection training.

b. Safety instruction.

c. Preventative maintenance instruction.

d. Calibration and other pertinent services.

END OF SECTION 46 76 27

APPENDIX A

CONSTRUCTION STAKING REQUEST FORM

2803 River Road, Yakima, WA 98902
Office: (509) 966-7000
hlacivil.com

CONSTRUCTION STAKING REQUEST

EMAIL TO: tfries@hlacivil.com and eherzog@hlacivil.com
QUESTIONS TO: TIMOTHY D. FRIES, PLS at (509) 966-7000

CITY OF GRANDVIEW
WASTEWATER TREATMENT PLANT IMPROVEMENTS - PHASE 1
HLA PROJECT NO. 23030

Contractor Name: _____

Contractor Cell No.: _____ Contractor Email: _____

Date of Request: _____ Time of Request: _____

The Contractor shall provide at least three (3) working days notice as required by the Contract Technical Specifications.

ITEM	DESCRIPTION	STATION TO STATION	WHEN REQUIRED DATE	TIME
1.				
2				
3				

SIGNATURE

_____
Contractor

The Contractor is responsible for providing traffic control for the survey crew at their own expense.

APPENDIX B

PHASE 1 GEOTECHNICAL REPORT

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

GEOTECHNICAL SITE INVESTIGATION REPORT

CITY OF GRANDVIEW WWTP UPGRADES PROJECT
GRANDVIEW WASTEWATER TREATMENT PLANT - DUMP ROAD
SOUTHEAST OF EUCLID ROAD & BRIDGEVIEW ROAD
YAKIMA COUNTY, WASHINGTON

GNN PROJECT NO. 244-1757

AUGUST 2024

Prepared for

HLA ENGINEERING & LAND SURVEYING, INC.
2803 RIVER ROAD
YAKIMA, WA 98902

Prepared by

GN NORTHERN, INC.
CONSULTING GEOTECHNICAL ENGINEERS
YAKIMA, WASHINGTON
(509) 248-9798

Common Sense Approach to Earth and Engineering
Since 1995



At GN Northern our mission is to serve our clients in the most efficient, cost-effective way using the best resources and tools available while maintaining professionalism on every level. Our philosophy is to satisfy our clients through hard work, dedication and extraordinary efforts from all of our valued employees working as an extension of the design and construction team.

Northern, Inc.

August 6, 2024

HLA Engineering & Land Surveying, Inc.
2803 River Road
Yakima, WA 98902

Attn: Robert Scott, PE

Subject: **Geotechnical Site Investigation Report**
City of Grandview WWTP Upgrades Project
Grandview Wastewater Treatment Plant - Dump Road
Southeast of Euclid Road & Bridgeview Road
Yakima County, Washington

GNN Project No. 224-1757

Dear Mr. Scott,

As requested, GN Northern (GNN) has completed a geotechnical site investigation for the proposed *City of Grandview WWTP Upgrades Project* to be constructed at the Grandview Wastewater Treatment Plant located on Dump Road southeast of the intersection of Euclid Road and Bridgeview Road approximately 2 ½-miles south of the City of Grandview in Yakima County, Washington.

Based on the findings of our subsurface study, we conclude that the site is suitable for the proposed construction provided that our geotechnical recommendations presented in this report are followed during the design and construction phases of the project.

This report describes in detail the results of our investigation, summarizes our findings, and presents our recommendations concerning earthwork and the design and construction of foundations and infrastructure for the proposed project. ***It is important that GNN be retained by the owner to provide consultation during the design phase, as well as field compaction testing and geotechnical monitoring services during the construction phase, to review and monitor the implementation of the geotechnical recommendations.***

If you have any questions regarding this report, please contact us at 509-248-9798.

Respectfully submitted,

GN Northern, Inc.

Aaron B. Cleveland, GIT
Staff Geologist

Karl A. Harmon, LEG, PE
Senior Geologist/Engineer

KARL A. HARMON
STATE OF WASHINGTON
41534
REGISTERED
PROFESSIONAL ENGINEER

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APPENDICES

Appendix I – Vicinity Map (Figure 1), Site Exploration Maps (Figure 2, 2A, 2B, 2C & 2D), Geologic Map (Figure 3), USGS Quaternary Fault Map (Figure 4), HLA Topogrpahic Maps
Appendix II – Exploratory Test-Pit Logs, Key Chart (for Soil Classification)
Appendix III – Laboratory Testing Results
Appendix IV – Site & Exploration Photographs, Bedrock Core Photographs
Appendix V – Seismic Refraction Survey Report
Appendix VI – Slope Stability Analysis Outputs
Appendix VII – CAT Rippability Charts
Appendix VIII –NRCS Soil Survey
Appendix IX – WA Department Of Ecology Well Logs
Appendix X – ASCE 7-16 Seismic Parameters

1.0 PURPOSE AND SCOPE OF SERVICES

This report has been prepared for the proposed City of Grandview WWTP Upgrades Project to be constructed at the Grandview Wastewater Treatment Plant located on Dump Road southeast of the intersection of Euclid Road and Bridgeview Road approximately 2 ½-miles south of the City of Grandview (*City*) in Yakima County, Washington.; site location is shown on the *Vicinity Map* (Figure 1, Appendix I). Our investigation was conducted to collect information regarding subsurface conditions and present recommendations for suitability of the subsurface materials to support the proposed improvements and allowable bearing capacity for the proposed construction.

GN Northern, Inc. has prepared this report for use by the client and their design consultants in the design of the proposed development. Do not use or rely upon this report for other locations or purposes without the written consent of GN Northern, Inc.

Our study was conducted in general accordance with our *Proposal for Geotechnical Engineering Services* dated April 6, 2023. Notice to proceed was provided in the form of an authorized *Agreement for Subconsultant Services to HLA Engineering and Land Surveying, Inc.* signed by Michael T. Battle on June 11, 2024.

An *updated* annotated copy of the *City of Grandview Figure 7.1 - Overall Site Plan* prepared by HLA, showing the approximate location of the proposed improvements, was provided via email on June 6, 2024. Topographic surveys with preliminary grading plans for the sites of each of the planned improvements were received from HLA via email on June 25, 2024. Field exploration and testing, consisting of twelve (12) test-pits, was completed on June 28, 2024. Additionally, a geophysical survey consisting of four (4) seismic refraction lines was performed on June 26, 2024. In an effort to assess the strength properties of the onsite intact basalt bedrock materials, GNN obtained seven (7) core samples drilled from the surfaces of selected outcrops on August 5, 2024. Locations of the exploratory test-pits, seismic refractions surveys, and rock cores are shown on the *Site Exploration Maps* (Figures 2A, 2B, 2C, & 2D, Appendix I), and detailed test-pit logs are presented in Appendix II, and results of laboratory testing are attached in Appendix III.

This report has been prepared to summarize the data obtained during this study and to present our recommendations based on the proposed construction and the subsurface conditions encountered at the site. Results of the field exploration were analyzed to develop recommendations for site

development, earthwork, and foundation bearing support. Design parameters and a discussion of the geotechnical engineering considerations related to construction are included in this report.

2.0 PROPOSED CONSTRUCTION

Based on the initial information you provided in an email on March 16, 2023 along with updated communications via email on June 6, 2024 and an onsite meeting on June 24th, we understand the City plans to construct various upgrades at the existing facilities over a multi-year span. As outlined in the executive summary of the recent Wastewater Treatment Plant Plan, the scope of improvements will include:

- New headworks screen
- New 80' diameter primary clarifier and waste sludge pump
- Replacement of existing primary clarifier mechanism
- New influent pump and emergency generator
- Two new 85' diameter intermediate clarifiers
- New third mechanical treatment process train, secondary clarifier, and emergency generator
- New 70' diameter sludge holding tank
- New 2,400 SF sludge dewatering building with an attached 1,200 SF sludge dewatering pull-through structure (FF elevation 708')
- New 2,000 SF storage building (FF elevation 708')
- Two new lined 18-Million Gallon flow equalization lagoons (approximately 5.4-acres each), including mixers and effluent pump station
- New Game Pond pump station
- Decommissioning of unlined lagoons

Structural loading information was not available at the time of this report. Based on our experience with similar projects, we expect maximum wall loads for the new sludge dewatering building to be on the order of 3,500 plf and maximum column loads to be less than 80 kips. It shall be noted that assumed loading is based on limited preliminary information provided at the time of this report. If loading conditions differ from those described herein, GNN should be given an opportunity to perform re-analysis. Settlement tolerances for structures are assumed to be limited to 1 inch, with differential settlement limited to ½ inch.

3.0 FIELD EXPLORATION & LABORATORY TESTING

Prior to our field investigation, GNN engineers met with HLA on June 25, 2024 to perform site reconnaissance and check for site access constraints related to the planned field exploration activities. Field exploration, consisting of twelve (12) test-pits was completed on June 28, 2024. A local public utility clearance was obtained prior to the field exploration. The exploratory test-pits were excavated by Ally Construction Service, LLC using a Sany Sy35U drill rig/excavator to depths ranging from approximately 1 to 9 feet below existing ground surface (BGS). Following completion, the test-pit excavations were loosely backfilled with the excavated spoils. Additionally, seven (7) core samples of the bedrock were obtained from near-surface outcrops on August 5, 2024 using a 2" OD core drill machine. Locations of the test-pits and core samples are shown on the *Site Exploration Maps* (Figures 2, 2A, 2B, 2C & 2D).

The noted points of exploration and testing methods employed to assess subsurface conditions within the various site areas of proposed improvements/upgrades are outlined below:

Table 1: Summary of Site Investigation for Proposed Structures

Proposed Structures	Test-Pits	Rock Cores	Seismic Survey Line
Two 85’ Intermediate Clarifiers	TP-1, TP-5, & TP-6	CORE#7	
3rd Mechanical Treatment Train	TP-4 & TP-7		SL-2
Secondary Clarifier	TP-2 & TP-3		
New 70’ Sludge Holding Tank	TP-8	CORE#1	SL-1
New Sludge Dewatering Bldg.	TP-9	CORE#2	SL-1
Primary Clarifier	TP-10	CORES#3 & #4	
Two 18MG Aerated Lagoons	TP-11 and TP-12	CORES#5 & #6	SL-3 & SL-4

The soils observed during our field exploration were classified according to the Unified Soil Classification System (USCS), utilizing the field classification procedures as outlined in ASTM D2488. A copy of the USCS Classification Chart is included in Appendix II. Photographs of the site exploration and rock core samples are included in Appendix IV. Depths referred to in this report are relative to the existing ground surface elevation at the time of our investigation. The surface and subsurface conditions described in this report are as observed at the time of our field investigation.

Representative samples of the subsurface soils obtained from the field exploration were selected for testing to determine the index properties of the soils in general accordance with ASTM procedures. The following laboratory tests were performed:

Table 2: Laboratory Tests Performed

Test	To determine
Particle Size Distribution (ASTM D6913)	Soil classification based on proportion of sand, silt, and clay-sized particles
Natural Moisture Content (ASTM D2216)	Soil moisture content indicative of in-situ condition at the time samples were taken
Preparing Rock Core as Cylindrical Test Specimens and Verifying Conformance to Dimensional and Shape Tolerances (ASTM D4543)	Rock core sample preparation for testing
Uniaxial Compressive Strength of Intact Rock Core Specimen (ASTM D7012)	Uniaxial compressive strength of intact rock formation

Results of the laboratory test are included on the test-pit logs and are also presented in graphic form in Appendix III attached to the end of the report.

4.0 SEISMIC REFRACTION GEOPHYSICAL SURVEY

A total of four (4) seismic refraction survey lines were completed at the site on June 26, 2024 at the location shown in the attached report in Appendix V. The seismic refraction method is based on the measurement of the travel time of seismic waves refracted at the interfaces between subsurface layers of different velocity. Energy radiates out from the various shot points (sledgehammer impact to surface), either travelling directly through the upper layer (direct arrivals) or travelling down to and then laterally along higher velocity layers (refracted arrivals) before returning to the surface. This energy is detected on the surface using a linear array (or spread) of geophones spaced at regular intervals. Observation of the travel-times of the direct and refracted signals provides information on the depth profile of the refractor.

Arrival time data is recorded on a seismograph and downloaded to a computer for analysis. Travel-time versus distance graphs are then constructed and velocities calculated for the overburden and refractor layers through analysis of the direct arrival and T-minus graph gradients. Depth profiles for each refractor are produced by an analytical procedure based on consideration of shot and

receiver geometry and the measured travel-times and calculated velocities. The final output comprises a depth profile of the refractor layers and a velocity model of the subsurface.

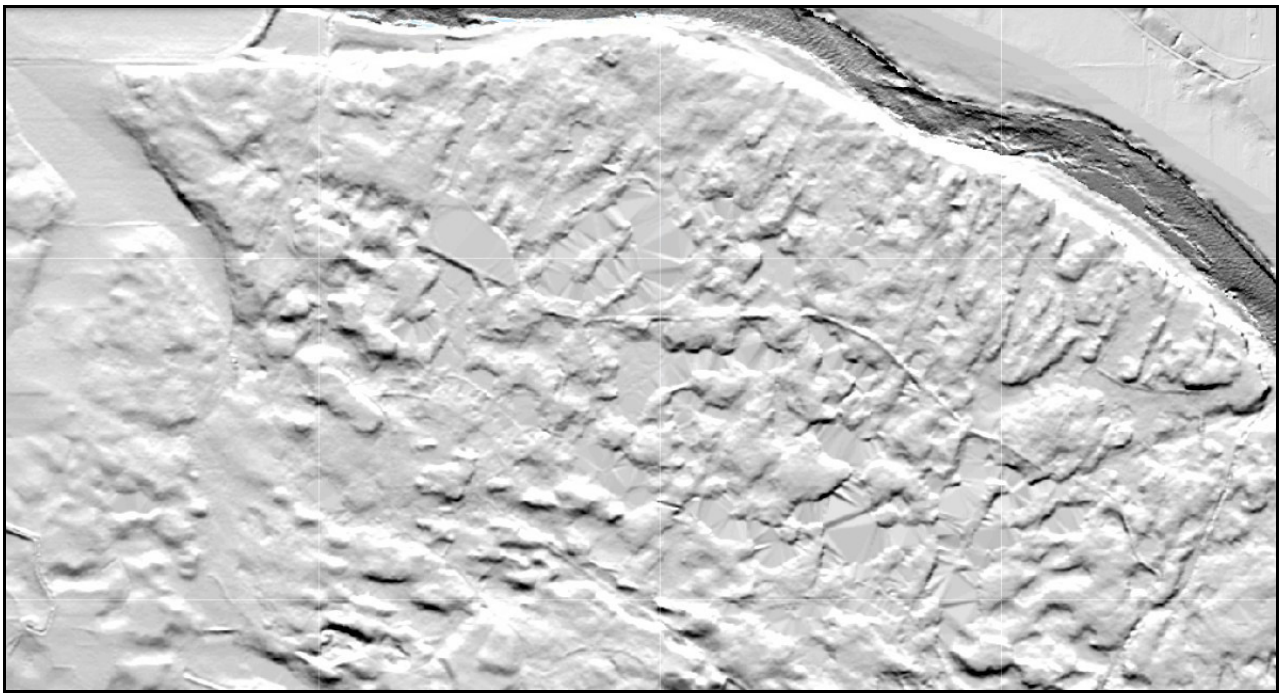
The findings of the seismic refraction survey generally confirm that once the local intact basalt layer is encountered, either on the surface or buried beneath the variably thin layer of Loess overburden material, P-wave velocity typically exceed 9,000 feet/second and therefore confirm the bedrock is considered *non-rippable*.

5.0 SITE CONDITIONS

Overall WWTP: The various sites of the proposed improvements and upgrades are located within the existing City of Grandview WWTP situated southeast of the intersection of Euclid Road and Bridgeview Road, with a site address of 850 Bridgeview Road located approximately 2 ½-miles south of the City of Grandview in Yalima County, Washington. The sprawling ~610-acre site of the WWTP facilities is located within eastern 1/2 of Section 3 and the majority of Section 2, Township 8 North and Range 23 East, Willamette Meridian.

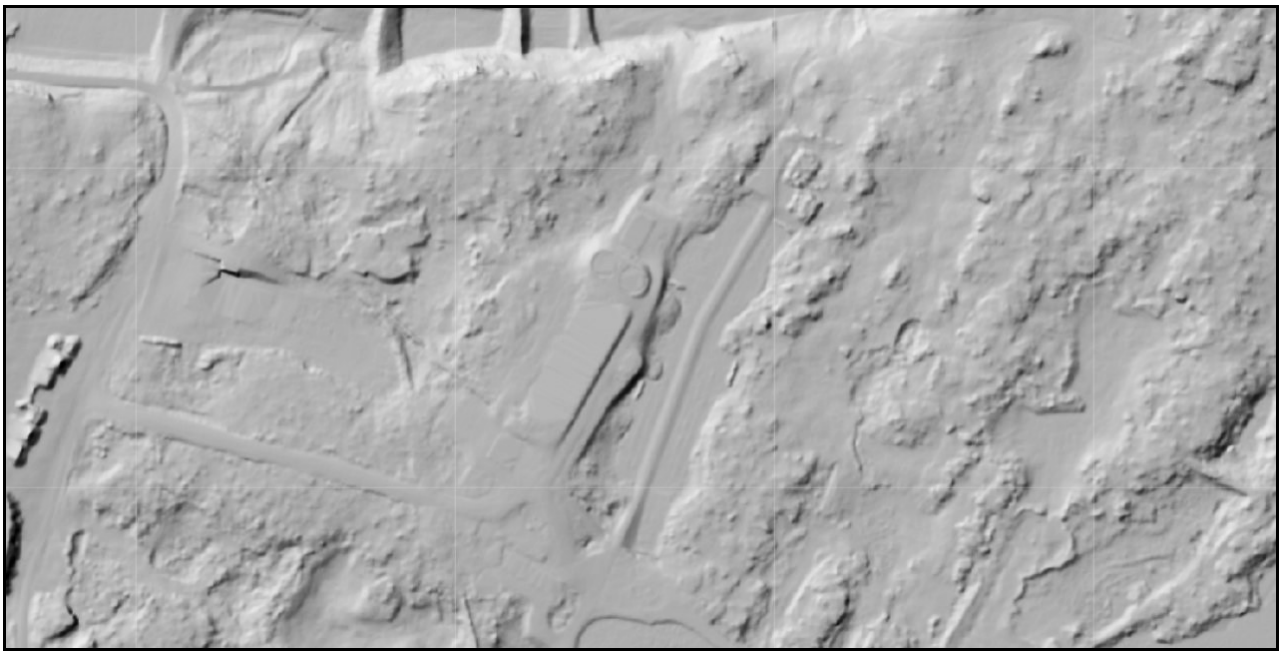
The majority of the proposed upgrades at the facility are located within the primary developed northwestern portion of the WWTP property. Existing developments within this portion of the site include a Mechanical Treatment Plant, Sludge Dewatering Facility, sludge drying beds, an existing man-made aerated lagoon (Lagoon No. 1), aerated Lagoon A situated within a natural occurring pond, an irrigation pump station, and the Primary Clarifier / Distribution Facility. Access to the various existing facilities is connected via a variety of paved and unpaved roadways.

The WWTP is generally situated within a region of hummocky desert topography characterized by highly uneven surface conditions and defined by irregular elevated/exposed basalt outcrops and associated low-lying areas covered by moderate to dense native grasses and brush. In addition to the noted man-made and lined Lagoon No.1, the region includes numerous natural wetlands and ponded areas (see LiDAR images below).



Two (2) New 85' Intermediate Clarifiers: Surface conditions are varied within the area of the two (2) new proposed intermediate clarifiers to be located west of the Mechanical Treatment plant and include some limited native surfaces that have been altered by placement of various fill and debris, including stockpiled basalt boulder and cobbles that were apparently associated with previous blasting and construction activities for the existing treatment plant.

Third Treatment Train & Secondary Clarifier: The site of the planned Third Treatment Train and Secondary Clarifier is located immediately west of the existing treatment plant. The majority of this site is relatively flat with the exception of the northern portion where the secondary clarifier will be constructed which includes an existing rounded descending fill slope. The southern portion of the planned treatment train site is enclosed by a chain-link fence and is used to park facility vehicles.



New 70' Sludge Holding Tank: The location of the proposed new 70' Sludge Holding Tank is situated northwest of the existing sludge dewatering building and an exiting tank. The surface is relatively flat and covered with moderate growth of desert grasses and weeds. An exiting buried pressurized sewer main crosses from northwest to southeast along the southwest side of the proposed sludge holding tank.

New Sludge Dewatering Building: The planned new sludge building site is located southwest of the existing sludge dewatering building. The footprint of the planned building straddles a significant grade differential, with the northern portion situated atop an upper existing paved driveway, transitioning to a steeply descending slope to the south into lower wetlands and a ponded basin.

New Primary Clarifier: The site of the proposed new Primary Clarifier is situated within the existing Primary Clarifier / Distribution Facility that is largely enclosed by a chain-link fence. The site of the planned primary clarifier is located west of the existing northern control building. Surface conditions are highly varied within the planned footprint, ranging from a relatively flat gravel covered surface near the existing building, descending toward the west into an apparent bedrock trough filled with numerous basalt boulders, including a slope that descend toward the west.

Two (2) New 18 MG Aerated Lagoons: The sites of the planned irregular shaped New 18 MG Aerated Lagoons are situated within open undeveloped desert land located to the south/southwest of Lagoon No.1 and the Primary Clarifier / Distribution Facility. Large portions within each of the outlined planned lagoons are currently occupied by existing naturally occurring ponds. As discussed above, the dry land surface conditions surrounding the existing natural ponds consist of hummocky desert topography characterized by highly uneven surface conditions and defined by irregular elevated/exposed basalt outcrops and associated low-lying areas covered by moderate to dense native grasses and brush. Some areas of imported fill materials that included miscellaneous concrete debris were observed on the surface along the west side of the proposed western lagoon.

6.0 GEOLOGIC SETTING

The project site lies on the northern flanks of the Hores Heavan Hills within the Yakima River Valley atop a basalt river terrace along the southern banks of the Yakima River. The site is situated within the Columbia Plateau, a broad plain situated between the Cascade Range to the west and the Rocky Mountains to the east. The Columbia Plateau was formed by a thick sequence of Miocene Age tholeiitic basalt flows, called the Columbia River Basalt Group, which erupted from fissures in north central and northeastern Oregon, eastern Washington, and Western Idaho. The Columbia Plateau is often called the Columbia Basin because it forms a broad lowland surrounded by mountains. The Columbia River Basalt Group is underlain by continental sedimentary rocks from early in the Tertiary Period. Variably thin to missing (basalt outcrop) surficial deposits consist of Plio-Pleistocene loess, silt, and fine-grained sand.

7.0 SUBSURFACE CONDITIONS

Our understanding of the subsurface soil and bedrock conditions is based on twelve points of exploration across the various site/areas of proposed improvements and upgrades. In general, surface & subsurface conditions include a variably thick (thin) upper layer of aeolian Loess deposits, typically consisting of Sandy Silt (ML) / Silty Sand (SM) and/or artificial fill material atop the underlying basalt bedrock, along with extensive areas of exposed basalt rock outcrops directly at the surface. Based on observation and testing of rock core samples, the native intact basalt rock was generally found to be relatively fresh to slightly weathered, strong to very strong, and slightly to moderately fractured/jointed as summarized in Table 2 below:

Table 3: Summary of Rock Core Quality Designation

Core ID	Approx. GPS Coordinates	Recovery Length (inches)	RQD Length (inches)	RQD
CORE#1	46.211862°, -119.912867°	9.5	4.5	47%
CORE#2	46.211295°, -119.912739°	11.3	11.3	100%
CORE#3	46.209400°, -119.909600°	11	0	0%
CORE#4	46.209431°, -119.909546°	10.5	4	38%
CORE#5	46.209143°, -119.912623°	11	0	0%
CORE#6	46.209128°, -119.910681°	9.5	5.5	58%
CORE#7	46.213152°, -119.912676°	9.5	7.5	79%

Test-pit logs in Appendix II show detailed descriptions and stratification of the soils/rock encountered. The following sections provide a detailed summary of the noted soil and rock strata observed at each of the various locations of proposed development:

Two (2) New 85' Intermediate Clarifiers: Based on the finding of our site reconnaissance and observations of exposed conditions within three (3) shallow exploratory test-pits (TP-1, TP-5, and TP-6) in the area of the proposed 85' clarifiers, subsurface conditions generally consist of and upper ~1.5' to ~5' layer of apparent fill materials. The apparent fill consists of loose to medium dense Silty Gravel (GM) with angular cobbles and boulders. Each of the test-pits excavated in this area were terminated due to bucket refusal atop the buried basalt bedrock. It should be further understood that the three test-pits were excavated along the eastern edge of a large (~7,000 to ~8,000 ft^2 area) stockpile of basalt boulders and large cobbles. While some limited areas of apparent native surfaces remain, the majority of this site appears to be covered by excess blasted material associated with previous construction activities for the existing treatment plant situated to the east.

Third Treatment Train & Secondary Clarifier: Based on observations of exposed conditions within test-pits TP-4 and TP-7, along with findings from the seismic refraction survey line performed in this area (SL-2), it appears evident that the areas along the western side of the existing treatment train structure includes relatively deep undocumented fill materials apparently resulting from and associated with previous construction activities for the existing facilities. Fill materials within TP-4 typically included relatively loose to medium dense Silty Gravels (GM) with angular cobbles and boulders. Test-pit TP-4 was terminated at a depth of ~5.5' to 6' BGS due to bucket refusal on basalt boulder rubble.

Unique to test-pit TP-7 excavated within the noted chain-link fence enclosure, we observed an upper ~2.5' layer of Silty Gravel fills (as previously described above) atop a ~1.5 layer of loose and moist Silt (ML) with occasional gravel, cobbles, and boulders. This intermediate layer of silty soil was underlain by fine grained Silty Sand (SM) that appeared to be loose and moist with occasional cobbles and boulders to the full depth of exploration at approximately 9' BGS. The sandy material was observed to become wet at a depth of approximately 7', with observed seepage flowing from the sidewalls at depths of approximately 8 to 8 ½ feet BGS resulting in severe caving conditions. Test-pit TP-7 was terminated at a depth of ~9' BGS scratching on apparent basalt bedrock. Based on the results of the seismic refraction survey (Line SL-2), we anticipate that the depth of artificial fill material could range in depth from ~9' to ~15'.

Test-pits TP-2 and TP-3 were excavated to depths of 5' and 6' BGS, respectively, within the planned footprint of the proposed Secondary Clarifier. TP-2 (located upslope) revealed apparent fill consisting of Silty Gravels (GM) with quarry spalls, cobbles, and boulders, along with miscellaneous trash and debris including some segments of plastic-coated wire and attached blasting cap. TP-2 was terminated on bucket refusal condition at ~5' BGS atop basalt rubble. Test-pit TP-3 (located downslope) revealed an upper ~2' layer of apparent Silty Gravel fill (as previously described) along with miscellaneous trash and debris including some segments of plastic-coated wire and attached blasting cap. Beneath the upper layer of fill we encountered native Sandy Silt (ML) that appeared loose and moist. TP-3 was terminated at ~6' BGS due to bucket refusal on basalt bedrock.

New 70' Sludge Holding Tank: Based on exposed conditions within Test-pit TP-8, subsurface condition at the site of the proposed 70' Sludge Holding Tank consist of a variably thick (~1' to ~3') overlying layer of apparent native Silt with Sand (ML) with trace gravels and cobbles that was observed to be loose to medium dense and damp. TP-8 was terminated due to bucket refusal atop the underlying basalt bedrock.

New Sludge Dewatering Building: As discussed previously, the currently planned footprint of the new building straddles a significant grade differential, with the northern portion situated atop an upper existing paved driveway, transitioning to a steeply descending slope to the south into lower wetland and a ponded basin. Test-pit TP-9 was excavated within the lower portion of the slope to

avoid damaging the upper paved areas. The subsurface condition revealed consisted of a variably thick (~2.5' to ~3.5') overlying layer of apparent native Silt with Sand (ML) that was observed to be loose and moist to wet. TP-8 was terminated due to bucket refusal atop the underlying basalt bedrock.

New Primary Clarifier: Test-pit TP-10 excavated near the southern portion of the proposed tank footprint revealed a variably thick layer (~0' to ~5') of Silt with Sand (ML) that was observed to be very loose to loose and damp atop the buried basalt bedrock (bucket refusal).

Two (2) New 18 MG Aerated Lagoons: The proposed outlines of the planned aerated lagoons cover a vast area of highly undulating rugged rocky territory. Based on the finding of our site reconnaissance and observations of exposed conditions within Tet-pits TP-11 and TP-12, subsurface conditions along the proposed embankment alignments in this region of the WWTP typically consist of exposed basalt outcrop with intermixed pockets filled with loose and silty/sandy aeolian deposits.

7.1 Assessment of Bedrock Rippability

Based on the findings of our site investigation, the native undisturbed depth to the underlying basalt bedrock below the prevailing surface grade generally varies from 0-feet (rock outcropping at surface) to approximately 6-feet BGS (except as altered by previous cutting/blasting and/or placement of fill). The seismic refraction survey results, presented in Appendix V, indicate the overburden soil/fill layer (Unconsolidated Material) has primary wave (P-wave) velocity of approximately 1500 feet per second (fps). The basalt bedrock (Rock), directly below the overburden unit, has a P-wave velocity of approximately 9,000 fps. Basalt rock with P-wave velocities on the order of 9,000 fps is generally considered 'non-rippable'.

Considering a p-wave velocity of 9,000 ft/s, Caterpillar's Ripper Charts (Appendix VII) indicate that using a D8R, D9R or D10R ripper, the basalt is considered 'non-rippable'. Furthermore, the basalt is considered 'marginally rippable' using a CAT D11R ripper and 'rippable' using a CAT D11R CD single-shank ripper. Based on performance charts prepared by Caterpillar Tractor Company, a rippability correlation summary is presented in Table 3 below:

Table 4: Rippability Correlation Summary

P-Wave Velocity (fps)	Rock Characteristics
1,000 to 3,500	Highly weathered soil-like material which is easily excavated without ripping or with minor light ripping.
3,500 to 4,500	Weathered rock which can be ripped by moderate effort with the D8K or equivalent tractor-dozer and easily ripped by the D9L or equivalent tractor-dozer.
4,500 to 5,500	Moderately weathered rock which can be ripped with little to moderate difficulty by a D9L or equivalent tractor-dozer. These materials would be somewhat blocky upon excavation.
5,500 to 6,500	Moderately to lightly weathered rock which can be ripped with difficulty (single shank) by a D9L or equivalent tractor-dozer.
6,500 to 7,500	Lightly weathered to fresh rock with closely to moderately spaced fractures. The practicality of ripping becomes marginal but is still possible due to fracture spacing and development.
7,500 to 10,000	Generally fresh rock in a matrix of decomposed rock or generally fresh rock with close to moderate fracture space. A model D-11R dozer can rip some materials in this velocity range with difficulty. **Drill and blast for excavation.**
10,000 to 15,000	Mostly fresh rock with moderately to widely spaced fractures. **Drill and blast.**
> 15,000	Fresh rock, tight fractures widely spaced. **Drill and blast**

Note: Seismic velocities through rock are controlled in large part by the joint (fracture) and/or foliation density, orientation, separation, and geometry. These factors can vary widely throughout a given rock unit. Therefore, rippability can vary widely through a given rock unit, and can be controlled by these factors as well as the skill and experience of the equipment operator. Verification of the rippability using trial excavations was not performed at the site. Thus, caution is urged when using this information. Also, reported velocities and rippability for a given rock type should not be considered representative of that rock type over the entire project site.

7.2 NRCS Soil Survey

The soil survey map of the site prepared by the Natural Resources Conservation Service (NRCS) identifies the site soils as *Starbuck-Rock outcrop complex* with parent materials described as *Loess and residuum derived from basalt* (Appendix VIII).

7.3 Groundwater

Apparent groundwater conditions were observed within Test-pit TP-7 at a depth of approximately 8 feet BGS. This noted groundwater condition encountered within TP-7 is believed to be a perched condition perhaps due to localized stormwater runoff and/or irrigation at and around the adjacent Mechanical Treatment Plant. Groundwater was not found within any of the other test-pits that we explored across the project site(s).

To further assist in our evaluation, we reviewed the Washington Department of Ecology database of nearby well logs. Based on our review of nearby well logs located on/within the Grandview WWTP property, static groundwater has been measured at depths ranging from ~40 to ~75 feet BGS; well logs are included in Appendix IX. Groundwater levels typically fluctuate with precipitation, irrigation, drainage, and regional pumping from wells. Static groundwater conditions at depth are anticipated to be controlled in part by the nearby Yakima River levels.

Although not observed within most of the test-pits, we would anticipate the likelihood of random/scattered areas that could be subject to perched groundwater conditions at variable depths above the buried basalt bedrock surface.

8.0 SEISMIC DESIGN CONSIDERATIONS

The "Site Class" is a classification based on the properties of the upper 100 feet of the subsurface soil and bedrock materials. Based on review the NEHRP Site Class Map, average shear wave velocity at the project site in the upper 100 feet is >2,500 to 5,000 feet/second, site class for the project is 'Site Class B'.

A site-specific Refraction Microtremor (ReMi) survey to determine the weighted average shear wave velocity of the upper 100 feet (Vs 100) of the soil profile was not conducted. However, based on the subsurface data obtained during our field exploration, we confirm the site classified as a **Site Class B** (Rock) as described in Section 20.3 and Table 20.3-1 of ASCE 7-16 and ASCE/SEI 7-22, Section 20.4.1, Table 20.2-1.

Seismic parameters for a code-based response spectrum with a return period of 2,475 years based on ASCE/SEI 7-16 and 7-22 were obtained for the project site (Latitude: 46.213802°N / Longitude: 119.91262°W) using the online ASCE Hazard Tool (ascehazardtool.org). The following tables present recommended site-specific seismic design parameters:

Table 5a: ASCE 7-16 Code-Based Seismic Design Parameters (Site Class B)

Seismic Design Parameter	Value (unit)	Definition
S_S	0.444 (g)	MCE mapped spectral response acceleration at short periods
S_1	0.173 (g)	MCE mapped spectral response acceleration at 1-second period
F_a	0.9	Site coefficient for spectral response acceleration at short periods
F_v	0.8	Site coefficient for spectral response acceleration at 1-second period
S_{MS}	0.399 (g)	MCE spectral response acceleration at short periods as adjusted for site effects
S_{M1}	0.138 (g)	MCE spectral response acceleration at 1-second period as adjusted for site effects
S_{DS}	0.266 (g)	Design spectral response acceleration at short periods
S_{D1}	0.092 (g)	Design spectral response acceleration at 1-second period
PGA	0.199 (g)	Site modified peak ground acceleration
PGA_M	0.179 (g)	MCE geometric mean peak ground acceleration

Table 5b: ASCE 7-22 Code-Based Seismic Design Parameters (Site Class B)

Seismic Design Parameter	Value (unit)	Definition
S_S	0.48 (g)	MCE mapped spectral response acceleration at short periods
S_1	0.14 (g)	MCE mapped spectral response acceleration at 1-second period
S_{MS}	0.34 (g)	MCE spectral response acceleration at short periods as adjusted for site effects
S_{M1}	0.11 (g)	MCE spectral response acceleration at 1-second period as adjusted for site effects
S_{DS}	0.23 (g)	Design spectral response acceleration at short periods
S_{D1}	0.074 (g)	Design spectral response acceleration at 1-second period
PGA_M	0.17 (g)	MCE geometric mean peak ground acceleration

8.1 Soil Liquefaction & Lateral Spreading

Liquefaction is the loss of soil strength from sudden shock or vibration (usually earthquake shaking), causing the soil to become a fluid mass. Liquefaction results in a loss of soil strength and can cause building structures to settle if it occurs in the bearing zone. Soil liquefaction is a natural phenomenon that occurs when saturated granular soils (below the water table) are subjected to vibratory motions, causing an increase in the water pressure within soil pores, as the soil tends to reduce in volume. When the pore water pressure reaches the vertical effective stress, the soil particles become suspended in water causing a complete loss in soil strength.

As mapped by the Washington State Department of Natural Resource, Division of Geology and Earth Resources (see excerpt below), the project site is mapped as '*bedrock*', therefore indicating that the liquefaction susceptibility risk is *nil*.



Excerpt from 'Liquefaction Susceptibility Map of Yakima County, Washington' (Palmer, 2004)

In general, for the effects of liquefaction to be manifested at the surface, groundwater levels must be within 50 feet of the ground surface and the soils within the saturated zone must also be susceptible to liquefaction. Liquefaction can cause excessive structural settlement, ground rupture, lateral spreading (movement), or failure of shallow bearing foundations. The following four conditions are generally required before liquefaction can occur:

- The soils must be saturated below a relatively shallow groundwater level.
- The soils must be loosely deposited (low to medium relative density).
- The soils must be relatively cohesionless (not clayey). Clean, poorly graded sands are the most susceptible. Silt (fines) content increases the liquefaction resistance in that more cycles of ground motions are required to fully develop pore pressures.
- Groundshaking must be of sufficient intensity to act as a trigger mechanism. Two important factors that affect the potential for soil liquefaction are duration as indicated by earthquake magnitude (M) and intensity as indicated by peak ground acceleration (PGA).

Based on the findings of our subsurface exploration, confirming the uniform presence of shallow competent basalt bedrock throughout the project site, the risk of soil liquefaction and therefore the potential for liquefaction settlement at the site is considered non-existent.

Lateral spreading related to seismic activity typically involves lateral displacement of large, surficial blocks of non-liquefied soil when a layer of underlying soil loses strength during seismic shaking. Lateral spreading usually develops in areas where sloping ground or large grade changes (including retaining walls) are present. Based on our understanding of the subsurface conditions and current site topography, it is our opinion that the risk of lateral spreading is non-existent.

8.2 Regional Faulting and Risk of Surface Fault Rupture

There are nine Quaternary-age faults or fault systems identified within 100 kilometers of the project site as listed below in Table 6 (also see Figure 4, Appendix I). These faults are all Class A faults. The table below provides distances from the site as well as other information about the fault. The nearest Quaternary fault to the site is the Horse Heaven Hills structures (567), located about 4-km south-southwest of the project site. This fault system extends from south of Kennewick and extends north-northwest then west southwest approximately 175-km to northwest of Goldendale. The eastern extent of the Toppenish Ridge Structures with a deformation within the last 15,000 years is located approximately 25 km west-northwest of the project site.

Table 6: Faults Within 100 km of Site

Fault Name	USGS Fault No.	Fault Class	Distance From Site	Average Strike	Dip Direction	Most Recent Deformation	Slip Rate (mm/yr)
Rattlesnake Hills structures	565	A	~29 km	N61°W	SW	<1.6 ma	<0.2
Horse Heaven Hills structures	567	A	~4 km	N90°W	SW	<1.6 ma	<0.2
Columbia Hills structures	568	A	~33 km	N75°E	N	<1.6 ma	<0.2
Frenchman Hills structures	561a	A	~86 km	N87°W	SW	<1.6 ma	<0.2
	561b	A	~86 km	N88°E	S	<1.6 ma	<0.2
Saddle Mountains structures	562a	A	~72 km	N71°W	S	<130 ka	0.2 to 1.0
	562b	A	~69 km	N71°W	-	<1.6 ma	<0.2
Umtanum Ridge structures	563b	A	~48 km	N87°W	S	<130 ka	<0.2
Ahtanum Ridge structures	564b	A	~36 km	N88°E	S	<1.6 ma	<0.2
Toppenish Ridge structures	566a	A	~ 25 km	N89°W	S	<1.5 ka	<0.2
	566b	A	~25 km	N78°E	S	<1.6 ma	<0.2
Wallula fault system	846	A	~75 km	N53°W	vertical	<1.5 ka	<0.2

*ka= kilo annum= 1,000 years
*ma= mega annum= 1,000,000 years

For the purposes of this report, an active fault is defined as a fault that has had displacement within the Holocene epoch or last 11,700 years. Due to the lack of any known active fault traces in the immediate site vicinity, surface fault rupture is unlikely to occur at the subject property. While future fault rupture could occur at other locations, rupture would most likely occur along previously established fault traces.

9.0 STABILITY OF PROJECT SITE SLOPES & LAGOON EMBANKMENTS

Slope stability analyses were conducted on selected critical cross-sections representing the proposed fill slope to support new secondary clarifiers in the northwest portion of the project site. In addition, slope stability analyses were conducted for presumptive embankment geometry for the two 18MG aerated lagoons. Considering our understanding that the footprints of the proposed aerated lagoons will be excavated into the local basalt bedrock formation, we have evaluated presumptive interior embankment geometries with assumed 1H:1V slope and embankment heights of 10 feet and 20 feet.

The analysis was conducted using a generalized geologic cross-section model developed from the preliminary grading shown on plans provided by HLA and presumptive embankment geometries along with soil and rock strength data obtained from our subsurface exploration and laboratory testing. The output of our slope stability analyses are attached in Appendix VI. It shall be noted that additional slope stability analyses may be required after design plans are prepared for the 18MG aerated lagoons.

The slope stability analyses were conducted by a two-dimensional limit equilibrium stability analysis of selected trial failure surfaces using the computer program *SLIDE (Version 7)*. Potential circular-arc failure surfaces were evaluated using the Spencer method. The computer program searched for critical potential failure surfaces with low computed factors of safety. The computed factor of safety (FS) against slope failure is simply the ratio of total resisting forces or moments (strength of the slope) to the total driving forces or moments for planar or circular failure surfaces respectively. A slope with a factor of safety of 1.0 is in equilibrium, indicating that the disturbing forces driving the slope down are equal to its strength to resist failure. Simply put, slope-failure results when the strength of the slope is overcome by gravity.

The stability of the slope has been analyzed under both static and seismic conditions. Our analysis used the pseudostatic method which modifies the limit equilibrium method by incorporating a horizontal static seismic force to simulate the potential inertial forces generated from earthquake ground accelerations. For slope stability analyses under seismic loading, a pseudostatic seismic coefficient, k_h (horizontal component), expressed in terms of acceleration (units of g), is typically estimated as a percentage of the horizontal peak ground acceleration (PGA). PGA for this site was calculated with a 2,475-year return interval (RI) using the USGS PSH Deaggregation tool for a 2% probability of exceedance in 50 years. For our analyses, we have selected a value of k_h = 0.138g, approximately half of the design PGA of 0.276g.

The selection of unit weight and shear strength parameters for the various earth materials were based on judgment and data obtained during our field investigation, laboratory testing, review of previous studies, research and previous experience with similar materials in similar geotechnical and geologic settings. Engineering and geologic judgment must be applied to the estimated shear strength parameters in order to consider lateral and vertical variations in the subsurface conditions, such as degree of cementation, fracturing, planes of weakness, and gradational characteristics. The following geotechnical strength parameters were used in our stability calculations:

Table 6a: Estimated Soil Strength Parameters

Material	Mohr-Coulomb Strength Parameters		Unit Weight (pcf)
	Friction Angle, ϕ	Cohesion, c (psf)	
Imported Gravel Borrow	34	0	135
Existing Fill: Silty Gravel	33	0	130
Sandy Silt	28	10	105

Table 6b: Estimated Rock Strength Parameters

Material	Generalized Hoek-Brown Strength Parameters				Unit Weight (pcf)
	UCS (psf)	m	s	a	
Basalt Bedrock	1.6236e+6	12.2385	0.108368	0.500593	170

GN Northern recommends that any reconfigured slopes should meet or be designed and constructed to meet a minimum factor of safety of 1.5 for the static condition and 1.1 under seismic loading. Our analyses generally indicate that the existing native/undisturbed site slopes are grossly stable due largely to the noted presence and strength characteristics of the shallow

competent basalt bedrock conditions. Furthermore, cut slopes into the competent basalt bedrock will be relatively stable at gradients of 1H:1V or steeper. Based on observations during our field reconnaissance of the subject property, we did not observe any apparent indications of existing failure or significant slope instability, as well as indications of possible signs demonstrating recent activity and instability of slide masses and geomorphic features of landslides.

Based on results of our slope stability analysis, the proposed fill slope along the north side of the new secondary clarifier and along the west side of the two new intermediate clarifiers, with a maximum gradient of 2.5H:1V and maximum net height of 13 feet, meets the minimum recommend safety factors. We recommend that any proposed cut and fill slopes at the project site shall be constructed in accordance with the recommendations of Section 11.16 of this report.

Based on the proposed footprint of new lined 18 MG aerated lagoons, rock excavation and/or blasting of the in-place basalt rock will be required to achieve the volume requirements for the ponds. Additionally, the existing naturally occurring ponds will need to be drained to allow for grading of the proposed lagoon floor and interior embankment slope along with import and placement of select fill for installation of a liner membrane.

10.0 SUMMARY OF FINDINGS & CONCLUSIONS

Conditions imposed by the proposed development have been evaluated on the basis of assumed elevations and engineering characteristics of the subsurface materials encountered in the exploratory test-pits, and their anticipated behavior both during and after construction. The following is a summary of our findings, conclusions and professional opinions based on the data obtained from a review of selected technical literature and the site evaluation.

- Based on the findings of this geotechnical evaluation and our understanding of the proposed improvements, from a geotechnical perspective, it is our opinion that the site is suitable for the proposed construction, provided the soil design parameters and site-specific recommendations in this report are followed in the design and construction of the project.

- Final design plans for the proposed development and improvement, including site grading, drainage and finished elevations, were not provided at the time of this report**.** Once the plans

are finalized, GNN **must** be provided an opportunity to review final design plans to provide revised recommendations if/as necessary.

- Once the existing ponds proposed for conversion to aerated lagoons have been fully drained, GNN shall be given an opportunity to review the exposed conditions to provide any additional recommendations and determine the need for additional exploration, as necessary.

- In general, surface & subsurface conditions include a variably thick (thin) upper layer of aeolian Loess deposits, typically consisting of Sandy Silt (ML) / Silty Sand (SM) and/or artificial fill material atop the underlying basalt bedrock, along with extensive areas of exposed basalt rock outcrops directly at the surface.

- Based on observations during our field reconnaissance of the subject property, we did not observe any apparent indications of existing failure or significant slope instability as well as indications of possible signs demonstrating recent activity and instability of slide masses and geomorphic features of landslides.

- New fill slopes constructed using imported Gravel Borrow fill shall be at a maximum gradient of 2.5H:1V not exceeding a maximum height of 15 feet. Cut slopes into the basalt bedrock will be grossly stable at gradients of 1H:1V or steeper.

- The native intact basalt rock was generally found to be relatively fresh to slightly weathered, strong to very strong, and slightly to moderately fractured/jointed with calculated RQD values ranging from 0% to 100%.

- A large (~7,000 to ~8,000 ft^2 area) stockpile of basalt boulders and large cobbles is currently located within the site of the proposed 85' diameter intermediate classifiers. We understand that this rubble consists of excess blasted material associated with previous construction activities for the existing treatment plant situated to the east. This rubble will need to be removed and replaced with suitable engineered fill material. A significant amount of fill will be required to raise the site of the proposed intermediate clarifiers.

- Perched groundwater was observed within Test-pit TP-7 at a depth of approximately 8 feet BGS. Groundwater was not found within any of the other test-pits that we explored across the project site(s). Based on our review of nearby well logs located on/within the Grandview

WWTP property, static groundwater has been measured at depths ranging from ~40 to ~75 feet BGS. Although not observed within most of the test-pits, we anticipate the likelihood of random/scattered areas that could be subject to perched groundwater conditions at variable depths above the buried basalt bedrock surface.

- Upon completion, test-pit excavations were loosely backfilled with excavation spoils. The contractor is responsible for locating the test-pits to re-excavate the loose soil and re-place as compacted engineered fill.

- The underlying geologic condition for seismic design is site class '**B**'. The *minimum* seismic design should comply with the 2021 International Building Code (IBC) and ASCE 7-16.

- Although limited in quantity, the existing onsite near surface soils, typically consisting Sandy silt & Silty Sand with some gravels, are generally suitable for reuse as general fill and engineered fill provided they are screened and processed to be free of any oversize rock (> 4-inch in nominal size) and other deleterious materials.

- The presence of shallow basalt bedrock throughout the site(s) poses a challenge/difficulty for excavation with traditional earthwork equipment. For excavation into hard, competent rock, rock excavation techniques will be necessary. Based on review of data from the seismic refraction survey conducted at the project site, primary wave (P-wave) velocities were found to exceed 9,000 feet per second (fps). Basalt rock with P-wave velocities over approximately 7,500 to 9,500 fps is considered non-rippable. Excavations into the basalt will require the use of rock hammers and/or blasting.

- Depending upon the time of the year construction takes place, there is potential for perched groundwater conditions to develop atop the basalt. Consequently, dewatering may be required for some excavations extending below the zone of groundwater seepage to facilitate construction

- The near-surface site soil is susceptible to wind and water erosion when exposed during grading operations. Preventative measures and appropriate BMPs to control runoff and reduce erosion should be incorporated into site grading plans.

11.0 GEOTECHNICAL RECOMMENDATIONS

The following geotechnical recommendations are based on our current understanding of the proposed project as described in Section 2.0 of this report. Note that Soil Design Parameters and Recommendations presented in this report are predicated upon appropriate geotechnical monitoring and testing of the site preparation and foundation and building pad construction by a representative of GNN's **Geotechnical-Engineer-of-Record (GER)**. Any deviation and nonconformity from this requirement may invalidate, partially or in whole, the following recommendations.

Once the existing ponds proposed for conversion to aerated lagoons have been fully drained, GNN shall be given an opportunity to review the exposed conditions to provide any additional recommendations and determine the need for additional exploration, as necessary.

We recommend that GNN should be engaged to review the geotechnical aspects of the approximately 95 percent plans and specifications (grading and foundation plans) for conformance with the intent of our recommendations and provide revised, augmented, and/or additional geotechnical recommendations as needed.

11.1 Clearing and Grubbing

At the start of site grading, any existing pavements, vegetation and large roots shall be fully removed from the proposed building and structural areas. The surface shall be stripped of all topsoil and/or organic growth (vegetation); the topsoil and organic rich soils shall either be stockpiled on-site separately for future landscape use or be removed from the construction area. Depth of stripping can be minimized with real-time onsite observation of sufficient removals. Areas disturbed during clearing shall be properly backfilled and compacted as described below.

11.2 Site Grading

Site grading shall incorporate the requirements of IBC 2021 Appendix J. A representative of the GER should observe site clearing, grading, and the bottoms of excavations before placing fills. Local variations in soil conditions may warrant increasing the depth of over-excavation and recompaction. Seasonal weather conditions may adversely affect grading operations. To improve compaction efforts and prevent potential pumping and unstable ground conditions, we suggest performing site grading during dryer periods of the year.

All undocumented/unsuitable fill materials encountered during grading shall be chased, removed and replaced with suitable onsite sourced fill soils or imported granular fill material placed as engineered structural fill. A representative of the GER should confirm suitable bearing conditions and evaluate footing subgrades on an case-by-case basis. Observations should also confirm that undocumented/unsuitable fill and loose material were removed.

Place backfill evenly adjacent to structures, piping, or conduit to required elevations. Wedging action shall be prevented during backfill against structures or displacement of piping or conduits by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

Soil conditions shall be evaluated by in-place density testing, visual evaluation, probing, and proof-rolling of the imported fill and re-compacted on-site soil as it is prepared to check for compliance with recommendations of this report. A moisture-density curve shall be established in accordance with the ASTM D1557 method for all onsite soils and imported fill materials used as structural fill.

Infiltration test-pits were loosely backfilled during our site investigation. During site development, the earthwork contractor is required to re-excavate these test-pits and backfill the excavations with suitable fill material and compact as appropriate for the location within the building/structure pads.

11.3 Excavations

It shall be the responsibility of the contractor to maintain safe temporary slope configurations since the contractor is at the job site, able to observe the nature and conditions of the slopes and be able to monitor the subsurface conditions encountered. Unsupported vertical cuts deeper than 4 feet are not recommended if worker access is necessary. The cuts shall be adequately sloped, shored or supported to prevent injury to personnel from caving and sloughing. The contractor and subcontractors shall be aware of and familiar with applicable local, state and federal safety regulation including the current OSHA Excavation and Trench Safety Standards, and OSHA Health and Safety Standards for Excavations, 29 CFR Part 1929, or successor regulations.

According to chapter 296-155 of the Washington Administrative Code (WAC), it is our opinion that the variably thick overlying silty soils encountered at the site will classified as Type C soils.

We recommend that temporary, unsupported, open cut slopes shall be no steeper than 1.5 feet horizontal to 1.0 feet vertical (1.5H:1V) in Type C soils. No heavy equipment should be allowed near the top of temporary cut slopes unless the cut slopes are adequately braced. Final (permanent) fill slopes should be graded to an angle of 2H:1V or flatter. Where unstable soils are encountered, flatter slopes may be required. We recommend that temporary excavation side slopes in bedrock shall not be steeper than 1H:1V.

The presence of shallow fresh/strong basalt bedrock throughout the site(s) poses a challenge/difficulty for excavation with traditional earthwork equipment. Based on review of available data from the geophysical testing conducted at the project site, primary wave (P-wave) velocities were found to exceed 9,000 feet per second (fps). Basalt rock with P-wave velocities over approximately 7,500 to 9,500 fps is generally considered non-rippable. As discussed previously in Section 7.1 excavation in bedrock will require drill and blast. Use of rock hammer and/or controlled blasting is feasible for confined excavations such as trenches.

11.4 Rock Blasting

Blasting (and use of explosives) for rock excavations shall comply with applicable federal, state and local standards and codes. A contractor licensed and experienced in blasting should perform the work. Stringent safety precautions should be implemented both prior and during blasting activities. We recommend Washington Administrative Rules (WAC) and OSHA safety guidelines must be implemented in the field prior to and during blasting. The contractor should submit a SITE SPECIFIC SAFETY PLAN and a BLASTING PLAN prior to commencing the blasting activities to ensure the safety of workers and adjacent nearby structures. As a minimum following Washington Codes (WAC) shall be applicable for use of explosives and blasting:

- WAC 296-52 Safety Standards for the Possession and Handling of Explosives
- WAC 296-800 Safety and Health Core Rules
- WAC-296-155 Safety Standards for Construction Work

We recommend that blasting of the bedrock should be accomplished with appropriate blasting method(s) common to the local area and that the blasting contractor is responsible for selection of an appropriate blasting method. The rock blasting can be accomplished using an isolated shot hole

technique. Two (2) inch diameter isolated shot holes should be spread in a square pattern. The dimensions of the total shot hole pattern are based on the total area to be blasted. The shot holes should be drilled with appropriate drilling methods common to the local area. A two (2) inch core drilling using a Hydro Track drill rig may be appropriate for the type of rock encountered at the site. The drilled holes should extend down through the subsurface overburden and bedrock until planned excavation elevations are achieved. A blasting dynamite powder (Anfo or other approved) should be placed in each isolated shot hole at a rate of about 0.75 pounds per cubic yard of rock to be blasted. Due to the nearby structures, underground utilities and overhead power lines, we recommend the charge of blasting be kept very low and each shot be delayed for at least 30 milli seconds so that shaking of the ground will have either minimal or no impact on the surrounding structures. After blasting, the blasted rock and overburden zone should be excavated and removed by using any conventional heavy duty excavator. An experienced and licensed blasting contractor who has successfully completed blasting projects with similar situations should be selected for rock blasting.

A Blasting Plan shall be prepared by a "Licensed/Approved Blasting Consultant" and should include evaluating the Peak Particle Velocity (PPV), calculations for overpressure and debris hazard, and address federal, state, and local requirements. The blasting plan submittal shall address the following:

- ✓ Requirements, including federal, state, and local.
- ✓ Notification of all affected agencies and parties.
- ✓ Site security and safety.
- ✓ Explosive transportation, storage, and handling at the job site.
- ✓ Storage of explosives.
- ✓ Handling of explosives.
- ✓ Loading explosives and blasting agents.
- ✓ Pre-blast safety procedures.
- ✓ Firing procedures
- ✓ Post-blast inspection.
- ✓ Misfire procedures.
- ✓ Blast scheduling.

- ✓ Blast location.
- ✓ Explosive products and loading.
- ✓ Blast design parameters.
- ✓ Blasting controls.
- ✓ Vibration and air overpressure monitoring and control plan.
- ✓ Noise reduction methods.
- ✓ Pre-blast survey and blasting notification.

A pre-blast meeting with the Blasting Contractor is required to ensure compliance with the Blasting Plan.

Pre-Blast Survey: Inspection/survey of all existing structures within a 1,000 foot radius of blast zone that could be impacted from the blast (during blasting) at the construction site shall be conducted by the design team. Documentation depicting the existing conditions of adjoining and adjacent structures shall include inspection logs, photos, video documentation and count showing the total number of structures within the inspection radius.

Pre-Blasting Notification: The City of Grandview, Yakima County, any State Agency, any nearby residences/businesses and utility companies within at least 1,500 feet shall be notified prior to blasting.

Vibration/Seismic Monitoring: The contractor is responsible to provide seismographic monitoring and complete reporting according to State Law and Best Management Practices (BMP) for blasting activities undertaken at the construction site. Mobilization and set-up of seismographs or approved blast monitoring instrument for monitoring, maintenance of installed seismographs during the course of blasting, and reporting of blasting permit compliance per the Plan is required until blasting activities are ceased.

11.5 Construction Dewatering

Depending upon the time of the year construction takes place, there is potential for perched groundwater conditions to develop atop the basalt. Consequently, dewatering may be required for some excavations extending below the zone of groundwater seepage to facilitate construction. Dewatering should be accomplished in advance of construction, as necessary, so that excavation and placement of foundations, pipe, pipe bedding and backfill materials are completed in relatively

dry conditions. Dewatering should be performed such that the groundwater level around nearby existing structures is unaffected, as lowering the water level around existing structures could induce settlements. Design and implementation of dewatering systems should be the responsibility of the contractor.

Prior to commencement of construction activities to reconfirm the interior slopes of the existing pond for conversion into new aerated lagoons, the exiting natural ponds will need to be fully drained and dewatered.

We recommend that the contract documents require the Contractor to prepare and submit a dewatering plan for review and approval by the geotechnical engineer. The contractor shall also be made responsible for the dewatering system installation and maintenance. In addition, the Contractor should be responsible for control of surface water and should employ sloping, slope protection, ditching, sumps, and other measures as necessary.

11.6 Utility Excavation, Pipe Bedding and Trench Backfill

To provide suitable support and bedding for the pipe, we recommend the utilities be founded on suitable bedding material consisting of clean sand and/or sand & gravel mixture. To minimize trench subgrade disturbance during excavation, the excavator should use a smooth-edged bucket rather than a toothed bucket. All excavations should be wide enough to allow for compaction around the haunches of pipes and underground tanks. We recommend that utility trenching, installation, and backfilling conform to all applicable federal, state, and local regulations such as OSHA and WISHA for open excavations.

Pipe bedding and pipe zone materials shall conform to Section 9-03.12(3) of the *2024 WSDOT Standard Specifications (WSS).* Pipe bedding should provide a firm uniform cradle for support of the pipes. A minimum 4-inch thickness of bedding material beneath the pipe should be provided. Prior to installation of the pipe, the pipe bedding should be shaped to fit the lower part of the pipe exterior with reasonable closeness to provide uniform support along the pipe. Pipe bedding material should be used as pipe zone backfill and placed in layers and tamped around the pipes to obtain complete contact. To protect the pipe, bedding material should extend at least 6 inches above the top of the pipe.

In areas where the subgrade soils in the trench excavation consist of fine-grained soils, such as silt/clay, a geotextile separator fabric should be placed over the native soils prior to placement of the pipe bedding. We recommend that the geotextile meet the requirements of WSS 9-33.2(1), Table 3 for Separation.

Placement of bedding material is particularly critical where maintenance of precise grades is essential. Backfill placed within the first 12 inches above utility lines should be compacted to at least 90% of the maximum dry density as determined by ASTM D1557, such that the utility lines are not damaged during backfill placement and compaction. In addition, rock fragments greater than 1 inch in maximum dimension should be excluded from this first lift. The remainder of the utility excavations should be backfilled and compacted to 95% of the maximum dry density as determined by ASTM D1557. Compaction of backfill material should be accomplished with soils within ±2% of their optimum moisture content in order to achieve the minimum specified compaction levels recommended in this report. However, initial lift thickness could be increased to levels recommended by the manufacturer to protect utilities from damage by compacting equipment.

11.7 Suitability of the Onsite Soils and Rock for Reuse as Engineered Structural Fill

Although limited in quantity, the existing onsite near surface soils, typically consisting of sandy silt and silty sand with some gravels, are generally suitable for reuse provided they are screened and processed to be free of oversize material stones larger than 5-inch in nominal size and any other deleterious matter. The onsite silty sand/sandy soil are not suitable for engineered fill for placement under structural areas. Large quantities of rock rubble (cobbles to boulder size) is present on site and will be generated from blasting. This material will require crushing to a suitable gradation specification meeting WSS 9-03.14(1) - Gravel Borrow for reuse as engineered structural fill. An alternate gradation specification can be proposed by the contractor depending on the intended use. Suitable onsite soils shall be placed in maximum 8-inch thick loose lifts and each lift compacted to at least 95% relative compaction as determined by ASTM D1557 near its optimum moisture content. Compaction of these soils shall be performed within a range of ±2-3% of optimum moisture to achieve the proper degree of compaction.

11.8 Imported Granular Fill Soil

Imported fill material should consist of clean, non-plastic, freely-draining sand and gravel, free of organic matter or other deleterious materials. Such materials should contain particles no larger than 4 inches in maximum dimension, with less than 7 percent fines (based on the ¾-inch fraction) meeting the gradation specification of WSS 9-03.14(1) – Gravel Borrow.

11.9 Imported Crushed Rock Structural Fill

Imported crushed rock structural fill shall consist of well-graded, crushed aggregate material meeting the grading requirements of WSS 9-03.9(3) - Crushed Surfacing Base Course presented here. A representative sample of this fill material shall be collected by GNN prior to placement to ensure proper gradation and establish a Proctor curve.

Table 7: Crushed Surfacing Base Course (1-¼")

Sieve Size	Percent Passing (by Weight)
1¼ Inch Square	99 - 100
1 Inch Square	80 - 100
5/8 Inch Square	50 – 80
U.S. No. 4	25 - 45
U.S. No. 40	3 – 18
U.S. No. 200	Less than 7.5

11.10 Compaction Requirements for Engineered Structural Fill

All fill or backfill shall be approved by a representative of the GER, placed in uniform lifts, and compacted to a minimum 95% of the maximum dry density as determined by ASTM D1557. The compaction effort must be verified by a representative of the GER in the field using a calibrated nuclear density gauge in accordance with ASTM D6938. Compaction with conventional methods may not be applicable for onsite gravel soils contain oversize fraction. In this case refer to Section 11.11 below for proof-compaction as an acceptable option. The thickness of the loose, non-compacted, lift of structural fill shall not exceed 8 inches for heavy-duty compactors or 4 inches for hand operated compactors.

11.11 Compaction Control of Backfill Material with Over-Sized Fraction

When a coarse granular fill material contains more than 30% over-size fraction (material retained on the 3/4-in. sieve), the material is considered non-proctor testable per ASTM D1557 and compaction testing using a nuclear density testing per ASTM D6938 or sand cone density method per ASTM D1556 is not applicable to verify field compaction. In such cases a performance

specification to control the compaction is considered an appropriate alternative to verify densification of the placed fill material. Components of a performance specification typically contain the type and size of compaction equipment to be used, the lift thickness, acceptable range of water content, and sufficient compactive efforts.

We recommend that the subgrade or placed fill material shall be densified with a minimum 20-ton steel drum roller or a hoe-pack. Proof-roll the subgrade or fill material with a loaded tandem axle dump truck, observe deflections and rutting for indications of inadequate subgrade performance. Permanent rutting in excess of 3/4 inch should be considered unsatisfactory compaction. In addition, elastic movement in excess of ¾" inch with substantial cracking or substantial lateral movement should also be considered a sign of unsatisfactory compaction. A representative of the GER shall verify and approve the subgrade prior to placing the crushed rock.

Hoe-pack for densification - minimum 18,000 lbs excavator and hoe-pack with minimum 5,500 lbs of impulse force at 2,000 cycles per minute, compact the subgrade by applying steady and uniform pressure until a dense and non-yielding state is achieved. The depth of hoe-pack penetration shall be monitored for additional indications of sufficient compaction.

Using a ½ inch diameter steel T-probe, a representative of GER shall probe the subgrade soils or compacted fill layer at several locations across the surface of the compacted layer. If the T-probe readily penetrates the subgrade or placed fill material it indicates unsatisfactory compaction.

Adjust the lift thickness and moisture content, as recommended by the GER until the subgrade or placed fill layer exhibits firm, unyielding conditions. Continue the same process in placing each lift of fill material up to the planned elevation. Placement of fill material shall be observed and verified on a continuous basis (full time) by a representative of the GER.

11.12 Foundation Subgrade Preparation

After completion of the initial site preparation activities at each of the various project sites, we recommend that the subgrade for each of the proposed new structures shall be prepared as discussed below. To reduce the potential for differential settlement, the depth of over-excavations for each of the proposed new structures where applicable should be uniform across the structural pad footprint and extend a minimum lateral distance of (3) feet beyond the footprint.

11.12.1 - New 70' diameter Sludge Holding Tank and New 80' Primary Clarifier

Due to the presence of shallow competent basalt bedrock beneath the sites of proposed new Primary Clarifier and the new 70' diameter Sludge Holding tank, we recommend overexcavation to expose the underlying bedrock surface. If the exposed bedrock surface is found to be significantly uneven or sloped, additional excavation with rock hammers or other means shall be employed to generally level the surface. Any protruding rock(s) shall be removed or chipped-off to provide a level/even surface and a 4-inch thick mud-mat shall be placed over the bedrock where foundation is found directly on top of bedrock. In areas where bedrock surface is deeper than the foundation bottom elevation, following sufficient over-excavation of the underlying bedrock surface, crushed rock structural fill material shall be placed in accordance with Sections 11.9 and 11.10 to raise the tank pads to final design grade. A representative of the GER shall inspect the pad/footing excavations, observe the overexcavation bottom, perform compaction testing during placement of crushed rock structural fill.

11.12.2 - Two 85' diameter Intermediate Clarifiers and Secondary Clarifier

We understand that the intermediate clarifiers will be located west of the oxidation ditch, which will require a significant amount of fill to raise the site in this area. Due to the presence of existing fill soils, rock rubble (relatively thick undocumented fill materials) and significantly uneven surface conditions beneath the sites of proposed new Intermediate Clarifiers and the new Secondary Clarifier, we recommend overexcavation and full removal of all undocumented fill and rock rubble from within and extending a minimum 3 feet beyond proposed footprint. Overexcavation shall be extended to expose the underlying bedrock surface. Following sufficient overexcavation to exposed the competent underlying bedrock surface, granular fill material shall be placed in accordance with Sections 11.7 or 11.8 and 11.10 to raise the tank pads to final design grade. A minimum of 12 inches of imported 1¼" minus crushed rock shall be placed atop granular structural fill material extending up to the bottom of the foundation and slabs. A representative of the GER shall inspect the pad/footing excavations, observe the overexcavation bottom, perform compaction testing during placement of crushed rock structural fill.

A large (~7,000 to ~8,000 ft^2 area) stockpile of basalt boulders and large cobbles is currently located within the site of the proposed 85' diameter intermediate classifiers. We understand that this rubble consists of excess blasted material associated with previous construction activities for

the existing treatment plant situated to the east. This rubble will need to be removed and replaced with suitable engineered fill material.

11.12.3 - New Sludge Dewatering Building and Storage Building

Based on proposed floor elevation of 708' for the new Sludge Dewatering Building, the proposed building footprint will straddle cut excavation on the north side transitioning to a relatively thick fill condition towards the southeast. Due to the variable site grade and consequent variable elevation of bedrock surface, there is risk of differential settlement for the new structure. In areas where shallow bedrock is at or near the foundation bottom elevation a 4-inch thick mud-mat or a leveling course shall be placed over the bedrock prior to foundation construction. Prior to placement of mud-mat or a leveling course, if the exposed bedrock surface is found to be significantly uneven or sloped, additional excavation with rock hammers or other means shall be employed to generally level the surface. Any protruding rock(s) shall be removed or chipped-off to provide an even surface. In area, where bedrock surface is deeper than the bottom elevation of the foundation, imported crushed rock structural engineered fill shall be placed in accordance with Sections 11.9 and 11.10 to achieve bottom of foundation and building slab elevation to reduce the risk of differential settlement. A representative of the GER shall inspect the footing excavations, observe the over-excavation bottom, and perform compaction testing during placement of crushed rock structural fill.

The new Storage Building shall be supported on minimum 12 inches of imported crushed rock structural fill placed in accordance with Sections 11.9 and 11.10.

11.12.4 - Third Mechanical Treatment Train

Due to the presence of relatively thick undocumented fill materials on the order of 10 feet and significantly uneven surface conditions beneath the site of proposed Third Treatment Train, we recommend overexcavation and full removal of all undocumented fill and rock rubble from within and extending a minimum 5 feet beyond proposed footprint (where space allows). Overexcavation shall be extended to expose the underlying bedrock surface. As discussed above, if the exposed bedrock surface is found to be significantly uneven or sloped, additional excavation with rock hammers or other means shall be employed to provide for a generally level the surface. Any protruding rock(s) shall be removed or chipped-off to provide a level/even surface and a 4-inch

thick mud-mat shall be placed over the bedrock. Depending on the bottom floor elevation (bottom design grade), placement of fill material may be required. Where placement of fill material is necessary we recommend crushed rock structural engineered fill shall be placed in accordance with Sections 11.9 & 11.10. A representative of the GER shall inspect the pad/footing excavations, observe the overexcavation bottom, perform compaction testing during placement of crushed rock structural fill.

11.13 Foundation Bearing Support & Allowable Bearing Capacity

Based on subsurface conditions encountered at the site, presence of bedrock and recommended foundation subgrade preparation in Section 11.12 above, we have provided foundation design recommendations and parameters for the various proposed structures in the following paragraphs. In our opinion, shallow spread footings, mat foundation and ring wall foundation are suitable options for foundation types on this project. The construction details shall be considered when preparing the construction documents.

Foundations for clarifier tanks, sludge holding tank and buildings can directly bear on competent bedrock or compacted crushed rock structural fill extending to the bedrock. The exposed bedrock surface at the bottom of the over-excavation shall be prepared as recommended above in the *Foundation Subgrade Preparation* section.

The minimum foundation depth shall be 24 inches below the lowest exterior finished grade. The bottom of interior footings should be established at least 18 inches below the base of the floor slab. Foundation elements shall not be designed or constructed to straddle a transitional cut to fill subgrade support condition unless otherwise recommended.

The footings should be founded below an imaginary line projecting at a 1-horizontal to 1-vertical (1H:1V) slope from the base of any adjacent parallel utility trenches. The footings must be embedded so there is a minimum of 10 feet of horizontal distance between the base of the footings and any adjacent slope.

We recommend that a representative of the GER observe foundation excavation bottom and depth of overexcavation before placement of crushed rock structural fill to determine that bearing

surfaces have been adequately prepared and that the soil/bedrock conditions are consistent with those observed during our explorations.

11.13.1 - New Clarifier Tanks and Sludge Holding Tank

Both Mat Foundation or Ring Wall Foundation are suitable options for support of New Clarifier Tanks and Sludge Holding Tank. Mat shall be embedded to a sufficient depth to satisfy overturning moment and shall bear on a properly prepared bearing support/subgrade as described in Section 11.12.1 and 11.12.2 above. Based on the proposed siting of the intermediate clarifiers, a significant amount of fill will be required to raise the site in this area.

Foundations supported on imported crushed rock/granular structural engineered fill over bedrock may be designed for an allowable bearing capacity of **4,000 pound per square foot (psf)**. A minimum allowable bearing pressure of **10,000 psf** may be used for foundation supported entirely on basalt bedrock with a leveling course. These values represent net bearing pressures; the weight of the footings and overlying backfill can be ignored in calculating footing sizes. The allowable bearing pressure may be increased by one-third for short-term, transient loading conditions (i.e., seismic and/or wind loads). The two 85' Intermediate Clarifiers shall maintain a minimum setback of 10 feet from the crest/top of the adjacent descending fill slopes to satisfy the recommend design bearing capacity.

Where mat is designed as beams on an elastic foundation, a **modulus of subgrade reaction of 240 pounds per cubic inch** (psi) should be assumed for a properly prepared bearing support/subgrade per the recommendations of Section 11.12.1 and 11.12.2 above. The modulus value given is for a one-foot square plate and must be corrected for mat shape and size and adjusted for scaling effects using an appropriate formula, such as: $K_S = K_{V1} (B+1)^2 / (4B^2)$, where B = mat/slab width in feet.

The ring wall should be reinforced circumferentially to resist hoop stress resulting from lateral pressure of the soil confined within the ring wall. Tension in the footing and required reinforcing steel may be calculated using the following equations (from *Structural Engineers' Handbook* (Woznaik) and ACI 318-05):

$T= [0.5(S.G.)(g_F)]*K_o*Hw*D*d$

Where:
T = tension in the footing
S.G. = Specific Gravity of fluid
g_F = unit weight of fluid
Hw = Fluid Height
D = Diameter of tank
D = depth of footing
K_o = Coefficient of at-rest soil pressure (0.41 for compacted gravel fill)

$A_s = (1.7*(T))/ (f*F_y)$

Where:
A_s = area of steel reinforcement
T= Tension in the footing (from above)
f= reduction factor (0.9)
F_y = Yield strength of steel reinforcement

We estimate the total settlement for footings constructed per the recommendations of this report to be less than 1-inch, with differential settlement less than half that magnitude. We assume there is no stress overlap from adjacent footings. Footings located less than two times the footing width (2B) from each other will increase stresses beneath the adjacent footing, resulting in increased settlement. We expect elastic settlements to generally occur as loads are applied.

Lateral loads on footings can be resisted by passive earth pressure on the sides of the structure and by friction on the base of the footings. An allowable passive resistance may be calculated as a triangular equivalent fluid pressure distribution using an equivalent fluid density of **350 pcf**, provided the footings are cast directly against properly placed and compacted granular structural fill. Adjacent slabs, pavements, or the upper 12-inch depth of adjacent unpaved areas should not be considered when calculating passive resistance. A safety factor of 1.5 has been applied to the recommended passive pressure. A coefficient of base friction of **0.45** (concrete poured directly over crushed rock fill) may be used for the frictional resistance against sliding. An appropriate factor of safety shall be used to calculate sliding resistance at the base of footings.

11.13.2 - Sludge Dewatering Building and Storage Building

Footings constructed on subgrade prepared in accordance with Section 11.12.3 may be designed for an allowable **4,000 psf** bearing pressure. This value represents net bearing pressure; the weight of the footing and overlying backfill can be ignored in calculating footing size. The recommended allowable bearing pressure apply to the total of dead plus long-term live loads and may be increased by one-third for short-term loads, such as wind or seismic forces.

Provided footing subgrades are prepared in accordance with the recommendations presented Section 11.12.3, we estimate total foundation settlements will be less than 1-inch, with differential settlement less than half that magnitude. We assume there is no stress overlap from adjacent footings. Footings located less than two times the footing width (2B) from each other will increase stresses beneath the adjacent footing, resulting in increased settlement. We expect elastic settlements to generally occur as loads are applied.

Lateral forces on foundations from short term wind and seismic loading would be resisted by friction at the base of foundations and passive earth pressure against the buried portions. We recommend an allowable passive earth pressure for compacted onsite fill of **350 psf per foot** of embedment depth at depths greater than 2 feet below adjacent grades. We recommend a coefficient of friction of **0.45** be used between cast-in-place concrete and imported granular fill. The passive earth pressure and friction components may be combined, provided the passive component does not exceed two-thirds of the total. The lateral resistance values include a factor of safety of 1.5.

A representative of the GER shall inspect the footing excavations, observe footing excavation bottom, perform compaction testing during placement of structural fill material.

11.13.3 - Third Mechanical Treatment Train

Considering the entire structure and all foundation elements will extend to bear directly on bedrock, a minimum allowable bearing pressure of **10,000 psf** may be used for design. However, if any portion of the structure or foundation element is supported on fill material (imported crushed rock/granular structural fill) extending to the bedrock an allowable bearing capacity of **4,000 psf** shall be used for design.

Provided footing subgrades are prepared in accordance with the recommendations presented Section 11.12.4, we estimate total foundation settlements will be less than 1-inch, with differential settlement less than half that magnitude. We assume there is no stress overlap from adjacent footings. Footings located less than two times the footing width (2B) from each other will increase stresses beneath the adjacent footing, resulting in increased settlement. We expect elastic settlements to generally occur as loads are applied.

Lateral forces on foundations from short term wind and seismic loading would be resisted by friction at the base of foundations and passive earth pressure against the buried portions. We recommend an allowable passive earth pressure for compacted onsite fill of **350 psf per foot** of embedment depth at depths greater than 2 feet below adjacent grades. We recommend a coefficient of friction of **0.45** be used between cast-in-place concrete and imported granular fill. The passive earth pressure and friction components may be combined, provided the passive component does not exceed two-thirds of the total. The lateral resistance values include a factor of safety of 1.5.

A representative of the GER shall inspect the footing excavations, observe footing excavation bottom, perform compaction testing during placement of structural fill material.

11.14 Concrete Slab-on-Grade Floor (New Storage Bldg. and Lightly Loaded Equipment Pads)

We recommend placing a minimum 6-inch layer of crushed aggregate fill beneath the slabs. The material shall meet the WSS 9-03.9 (3), "Crushed Surfacing Top Course", with less than 5 percent passing the No. 200 sieve (fines). The crushed rock material shall be compacted to at least 95% of the maximum dry density as determined by the ASTM D1557 method. Prior to placing any concrete slabs, where soil is encountered the top 12 inches of the exposed subgrade shall be scarified, then moisture conditioned and compacted to a minimum in-place dry density of 95% of the maximum laboratory dry density determined by ASTM D1557. Any soft spots or yielding subgrade soils shall be over-excavation an additional 12-inches and replaced with compacted onsite granular fill.

11.15 Lateral Earth Pressure

Recommended lateral earth pressures, in terms of equivalent fluid pressure, for design of retaining walls or below-grade structures are presented in Table 8. These values are for retained soils and engineered structural backfill consisting of imported granular fill and are valid for static loading

cases only and assume that the structural wall backfill is adequately drained to avoid saturation and introduction of hydrostatic pressures. The recommended design lateral earth pressures do not include a factor of safety.

In order to develop an active condition, the wall must rotate about base, with top lateral movements of 0.002 H to 0.004 H. For at-rest pressure, no movement is assumed; use at-rest pressures for restrained or braced walls. GNN estimates deflection of the retaining structure is not permitted due to the adjacent structures and other considerations. Therefore, at-rest lateral earth pressures should be used for design. For passive earth pressure, walls must move horizontally to mobilize resistance. The horizontal resultant force (pressure x H/2, where H = height of buried wall) should be applied at an H/3 distance from the base of the wall.

Table 8: Lateral Earth Pressure Design Parameters

Retained Soil	Equivalent Fluid Unit Weight for Level Backfill, (pcf)			Wet Density, (pcf)	Internal Friction Angle (Drained)
	At-rest	Active	Passive		
Granular Structural Backfill / Drain Rock Material	56	35	525	135	36°

1. No safety factor is included in these values
2. Retained material shall consist of imported free draining granular material. Backfill should be prepared and compacted to at least 95 percent of maximum dry density as determined by the modified Proctor test (ASTM D1557).
3. The granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.
4. The upper 6 inches of soil should be neglected in passive pressure calculations. If exterior grade from top or toe of retaining wall is sloped, GNN should be contacted to provide location-specific lateral earth pressures.
5. For sloped backfill conditions, GNN should be contacted for additional analysis and recommendations.

If any surface, surcharge loads are closer than one-half of the wall height (horizontal distance) to the edge of the below-grade and/or retaining wall, increase the design wall pressure by $q/2$ over the whole area of the retaining wall. In this expression, q is the surface surcharge load in psf. GNN should review anticipated surcharge loading to confirm that the appropriate design values are considered. The horizontal surcharge resultant force (pressure x H, where H is height of buried wall) should be applied at an H/2 distance from the base of the wall.

Wall Drainage: Retaining structures should include adequate back drainage to avoid build-up of hydrostatic pressures. Positive drainage for retaining walls should consist of a vertical layer of permeable material (chimney drain), such as a pea gravel or crushed rock (typically ¼- to ¾-inch crushed), at least 18 inches thick, positioned between the back of wall and the backfill and extend

up to within 12 inches of finished grade where it should be capped with compacted low permeability fill to reduce infiltration of surface water into the drain system.

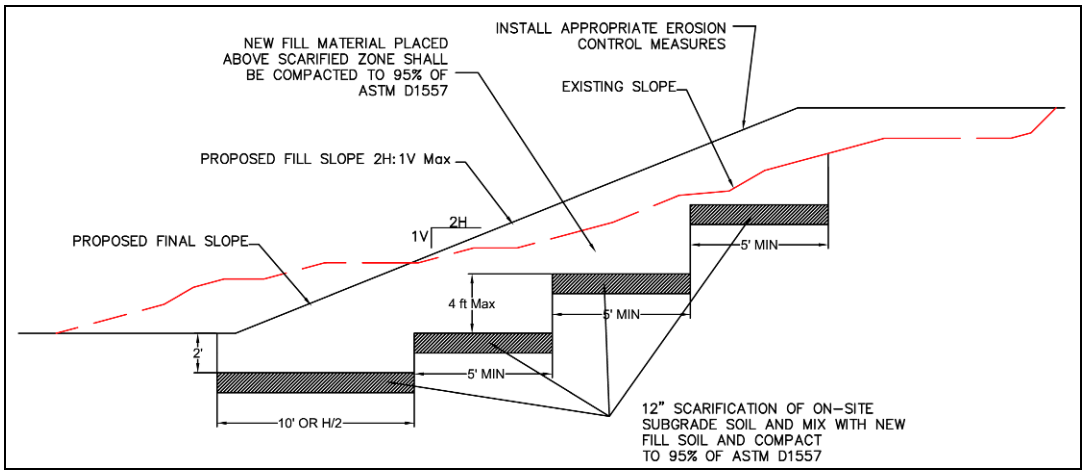
We recommend the select granular wall backfill be separated from general fill and/or native soil using a geotextile fabric that meets the specifications provided in WSS 9-33.2 - Geosynthetic Properties for drainage geotextiles. A non-woven filter fabric such as Mirafi 140N is typically used for this application.

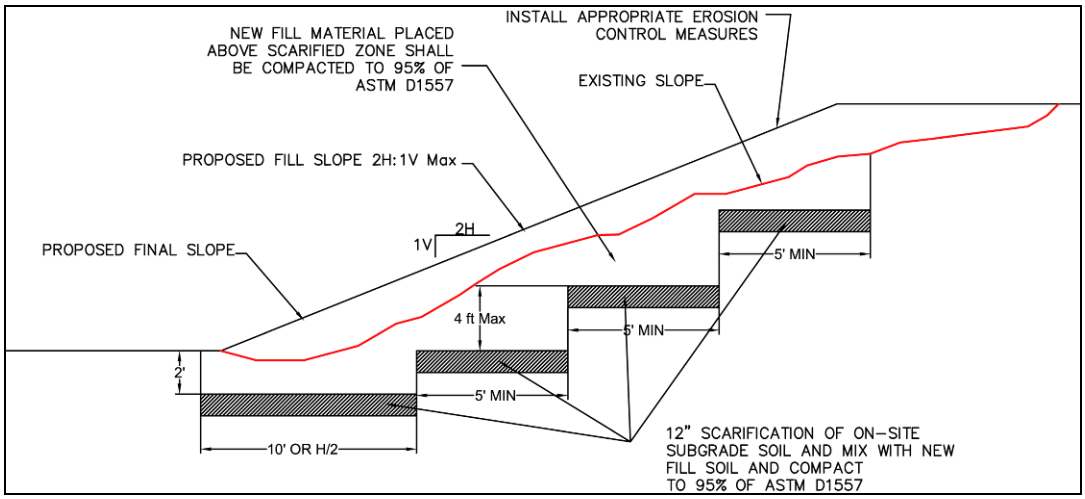
A 4-inch perforated rigid PVC drainpipe shall be embedded at the base of the drain rock. The drainpipe should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 3 percent passing the No. 200 sieve. The free-draining aggregate should be encapsulated in a filter fabric.

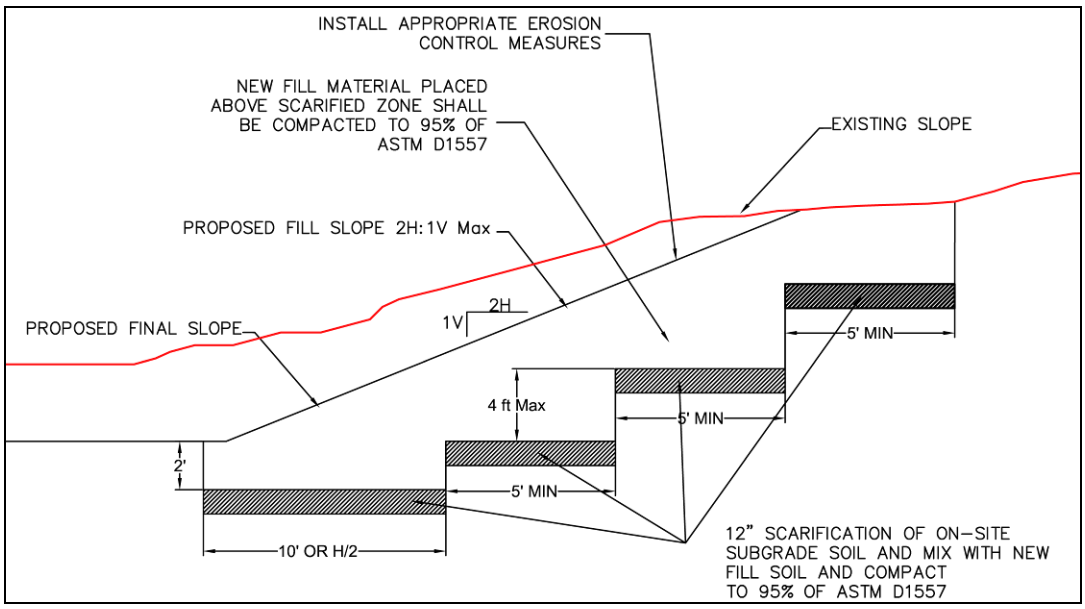
Backfill and Subgrade Compaction: Backfill behind the below-grade structural walls or retaining walls shall consist of imported granular fill material. Compaction on the retained side of the wall within a horizontal distance equal to 5 feet should be performed by hand-operated or other lightweight compaction equipment. This is intended to reduce potential locked-in lateral pressures caused by compaction with heavy grading equipment. Retaining wall foundation subgrade improvements and design shall be constructed in accordance with the recommendations of this report.

11.16 Construction of Project Slopes & Lagoon Interior Slopes

Typical grading details for proper slope construction are shown below:







Fill slopes shall be constructed with suitable engineered fill soil that has been properly moisture conditioned and compacted as recommended in this report. Fill slopes shall be overfilled and trimmed back to uniformly compacted material. The final slope surface shall be track-walked or grid rolled to improve the slope's resistance to erosion. A representative of the geotechnical engineer shall be present during embankment fill construction to observe compliance with the above recommendations.

Where fill slopes are to be constructed on natural slopes steeper than 5H:1V, the fill shall be keyed and benched into firm natural soil. Keys for all slope reconstruction greater than 5 feet in height

shall be cut into firm natural soil. The minimum key dimensions are 10 feet horizontal and 2 feet vertical from the lowest adjacent soil grade.

Cut slopes into bedrock may be constructed at a gradient of 1H:1V or steeper. A representative of the GER should monitor cut slopes during construction, to check for adverse geologic features exposed within the cut face.

Proper slope protection and maintenance should help minimize slope erosion and improve the stability of the project slopes. The project soils will be prone to erosion and will require protection and maintenance. Positive drainage shall be provided at the tops of all slopes to divert runoff away from the face. Erosion protection shall be provided, especially where concentrated runoff is anticipated. Periodic maintenance and repair of slopes should be performed. All slopes should be periodically inspected for evidence of cracking, erosion, and rodent infestation and any observed problems should be repaired. As the exposed site soils are susceptible to erosion, it is required that erosion control measures, such as planting, erosion control blankets or fabrics, sprayed tackifiers, or some combination of these, be utilized on all exterior slopes within this project. BMPs to control erosion on all exterior graded slopes will be required.

11.17 Subgrade Protection

The degree to which construction grading problems develop is expected to be dependent, in part, on the time of year that construction proceeds and the precautions which are taken by the contractor to protect the subgrade. The fine-grained soils currently present on site are considered to be moisture and disturbance sensitive due to their fines content and may become unstable (pumping) if allowed to increase in moisture content and are disturbed (rutted) by construction traffic if wet. If necessary, the construction access road should be covered with a layer of gravel or quarry spalls course. The soils are also susceptible to erosion in the presence of moving water. The soils shall be stabilized to minimize the potential of erosion into the foundation excavation. The site shall be graded to prevent water from ponding within construction areas and/or flowing into excavations. Accumulated water must be removed immediately along with any unstable soil. Foundation concrete shall be placed and excavations backfilled as soon as possible to protect the bearing grade. We further recommend that soils that become unstable are to be either removed and replaced with structural compacted gravel fill, or mechanically stabilized with a coarse crushed aggregate possibly underlain with a geotextile and compacted into the subgrade.

11.18 Surface Drainage

With respect to surface water drainage, we recommend that the ground surface be sloped to drain away from the structure. Final exterior site grades shall promote free and positive drainage from the building areas. Water shall not be allowed to pond or to collect adjacent to foundations or within the immediate building area. We recommend that a gradient of at least 5% for a minimum distance of 10 feet from the building perimeter be provided, except in paved locations. In paved areas, a minimum gradient of 1% should be provided unless provisions are included for collection/disposal of surface water adjacent to the structure. Catch basins, drainage swales, or other drainage facilities should be aptly located. All surface water such as that coming from roof downspouts and catch basins be collected in tight drain lines and carried to a suitable discharge point, such as a storm drain system. Surface water and downspout water should not discharge into a perforated or slotted subdrain, nor should such water discharge onto the ground surface adjacent to the building. Cleanouts should be provided at convenient locations along all drain lines.

12.0 CONTINUING GEOTECHNICAL SERVICES

GNN recommends that the Client should maintain an adequate program of geotechnical consultation, construction monitoring, and soils testing during the final design and construction phases to monitor compliance with GNN's geotechnical recommendations. ***Maintaining GNN as the geotechnical consultant from beginning to end of the project will provide continuity of services.*** If GN Northern, Inc. is not retained by the owner/developer and/or the contractor to provide the recommended geotechnical inspections/observations and testing services, the geotechnical engineering firm or testing/inspection firm providing tests and observations shall assume the role and responsibilities of Geotechnical Engineer-of-Record.

GNN can provide construction monitoring and testing as additional services. The costs of these services are not included in our present fee arrangement but can be obtained from our office. The recommended construction monitoring and testing includes, but is not necessarily limited to, the following:

- Consultation during the design stages of the project.
- Review of the grading and drainage plans to monitor compliance and proper implementation of the recommendations in GNN's Report.
- Observation and quality control testing during site preparation, grading, and placement of engineered fill as required by the local building ordinances.
- Geotechnical engineering consultation as needed during construction.

13.0 LIMITATIONS OF THE GEOTECHNICAL SITE INVESTIGATION REPORT

This GEOTECHNICAL SITE INVESTIGATION REPORT ("Report") was prepared for the exclusive use of the Client. GN Northern, Inc.'s (GNN) findings, conclusions and recommendations in this Report are based on selected points of field exploration, laboratory testing, and GNN's understanding of the proposed project at the time the Report is prepared. Furthermore, GNN's findings and recommendations are based on the assumption that soil, rock and/or groundwater conditions do not vary significantly from those found at specific exploratory locations. Variations in soil, bedrock and/or groundwater conditions could exist between and beyond the exploration points. The nature and extent of these variations may not become evident until during or after construction. Variations in soil, bedrock and groundwater may require additional studies, consultation, and revisions to GNN's recommendations in the Report.

This Report's findings are valid as of the issued date of this Report. However, changes in conditions of the subject property or adjoining properties can occur due to passage of time, natural processes, or works of man. In addition, applicable building standards/codes may change over time. Accordingly, the findings, conclusions, and recommendations of this Report may be invalidated, wholly or partially, by changes outside of GNN's control. Provided that the site conditions are not disturbed or altered after the planned grading is completed, the report will be valid for a period of 3 years from the issued date of the Report.

In the event that any changes in the nature, design, or location of structures are planned, the findings, conclusions and recommendations contained in this Report shall not be considered valid unless the changes are reviewed by GNN and the findings, conclusions, and recommendations of this Report are modified or verified in writing.

This Report is issued with the understanding that the owner or the owner's representative has the responsibility to bring the findings, conclusions, and recommendations contained herein to the attention of the architect and design professional(s) for the project so that they are incorporated into the plans and construction specifications, and any follow-up addendum for the project. The owner or the owner's representative also has the responsibility to verify that the general contractor and all subcontractors follow such recommendations during construction. It is further understood that the owner or the owner's representative is responsible for submittal of this Report to the

appropriate governing agencies. The foregoing notwithstanding, no party other than the Client shall have any right to rely on this Report and GNN shall have no liability to any third party who claims injury due to reliance upon this Report, which is prepared exclusively for Client's use and reliance.

GNN has provided geotechnical services in accordance with generally accepted geotechnical engineering practices in this locality at this time. GNN expressly disclaims all warranties and guarantees, express or implied.

Client shall provide GNN an opportunity to review the final design and specifications so that earthwork, drainage, and foundation recommendations may be properly interpreted and implemented in the design and specifications. If GNN is not accorded the review opportunity, GNN shall have no responsibility for misinterpretation of GNN's recommendations.

APPENDICES

Appendix I

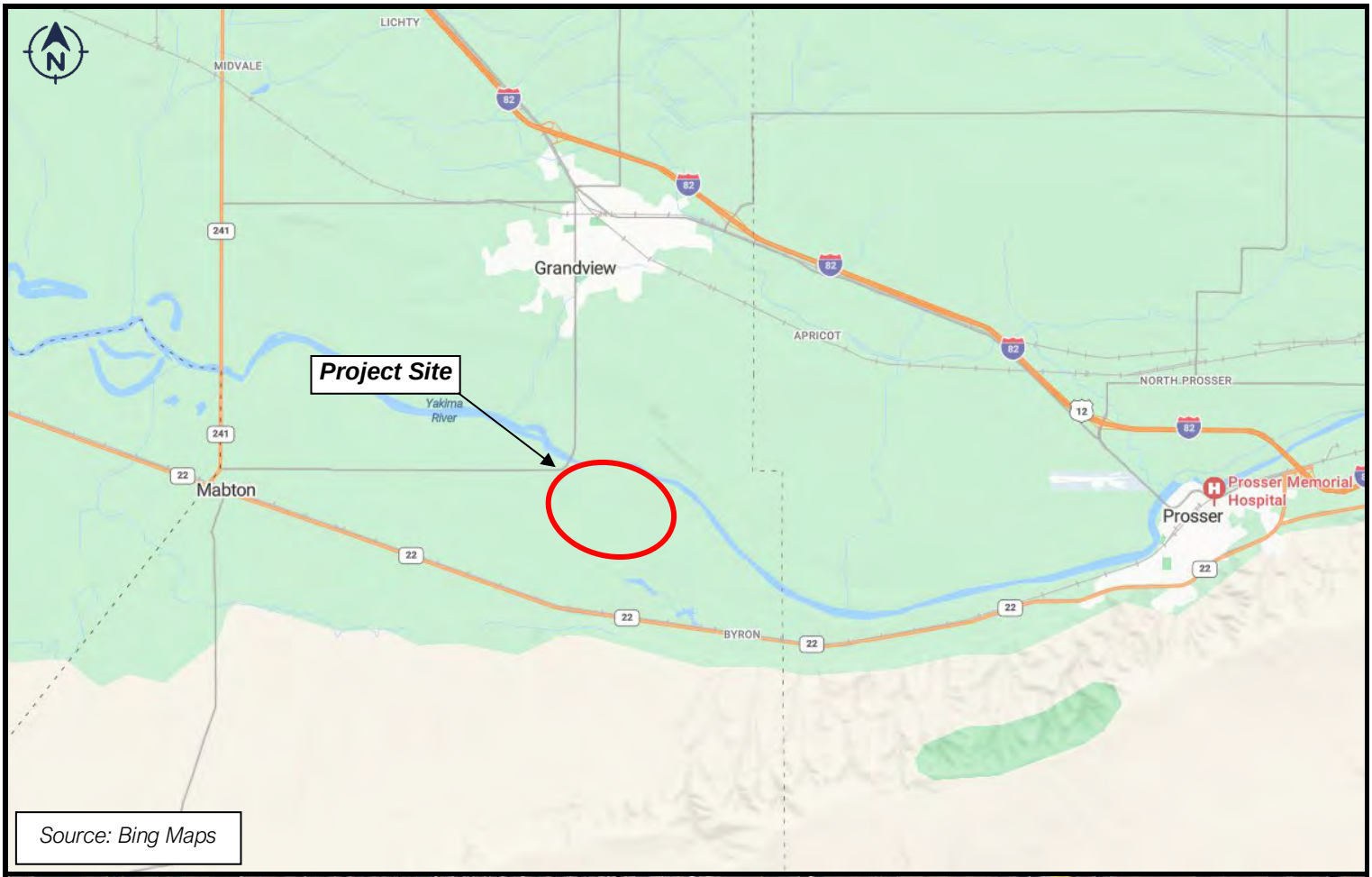
Vicinity Map (Figure 1)

Site Exploration Maps (Figures 2, 2A, 2B, 2C & 2D)

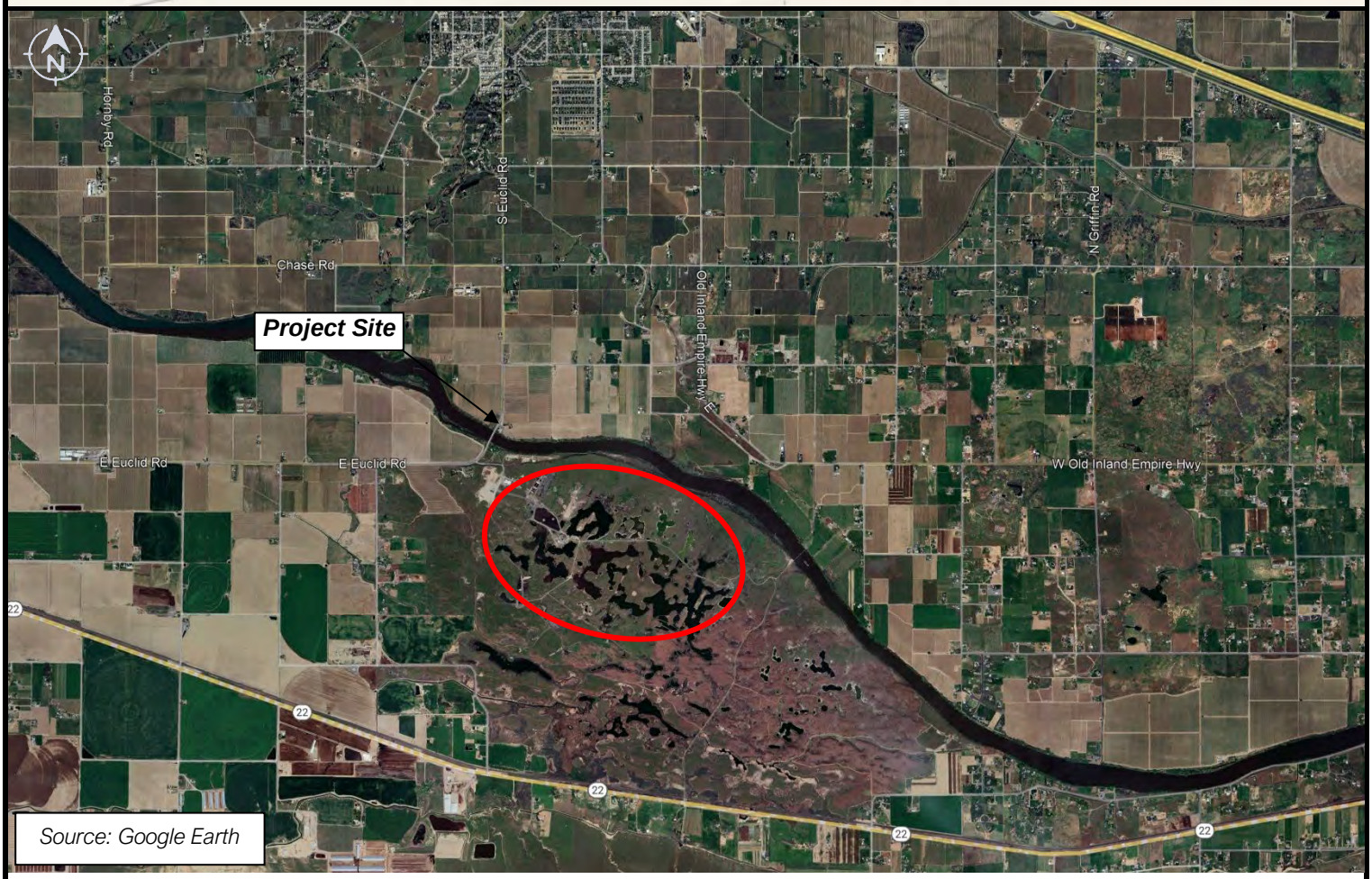
Geologic Map (Figure 3)

USGS Quaternary Fault Map (Figure 4)

HLA Topographic Maps



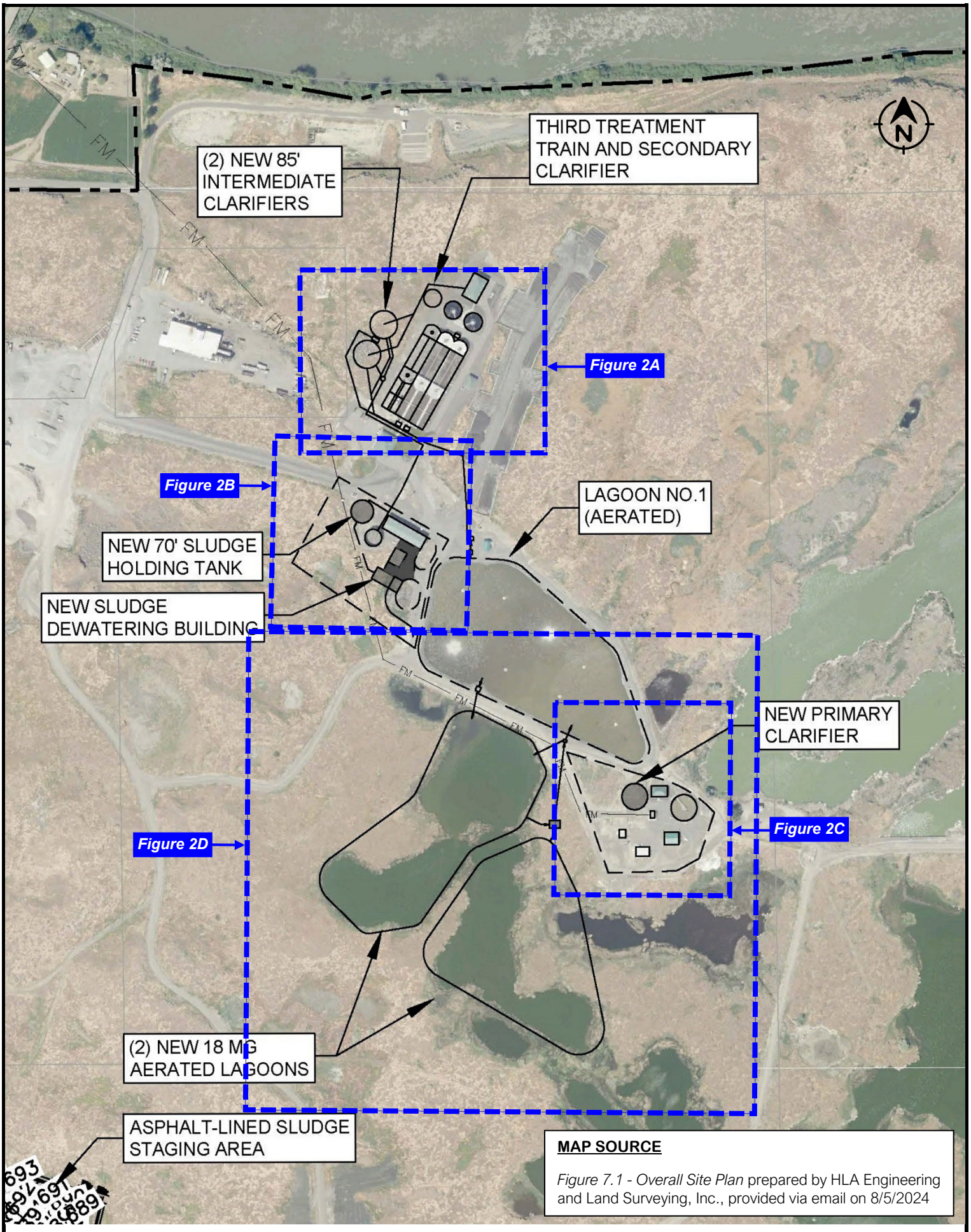
Source: Bing Maps



Source: Google Earth

FIGURE 1: VICINITY MAP

PROJECT NO. 224-1757



MAP SOURCE

Figure 7.1 - Overall Site Plan prepared by HLA Engineering and Land Surveying, Inc., provided via email on 8/5/2024

FIGURE 2: SITE EXPLORATION MAP

PROJECT NO. 224-1757

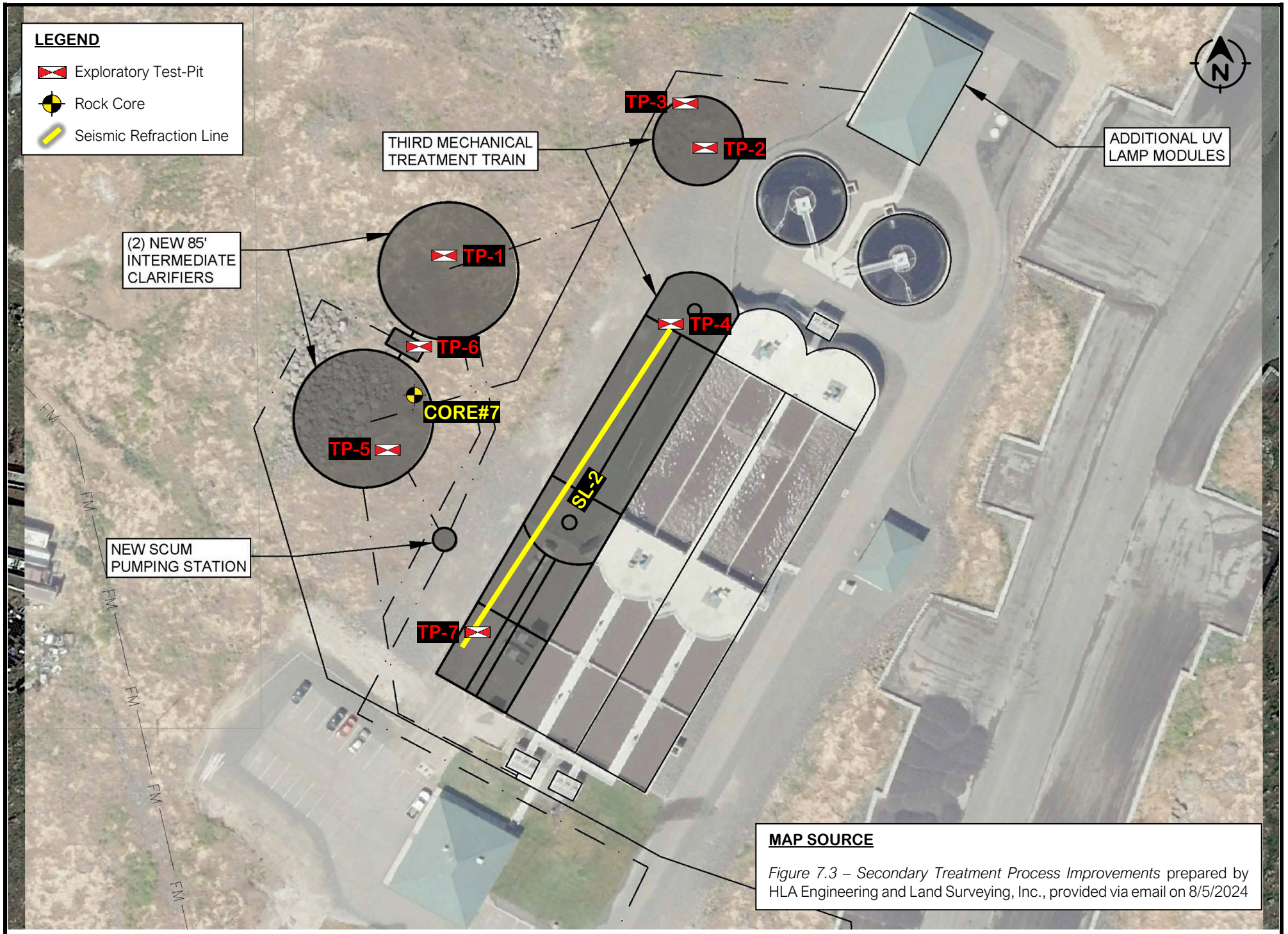


FIGURE 2A: SITE EXPLORATION MAP

PROJECT NO. 224-1757

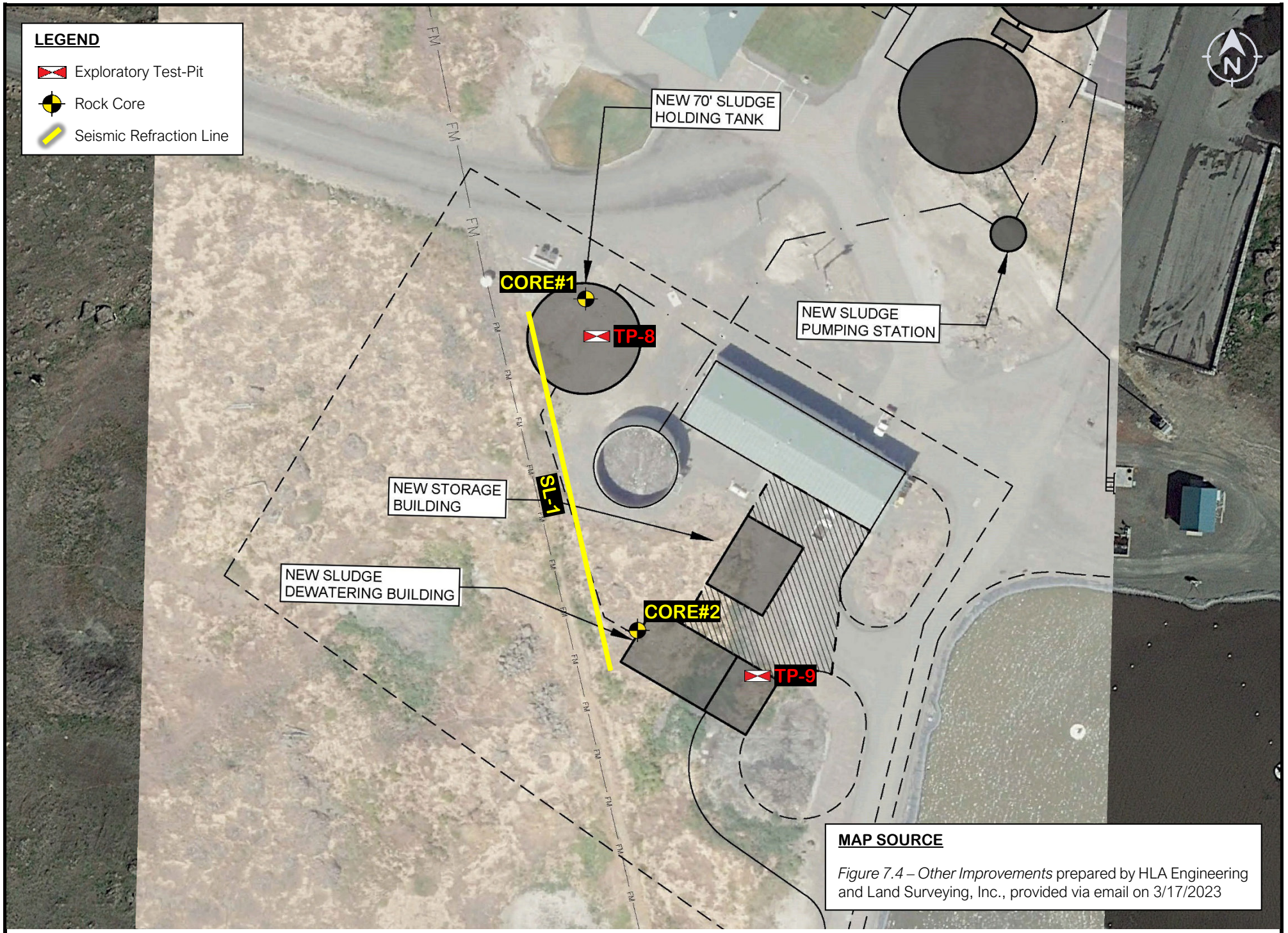


FIGURE 2B: SITE EXPLORATION MAP

PROJECT NO. 224-1757

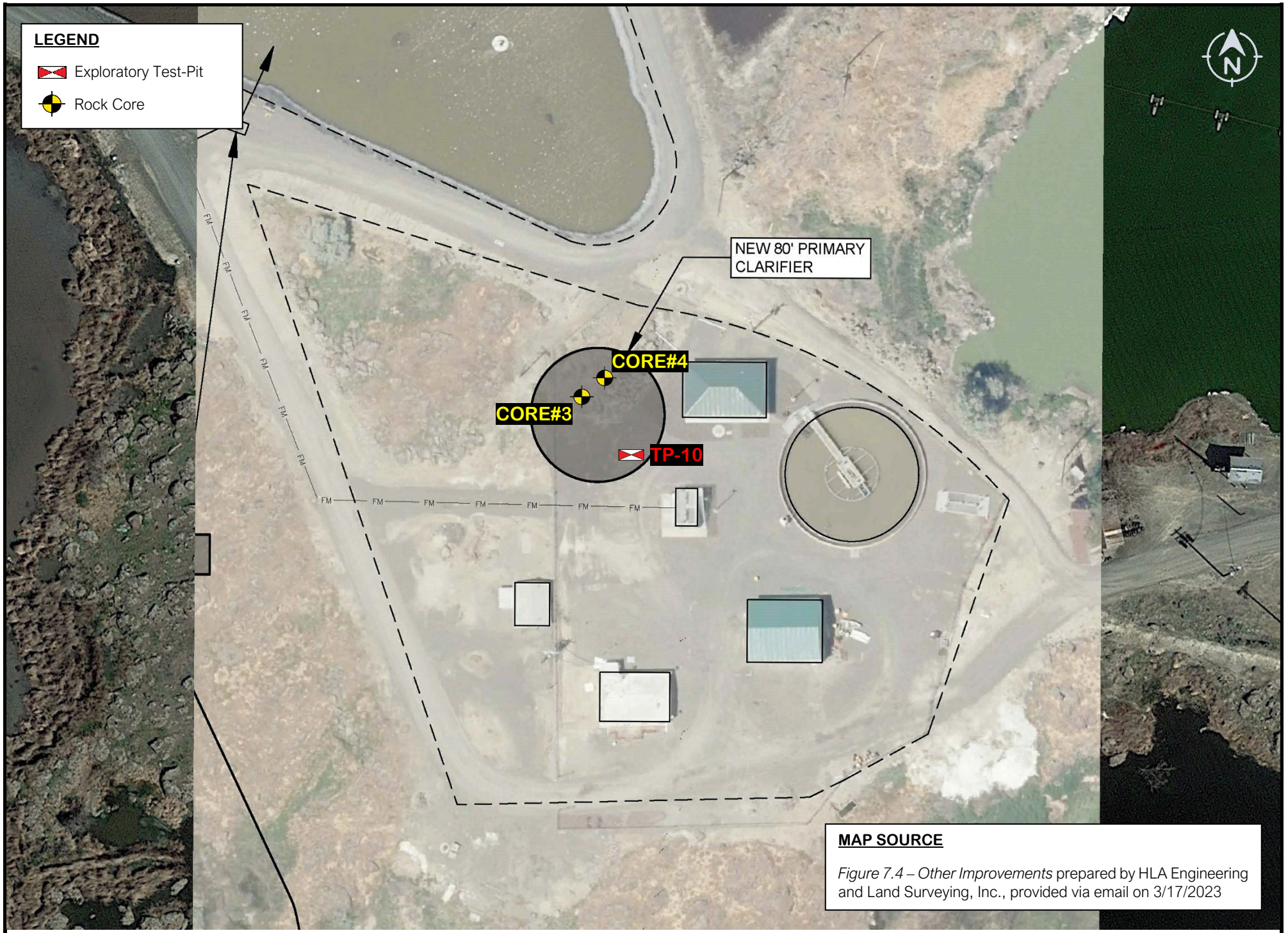


FIGURE 2C: SITE EXPLORATION MAP

PROJECT NO. 224-1757

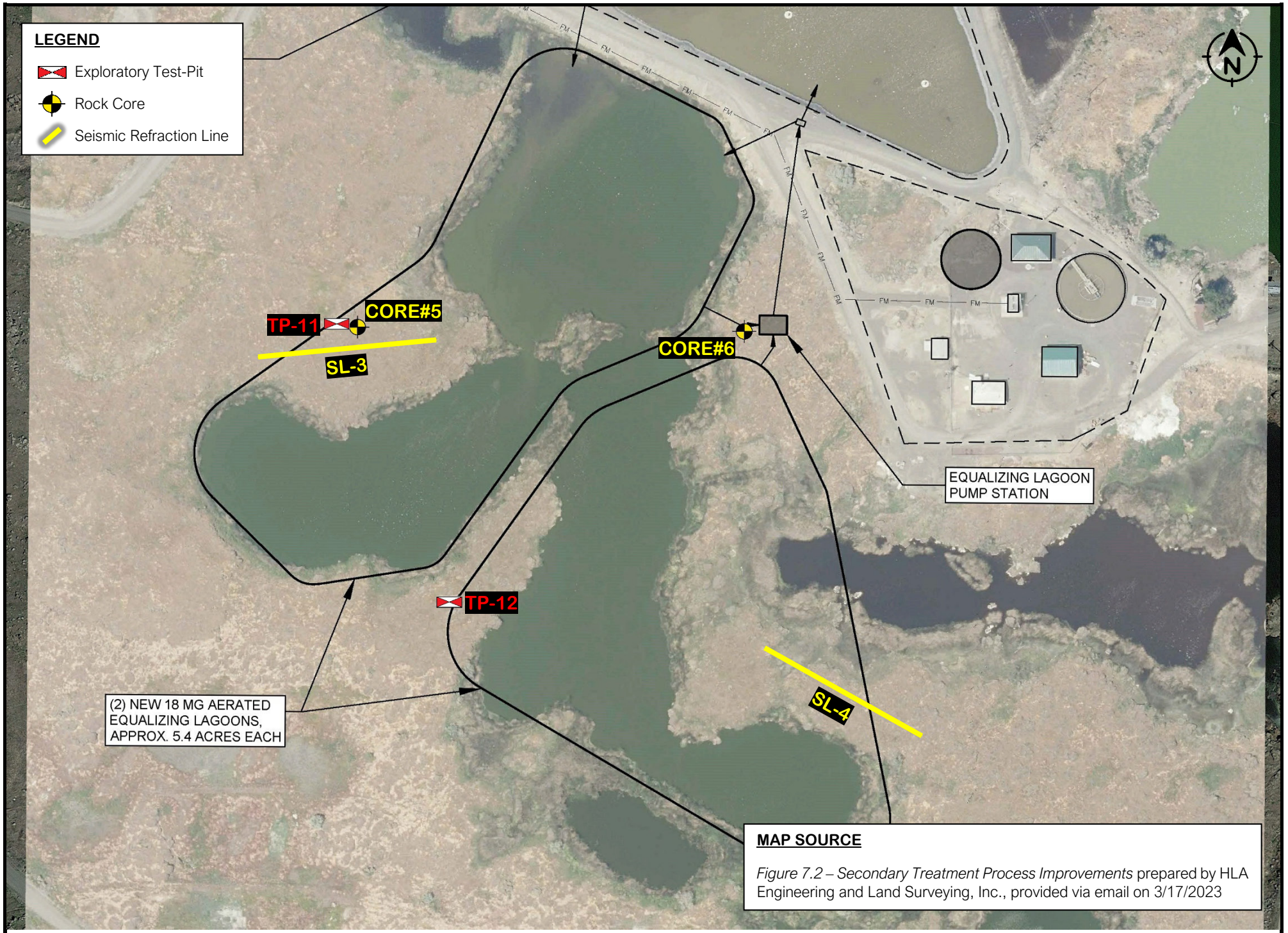


FIGURE 2D: SITE EXPLORATION MAP

PROJECT NO. 224-1757

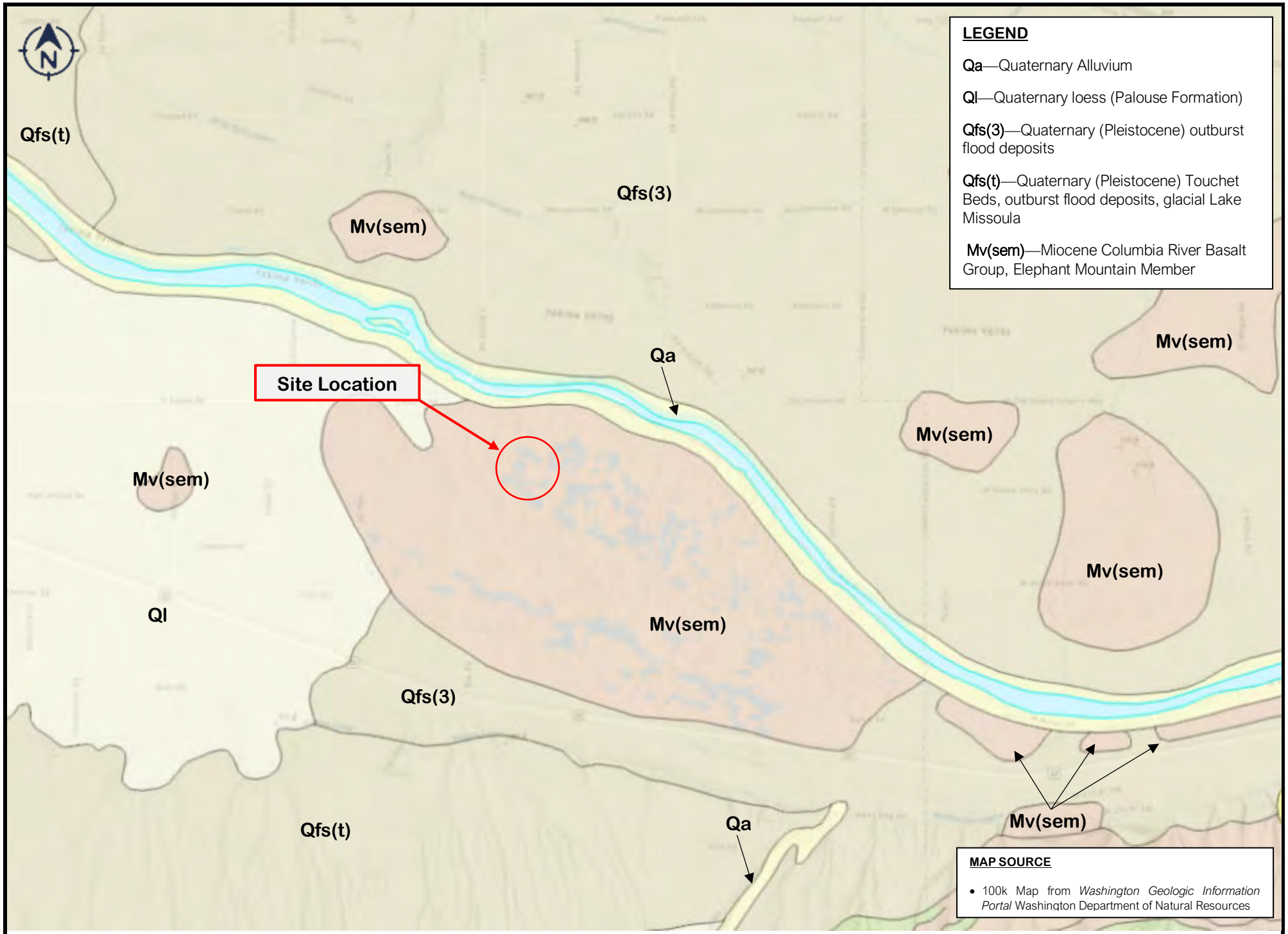


FIGURE 3: GEOLOGIC MAP

PROJECT NO. 224-1757

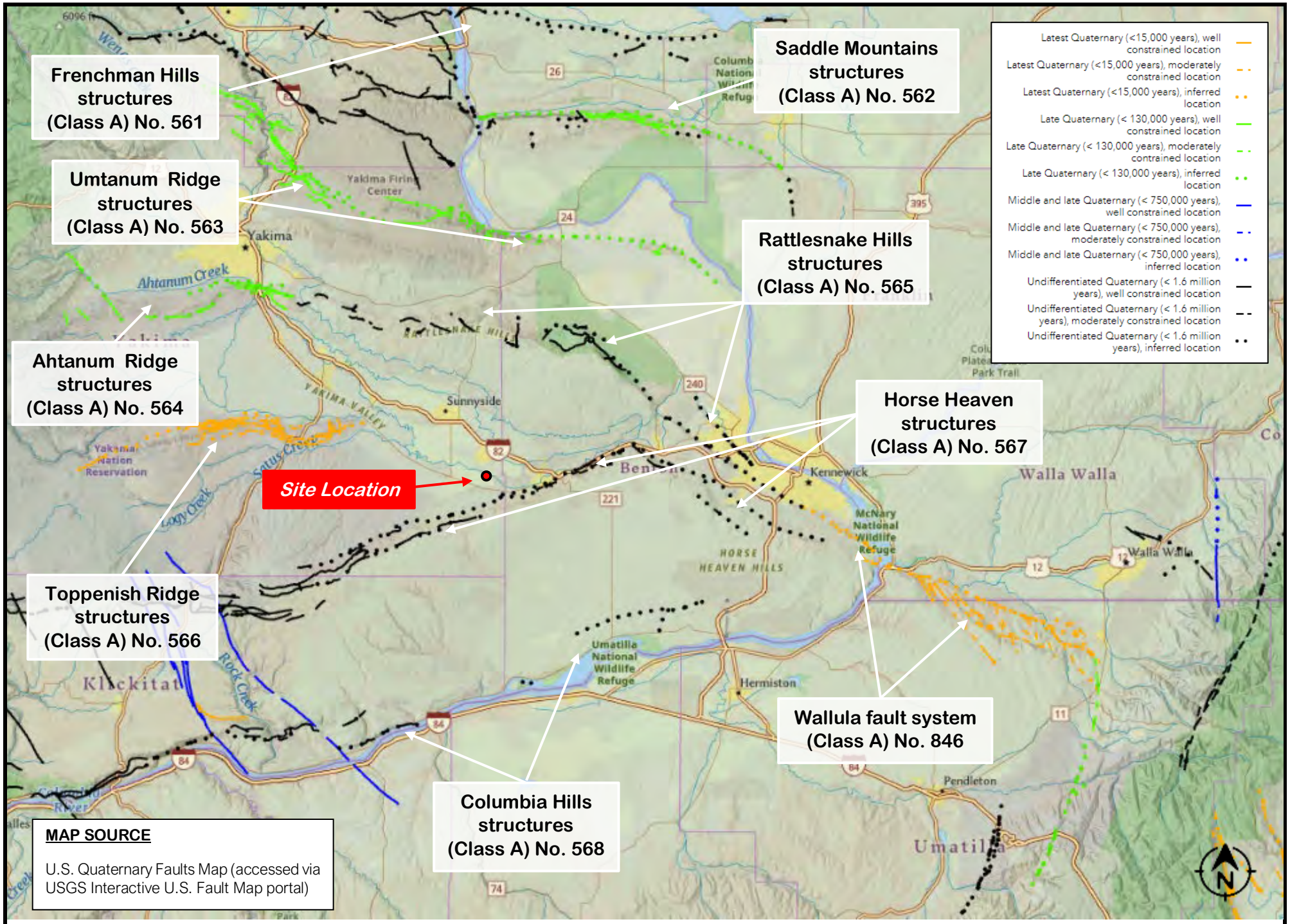
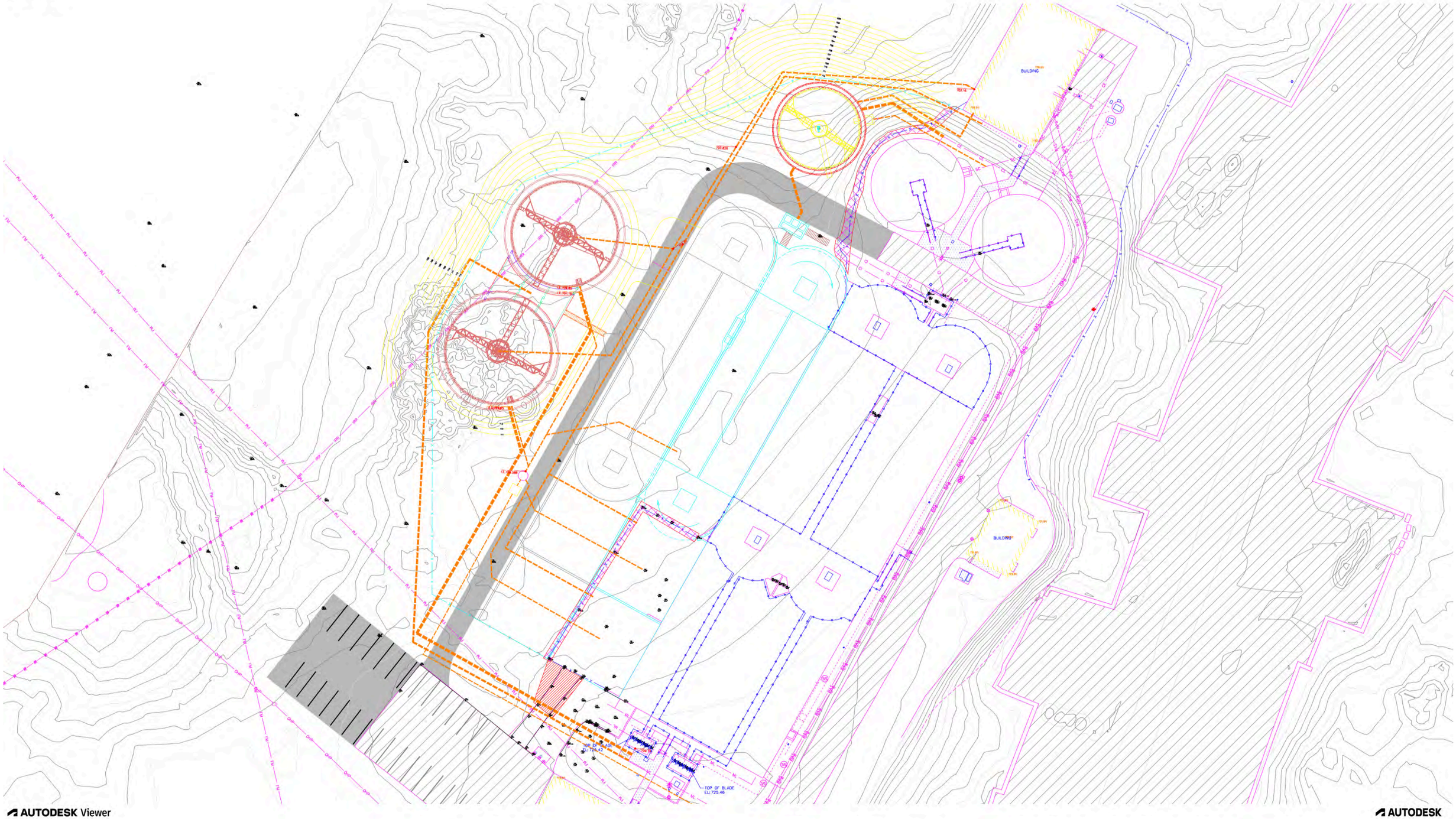


FIGURE 4: USGS QUATERNARY FAULT MAP

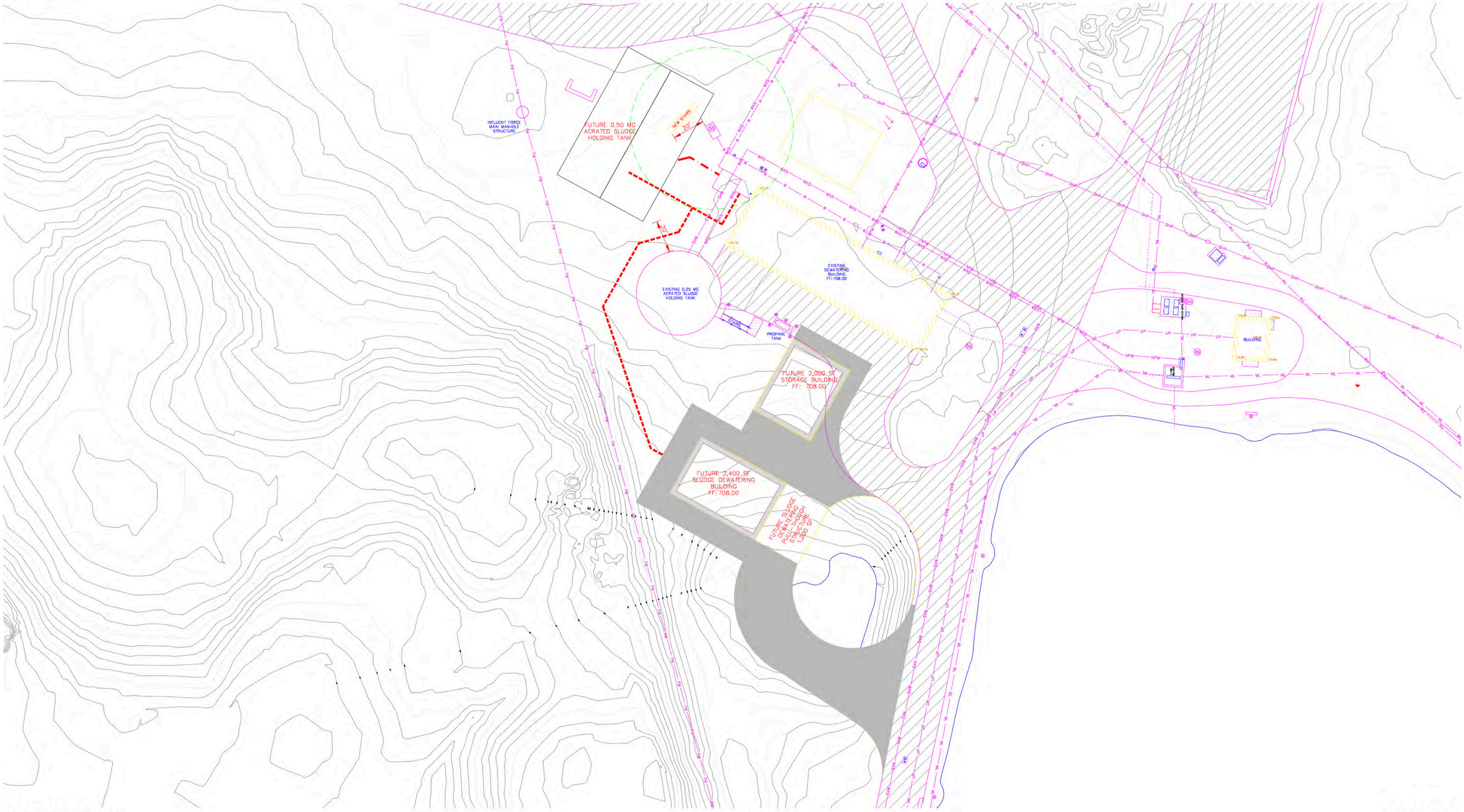
PROJECT NO. 224-1757

23030.dwg



AUTODESK Viewer
AUTODESK

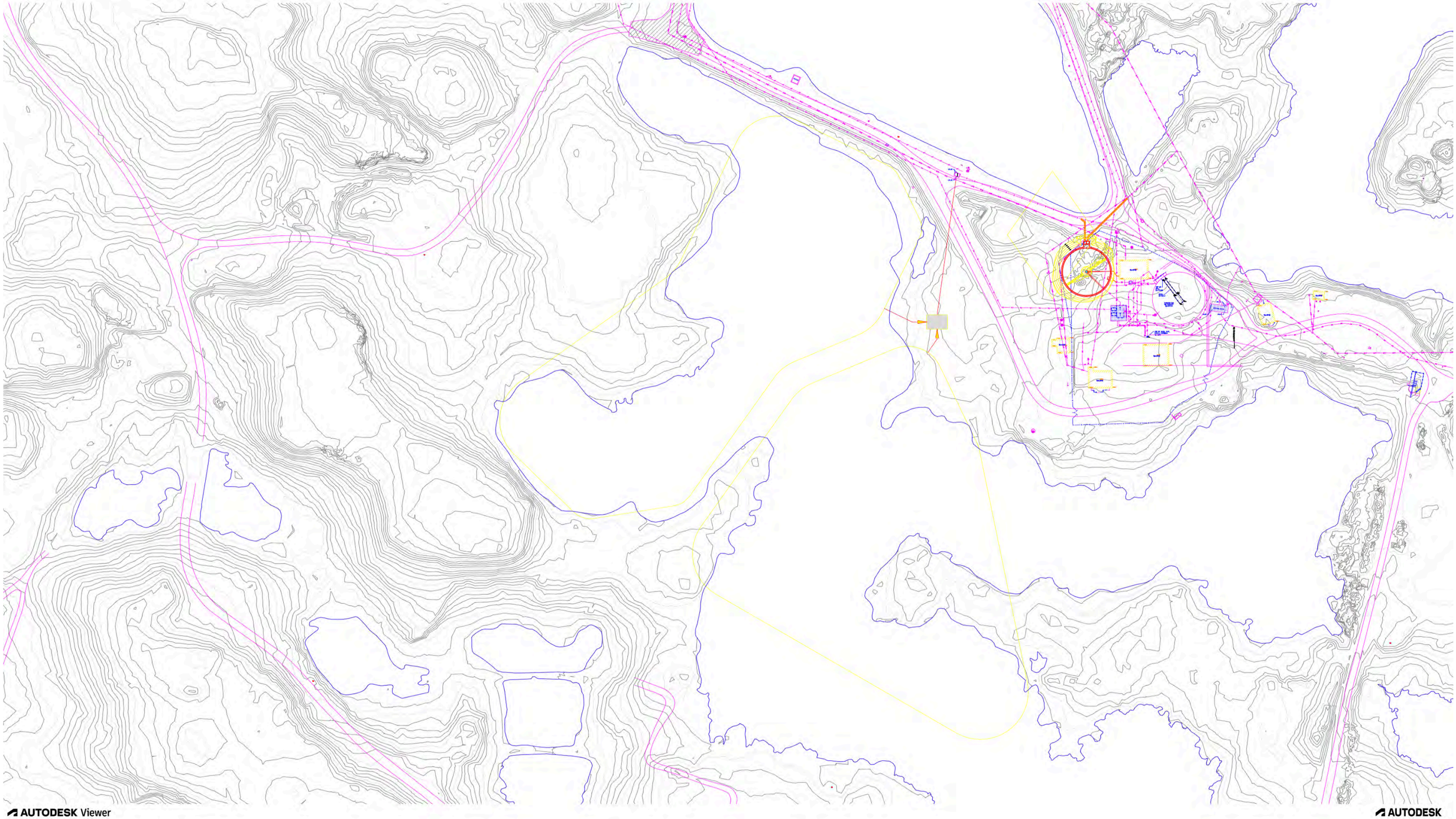
23030.dwg



AUTODESK Viewer

AUTODESK

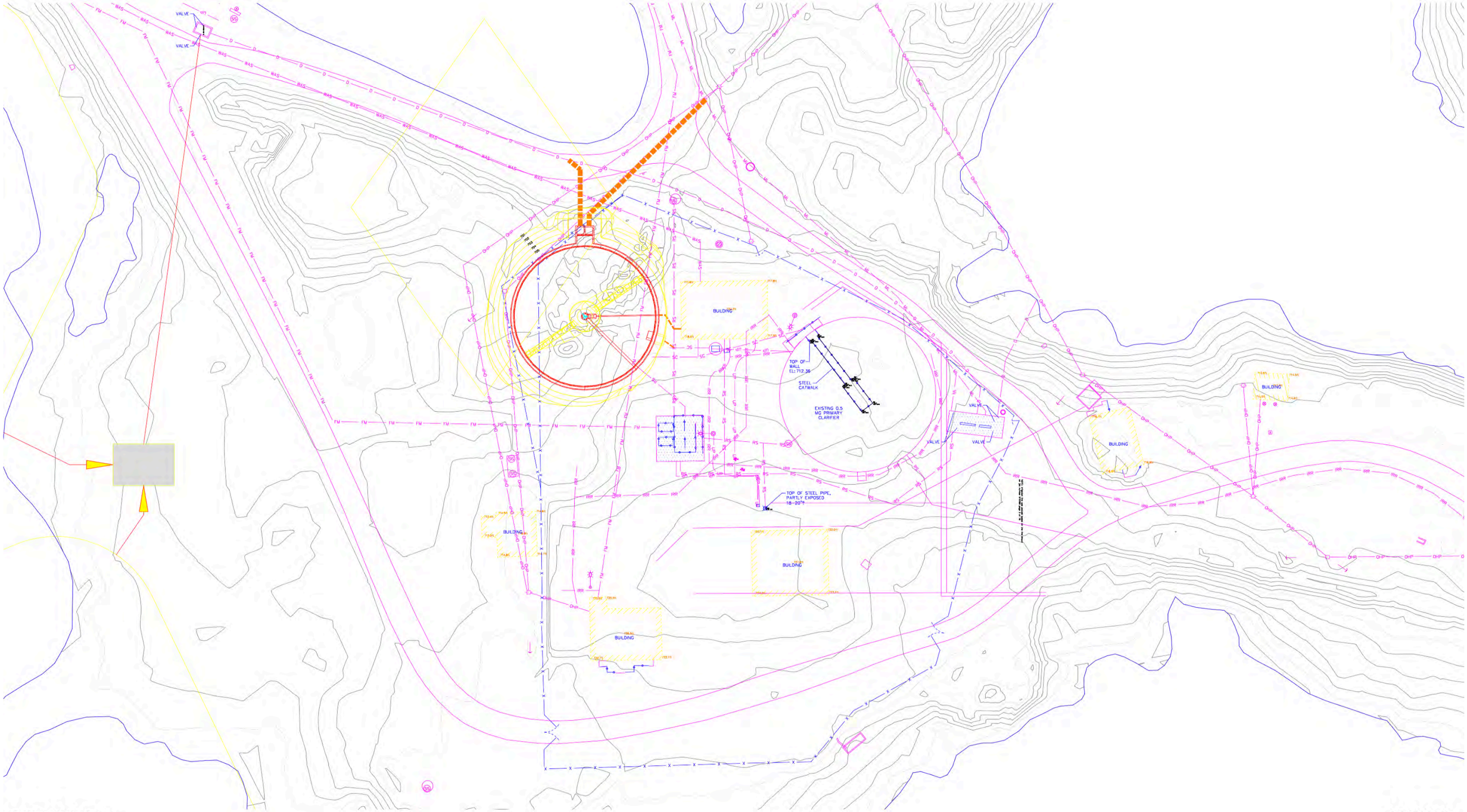
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AUTODESK Viewer

AUTODESK

23030.dwg



AUTODESK Viewer

AUTODESK

Appendix II

Exploratory Test-Pit Logs
Key Chart (for Soil Classification)

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-1

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 708 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.213385°, -119.912604°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		GM		APPARENT FILL: SILTY GRAVEL, (GM) brown, dry to damp, appears medium dense, with cobbles and boulders
2.5				
4.5				703.5

- Test-pit teminated at ~4.5' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 4.5 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-2

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 704 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.213565°, -119.911975°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		GM		APPARENT FILL: SILTY GRAVEL, (GM) quary spawls with silt, with cobbles and boulders, some trash, debris, blasting caps and wire, with angular boulder rubble
2.5				
5.0				699.0

- Test-pit teminated at ~5' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 5.0 feet.

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GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-3

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 699 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.213639°, -119.912022°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			GM		APPARENT FILL: SILTY GRAVEL, (GM) with cobbles, boulders, trash, wire, blasting caps, and broken plastic pipe
2.0					697.0
2.5	GB	MC = 10% Fines = 60%	ML		SANDY SILT, (ML) brown, moist, appears loose
5.0					
6.0					693.0

- Test-pit teminated at ~6' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 6.0 feet.

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GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-4

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 711 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.213271°, -119.912057°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		GM		APPARENT FILL: SILTY GRAVEL, (GM) appears medium dense, with angular gravel, cobbles and boulders
2.5				
5.0				
6.0				705.0

- Test-pit teminated at ~6' due to bucket refusal on apparent boulder rubble
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 6.0 feet.

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GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-5

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 709 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.213060°, -119.912741°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		ML		SILT WITH GRAVEL, (ML) brown, dry, appears loose, (variable depth to bedrock)
1.2				707.8

- Test-pit teminated at ~1.2' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 1.2 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-6

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 710 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.213233°, -119.912665°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		GM		APPARENT FILL: SILTY GRAVEL, (GM) brown, dry, appears loose, with angular cobbles, (variable depth to bedrock, ~0.5' to ~2.5' BGS)
2.5				707.5

- Test-pit teminated at ~2.5' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 2.5 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-7

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 709 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.212756°, -119.912524°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0					
		GM		FILL: SILTY GRAVEL, (GM) brown, dry, appears loose to medium dense, with angular cobbles, some boulders	
2.5					706.5
		ML		FILL: SILT, (ML) brown, moist, appears loose, with occasional gravel, cobbles, and boulders	
					705.0
5.0		SM		APPARENT FILL: SILTY SAND, (SM) brown, fine grained, moist to wet, appears loose, with occasional cobbles and boulders	
7.5				becomes wet to saturated	
				becomes saturated	
					700.0

- Test-pit teminated at ~9' due to bucket refusal on basalt
- Perched groundwater encountered at 8 feet BGS at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 9.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-8

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 708 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.211798°, -119.912840°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			ML		SANDY SILT, (ML) brown, damp, appears loose to medium dense, trace gravel and cobbles, some boulders (variable depth to bedrock, ~1' to ~3' BGS)
2.5	GB	MC = 11% Fines = 59%			
3.0					705.0

- Test-pit teminated at ~3' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 3.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-9

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 696 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.211217°, -119.912442°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			ML		SANDY SILT, (ML) olive, moist to wet, appears loose, (variable depth to bedrock, ~2.5' to ~3.5' BGS)
2.5	GB	MC = 30% Fines = 55%			
3.5					692.5

- Test-pit teminated at ~3.5' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 3.5 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-10

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 702 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.209305°, -119.909483°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					SANDY SILT, (ML) light brown, dry to damp, appears loose to very loose, (variable depth to bedrock, ~0.5' to ~6' BGS)
	GB	MC = 7% Fines = 51%			
2.5			ML		
5.0					
6.0					696.0

- Test-pit teminated at ~6' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 6.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-11

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 701 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.209154°, -119.912727°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0				ASH	
					700.0
1.0				SILT, (ML) brown, dry, appears loose, with gravel and cobbles	
		ML			
2.5					698.5

- Test-pit teminated at ~3.5' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 2.5 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

TEST PIT NUMBER TP-12

CLIENT HLA Engineering and Land Surveying, INC
PROJECT NAME City of Grandview WWTP Upgrades Project
PROJECT NUMBER 224-1757
PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA
DATE STARTED 6/28/24 **COMPLETED** 6/28/24
GROUND ELEVATION 700 ft **TEST PIT SIZE** 30 x 72 inches
EXCAVATION CONTRACTOR Ally Construction Services, LLC
GROUND WATER LEVELS:
EXCAVATION METHOD Sany SY35U Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** IM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 46.208189°, -119.912162°
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					FILL: SILTY SAND WITH GRAVEL, (SM) brown, fine to medium grained, damp, appears loose, trace coarse grained sand, trace gravel, trace cobbles
	GB	MC = 7% Fines = 29%			
2.5			SM		SILTY SAND, dark olive, fine to medium grained, damp, appears loose, (variable depth to bedrock) dark olive, damp to moist, (variable depth to bedrock, ~5.5 to ~6' BGS)
5.0					
6.0					694.0

- Test-pit teminated at ~6' due to bucket refusal on basalt
- Groundwater not encountered at time of excavation
- Referenced elevations are approximae and based on Google Earth topography

Bottom of test pit at 6.0 feet.

GENERAL BH / TP / WELL - GINT STD US LAB.GDT - 8/2/24 15:49 - C:\USERS\KHARM\ONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

Northern, Inc.
Kennewick, Yakima, Spokane, Hermiston (OR)

KEY CHART

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COARSE-GRAINED SOILS			FINE-GRAINED SOILS		
DENSITY	**N (BLOWS/FT)**	**FIELD TEST**	**CONSISTENCY**	**N (BLOWS/FT)**	**FIELD TEST**
Very Loose	0 – 4	Easily penetrated with ½-inch reinforcing rod pushed by hand	Very Soft	0 – 2	Easily penetrated several inches by thumb
Loose	4 – 10	Difficult to penetrate with ½-inch reinforcing rod pushed by hand	Soft	2 – 4	Easily penetrated one inch by thumb
Medium -Dense	10 – 30	Easily penetrated with ½-inch rod driven with a 5-lb hammer	Medium-Stiff	4 – 8	Penetrated over ½-inch by thumb with moderate effort
Dense	30 – 50	Difficult to penetrate with ½-inch rod driven with a 5-lb hammer	Stiff	8 – 15	Indented about ½-inch by thumb but penetrated with great effort
Very Dense	> 50	penetrated only a few inches with ½-inch rod driven with a 5-lb hammer	Very Stiff	15 – 30	Readily indented by thumb
			Hard	> 30	Indented with difficulty by thumbnail

USCS SOIL CLASSIFICATION

MAJOR DIVISIONS				GROUP DESCRIPTION
Coarse-Grained Soils <50% passes #200 sieve	**Gravel** and **Gravelly Soils** <50% coarse fraction passes #4 sieve	**Gravel** (with little or no fines)	GW	Well-graded **Gravel**
			GP	Poorly Graded **Gravel**
		Gravel (with >12% fines)	GM	Silty **Gravel**
			GC	Clayey **Gravel**
	Sand and **Sandy Soils** >50% coarse fraction passes #4 sieve	**Sand** (with little or no fines)	SW	Well-graded **Sand**
			SP	Poorly graded **Sand**
		Sand (with >12% fines)	SM	Silty **Sand**
			SC	Clayey **Sand**
Fine-Grained Soils >50% passes #200 sieve	**Silt** and **Clay** Liquid Limit < 50		ML	**Silt**
			CL	Lean **Clay**
			OL	Organic **Silt** and C**lay** (low plasticity)
	Silt and **Clay** Liquid Limit > 50		MH	Inorganic **Silt**
			CH	Inorganic **Clay**
			OH	Organic **Clay** and **Silt** (med. to high plasticity)
Highly Organic Soils			PT	**Peat**

Top Soil

LOG SYMBOLS

	2S	2" OD Split Spoon (SPT)
	3S	3" OD Split Spoon
	NS	Non-Standard Split Spoon
	ST	Shelby Tube
	CR	Core Run
	BG	Bag Sample
	TV	Torvane Reading
	PP	Penetrometer Reading
	NR	No Recovery
	GW	Groundwater Table

MODIFIERS

DESCRIPTION	RANGE
Trace	<5%
Little	5% – 12%
Some	>12%

MOISTURE CONTENT

DESCRIPTION	FIELD OBSERVATION
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but not visible water
Wet	Visible free water

SOIL CLASSIFICATION INCLUDES

1. Group Name
2. Group Symbol
3. Color
4. Moisture content
5. Density / consistency
6. Cementation
7. Particle size (if applicable)
8. Odor (if present)
9. Comments

MAJOR DIVISIONS WITH GRAIN SIZE

SIEVE SIZE						
12"	3"	3/4"	4	10	40	200
GRAIN SIZE (INCHES)						
12	3	0.75	0.19	0.079	0.0171	0.0029

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

Conditions shown on boring and testpit logs represent our observations at the time and location of the fieldwork, modifications based on lab test, analysis, and geological and engineering judgment. These conditions may not exist at other times and locations, even in close proximity thereof. This information was gathered as part of our investigation, and we are not responsible for any use or interpretation of the information by others.

Appendix III

Laboratory Testing Results

GRAIN SIZE DISTRIBUTION

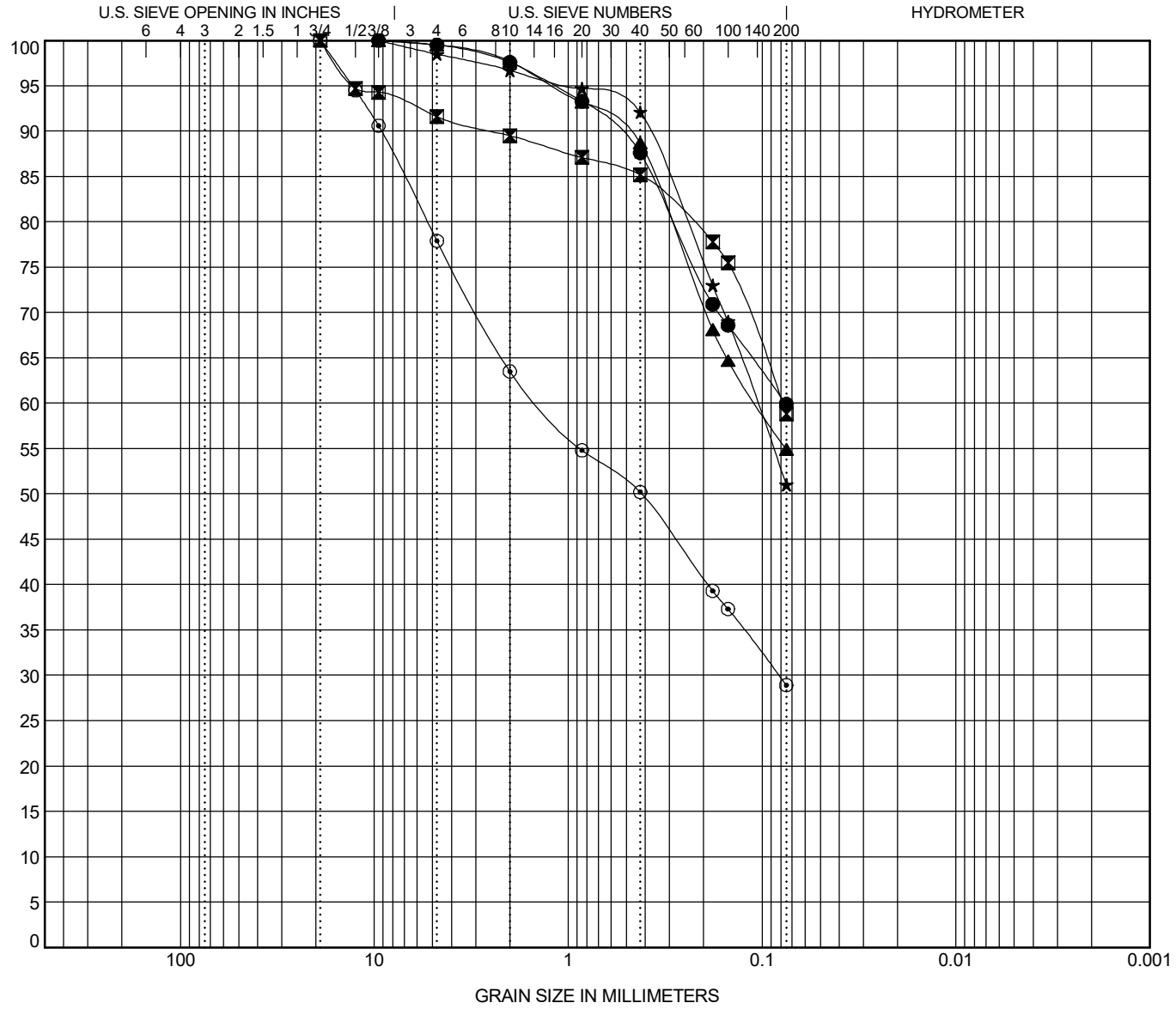
GN Northern, Inc
722 N. 16th Ave Suite 31
Yakima, WA 99802
Telephone: (509) 248-9798

CLIENT HLA Engineering and Land Surveying, INC

PROJECT NAME City of Grandview WWTP Upgrades Project

PROJECT NUMBER 224-1757

PROJECT LOCATION 850 Bridgeview Drive, Grandview, WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LOCATION		DEPTH	Classification	LL	PL	PI	Cc	Cu
●	TP-3	3.0	SANDY SILT (ML)					
⊠	TP-8	2.0	SANDY SILT (ML)					
▲	TP-9	2.0	SANDY SILT (ML)					
★	TP-10	1.5	SANDY SILT (ML)					
⊙	TP-12	1.5	SILTY SAND WITH GRAVEL (SM)					

LOCATION		DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-3	3.0	9.5	0.076			0.5	39.6	59.9	
⊠	TP-8	2.0	19	0.079			8.4	32.8	58.8	
▲	TP-9	2.0	9.5	0.108			0.5	44.6	54.9	
★	TP-10	1.5	9.5	0.106			1.5	47.5	51.0	
⊙	TP-12	1.5	19	1.418	0.082		22.1	49.0	28.9	

GRAIN SIZE - TEMPLATE_JESSE.GDT - 8/2/24 15:48 - C:\USERS\KHARMONEDRIVE\PUBLIC\ACTIVE PROJECTS\1 - CURRENT PROJECTS\224-1757 GRANDVIEW WWTP\224-1757 LOGS.GPJ

Northern, Inc.

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS
(ASTM D7012, Method C)

CLIENT: HLA Engineering and Land Surveying, Inc.

PROJECT NAME: City of Grandview WWTP Upgrades Project

PROJECT LOCATION: 850 Bridgeview Drive, Grandview, WA

PROJECT NUMBER: 224-1757

Core Sample ID	Core Length (inch)	Core Diameter (inch)	Cross-Sectional Area, A (in^2)	Failure Load, P (pounds)	Uniaxial Compressive Strength, σ_u (psi)
CORE#1	2.88	1.76	2.43	37,725	**14,903** [1]
CORE#2	3.50	1.76	2.43	32,425	**13,344**
CORE#3	3.50	1.76	2.43	36,090	**12,921**
CORE#4	3.50	1.76	2.43	33,005	**13,582**
CORE#5	3.50	1.76	2.43	30,110	**11,275**
CORE#6	3.50	1.76	2.43	31,615	**13,010**
CORE#7	3.50	1.76	2.43	29,040	**11,951**

Note [1]: strength correction factor applied per ASTM C42

Appendix IV

Site & Exploration Photographs
Bedrock Core Photographs



View of site conditions near test-pit TP-1



Subsurface soil profile within test-pit TP-1



Excavation of test-pit TP-2



View of site conditions near test-pit TP-3



Excavated spoils from within test-pit TP-3



View of site conditions near test-pit TP-4

PLATE 1: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 224-1757**



Subsurface soil profile within test-pit TP-4



Subsurface soil profile within test-pit TP-5



View of site conditions near test-pit TP-6



Subsurface soil profile within test-pit TP-6



View of site conditions near test-pit TP-7



Subsurface soil profile within test-pit TP-7

PLATE 2: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 224-1757**



View of site conditions near test-pit TP-8



View of site conditions near test-pit TP-9



View of site conditions near test-pit TP-10



View of site conditions near test-pit TP-11



Subsurface soil profile within test-pit TP-11

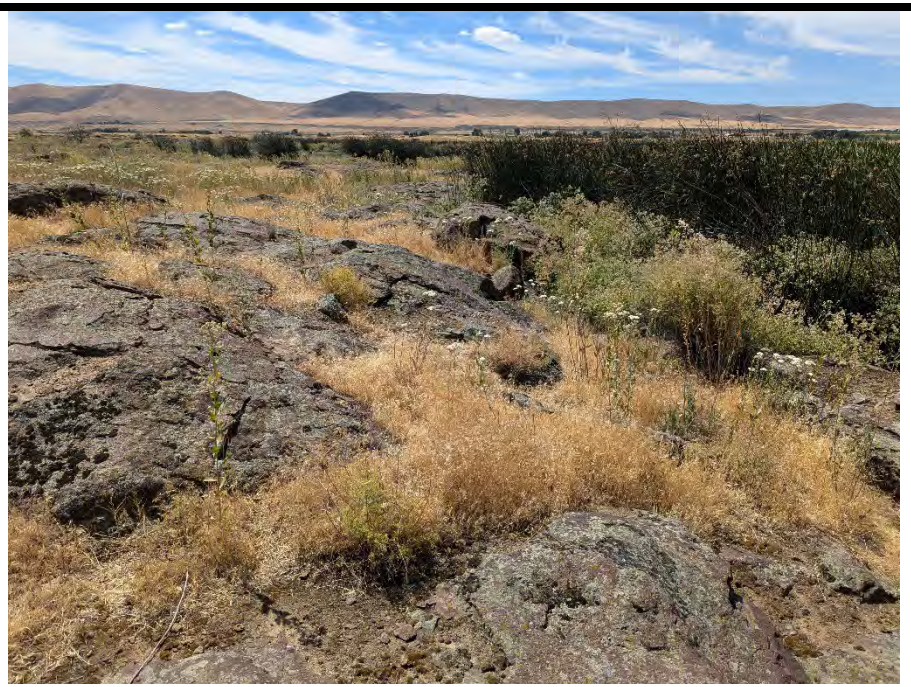


View of site conditions near test-pit TP-12

PLATE 3: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 224-1757**



Bedrock outcrop northwest of test-pit TP-9



Bedrock outcrop west of TP-10



Bedrock ridge north of TP-11



Bedrock outcrop near test-pit TP-12

PLATE 4: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 224-1757**



Bedrock outcrop along access road south of Lagoon A



Bedrock outcrop west access road south of Lagoon A



Bedrock outcrop east of test-pit TP-2



Bedrock outcrop east of test-pit TP-12

PLATE 5: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 224-1757**



Bedrock core CORE#1



Bedrock core CORE#2



Bedrock core CORE#3



Bedrock core CORE#4



Bedrock core CORE#5



Bedrock core CORE#6



Bedrock core CORE#7

PLATE 1: BEDROCK CORE PHOTOGRAPHS **PROJECT NO. 224-1757**

Northern, Inc.

Appendix V

Seismic Refraction Survey Report

Geophysical Survey LLC
711 S Tacoma Street
Kennewick, Washington 99336

July 2, 2024

Imran Magsi, PE, GE
GN Northern, Inc
722 N 16th Ave. #31
Yakima, WA 98902

Re: ***Seismic Study***
City of Grandview WWTP
Grandview, Washington

Mr. Magsi:

Geophysical Survey LLC conducted a seismic study for the City of Grandview WWTP project located south of the Yakima River in Grandview, Washington on June 26, 2024. Seismic refraction data were collected along four alignments (SL-1 Through SL-4) at the project site (Figure 1). The objectives of the study were to characterize subsurface conditions and estimate depth to bedrock and rippability of the subsurface materials.

Methodology

Seismic Refraction

The seismic refraction method is based on the measurement of the travel time of seismic waves refracted at the interfaces between subsurface layers of different velocity. Seismic energy is provided by a source ('shot') located on the surface. The source of the seismic energy was a 16 lb. sledgehammer.

Energy radiates out from the shot point, either travelling directly through the upper layer (direct arrivals) or travelling down to and then laterally along higher velocity layers (refracted arrivals) before returning to the surface. This energy is detected on the surface using a linear array (or spread) of geophones spaced at regular intervals. Beyond a certain distance from the shot point, known as the cross-over distance, the refracted signal is observed as a first-arrival signal at the geophones (arriving before the direct arrival). Observation of the travel-times of the direct and refracted signals provides information on the depth profile of the refractor.

Shots are deployed beyond both ends of the geophone spread in order to acquire refracted energy as first arrivals at each geophone position. Additional shots are deployed throughout the geophone spread.

Data are recorded on a seismograph and later downloaded to computer for analysis of the first-arrival times to the geophones from each shot position. Travel-time versus distance graphs are then constructed and velocities calculated for the overburden and refractor layers through analysis of the direct arrival and T-minus graph gradients. Depth profiles for each refractor are produced by an analytical procedure based on consideration of shot

and receiver geometry and the measured travel-times and calculated velocities. The final output comprises a depth profile of the refractor layers and a velocity model of the subsurface.

FIELD SURVEY

Mapping Control

Line shotpoints and geophones were mapped with a Trimble Pro6H GNSS (Global Navigation Satellite System) receiver with decimeter accuracy (<10cm).

Seismic Refraction Data Acquisition

Seismic data were recorded on twenty-four 14 Hz geophones spaced 10 feet apart using a Geometrics Geode seismic controller. 7 shotpoints per 24 geophone spread were collected and digitally recorded on a laptop computer. Data were collected along four alignments, in various orientations.

Seismic data was interpreted using SeisImager 2D software V5.2 from Geometrics. A two-layer earth model was created using a time term inversion. The time term model was used as an initial model for tomographic analysis which iteratively traces rays through the model with the goal of minimizing the RMS error between the observed and calculated travel times. Seismic refraction results are presented on Figures 2 and 3.

RESULTS AND INTERPRETATION

Figure 1 shows the location of each seismic refraction line. The seismic refraction profiles are shown on Figures 2 and 3. Bedrock outcrop was observed at the surface in the vicinity of SL-1, SL-3, and SL-4. A chart showing the typical rippability of materials is shown on Table 1. Interpreted seismic compression wave velocities are shown below in Table 2.

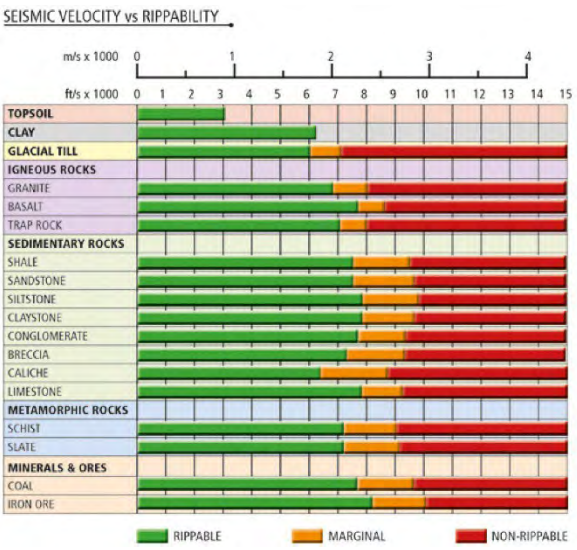


Table 1: Seismic Refraction P-Wave Velocity Rippability Chart

Seismic Refraction Velocity (P-wave)	Interpretation
1,500 feet/second	Unconsolidated Material
9,000 feet/second	rock

Table 2: Seismic Refraction Interpretation

CLOSURE

Geophysical surveys performed as part of this survey may or may not successfully detect or delineate any or all subsurface objects or features present. Locations, depths and scale of buried objects or subsurface features mapped as a result of this survey are a result of geophysical interpretation only, and should be considered as confirmed, actual, or accurate only where recovered by excavation or drilling.

Geophysical Survey LLC performed this work in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty, express or implied, beyond exercise of reasonable care and professional diligence, is made. This report is intended for use only in accordance with the purposes of the study described within.

Respectfully,

Geophysical Survey LLC



Mark Villa L.G.
Geophysicist



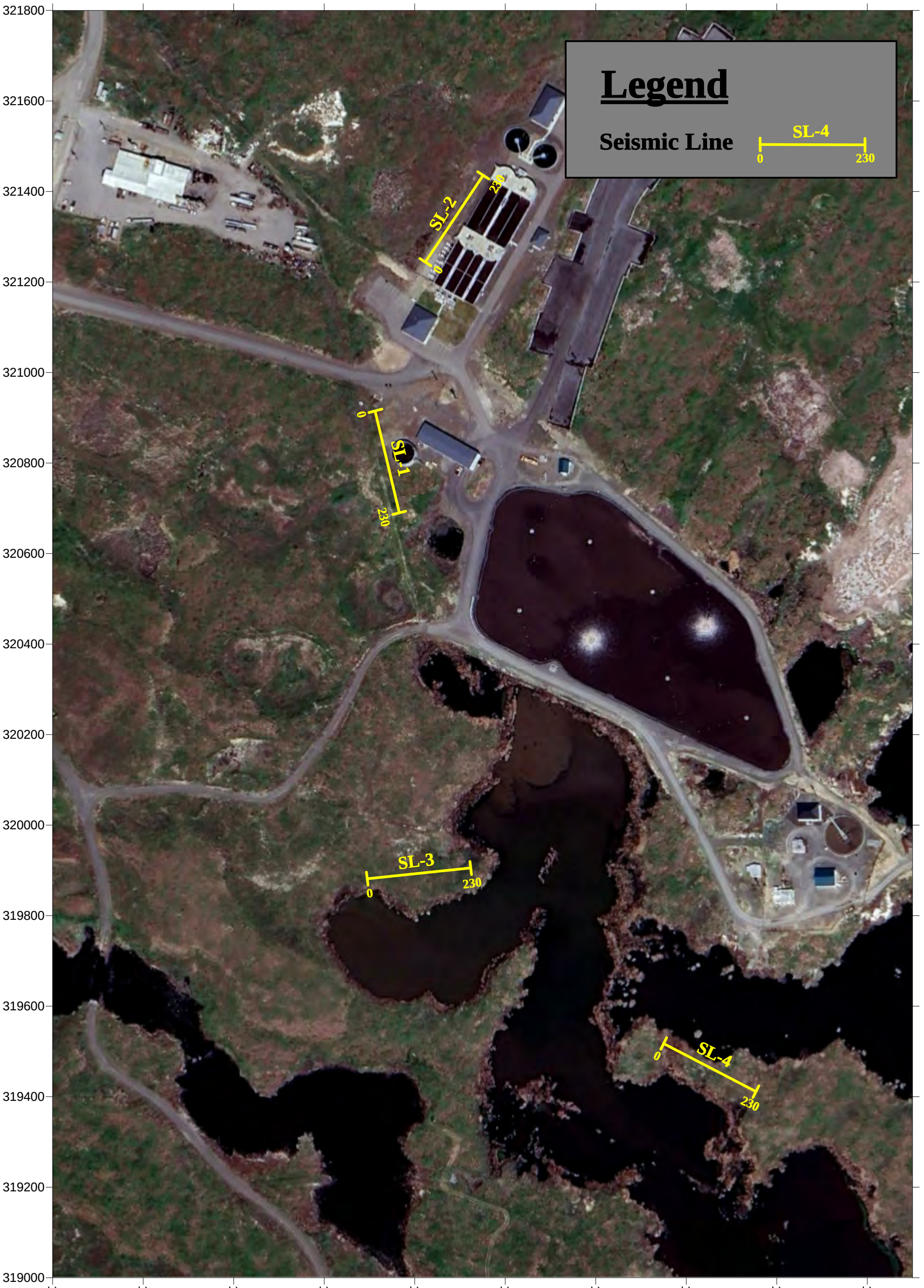
Andrew Baird R.G. (Oregon Only)
Geophysicist

References: Redpath, Bruce B., (1973) . "Seismic Refraction Exploration for Engineering Site Applications." *Tech Report E-73-4*, U.S. Army Engineer Waterways Experiment Station Explosive Excavation Research Laboratory

Seismic Study
City of Grandview WWTP
Grandview, Washington

LIST OF FIGURES

Figure 1 Site Map
Figure 2 Seismic Results (SL-1 and SL-2)
Figure 3 Seismic Results (SL-3 and SL-4)



GEOPHYSICAL SURVEY LLC

0ft 100ft 200ft

Washington State Plane
NAD83

City of Grandview WWTP
Grandview, Washington

N

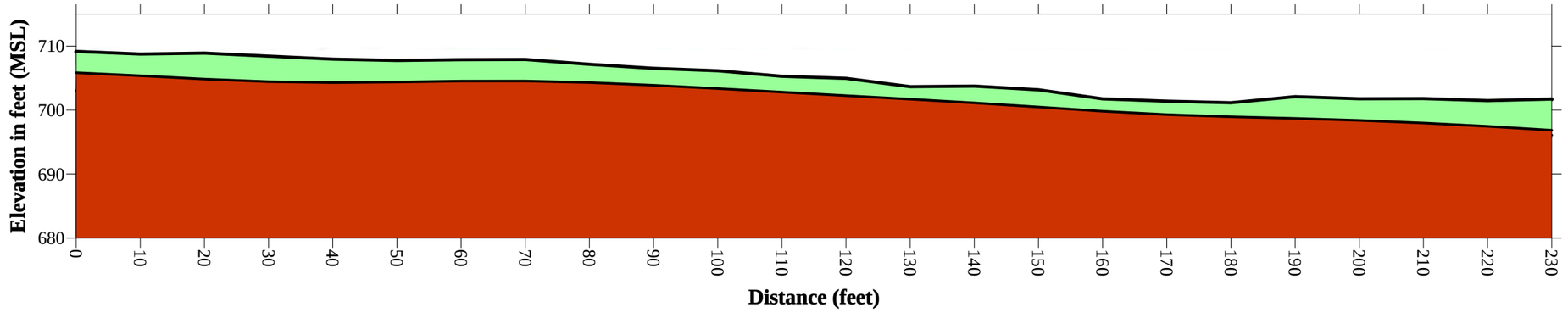
FIGURE 1
Site Map

Legend

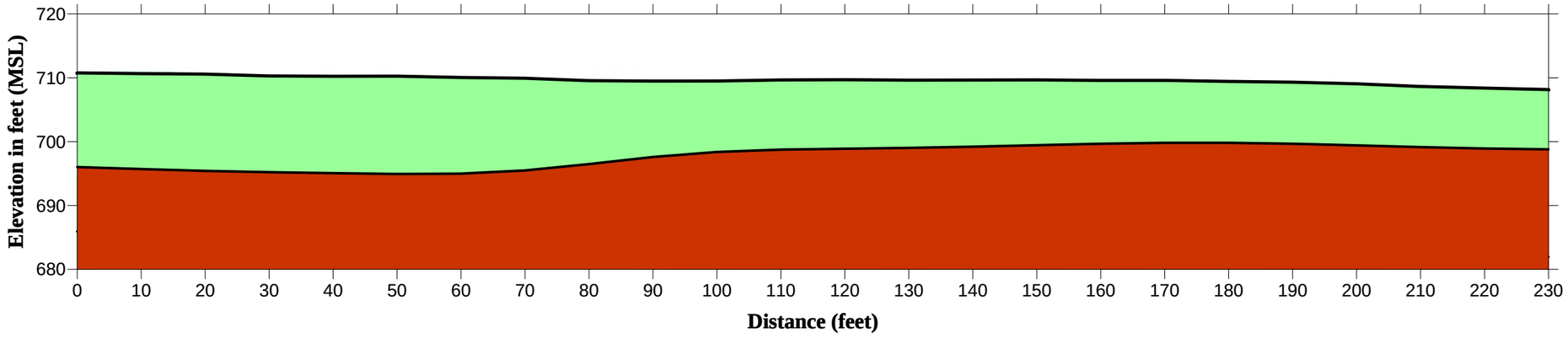
1,500 feet/second

9,000 feet/second

SL-1



SL-2



GEOPHYSICAL SURVEY LLC

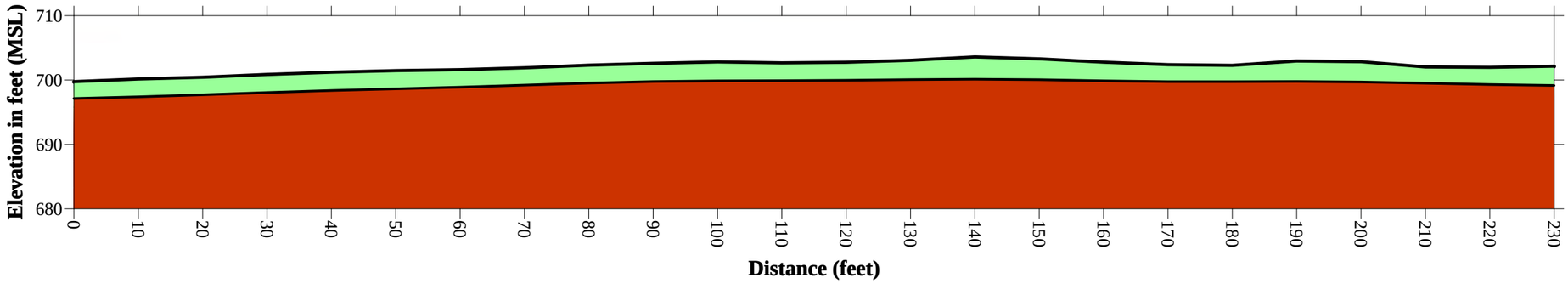
City of Grandview WWTP
Grandview, Washington

FIGURE 2
P-Wave Velocity Profiles (SL-1 and SL-2)

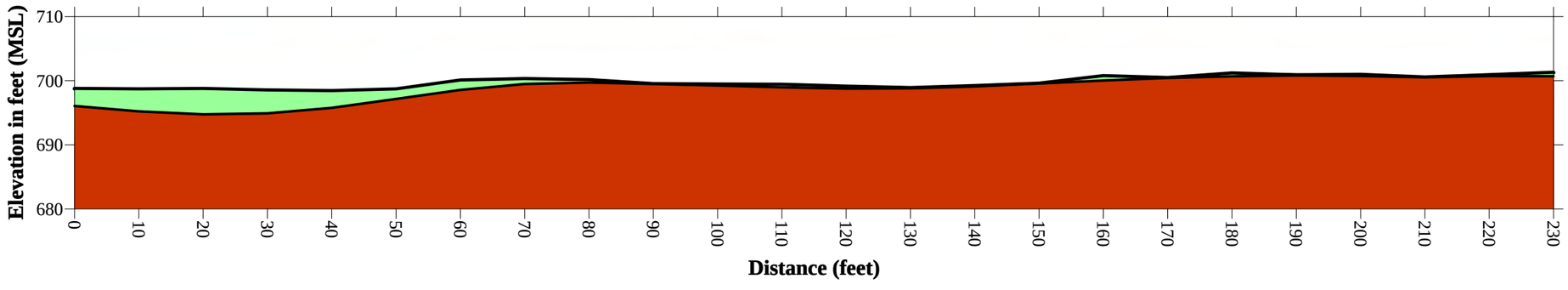
Legend

- 1,500 feet/second
- 9,000 feet/second

SL-3



SL-4



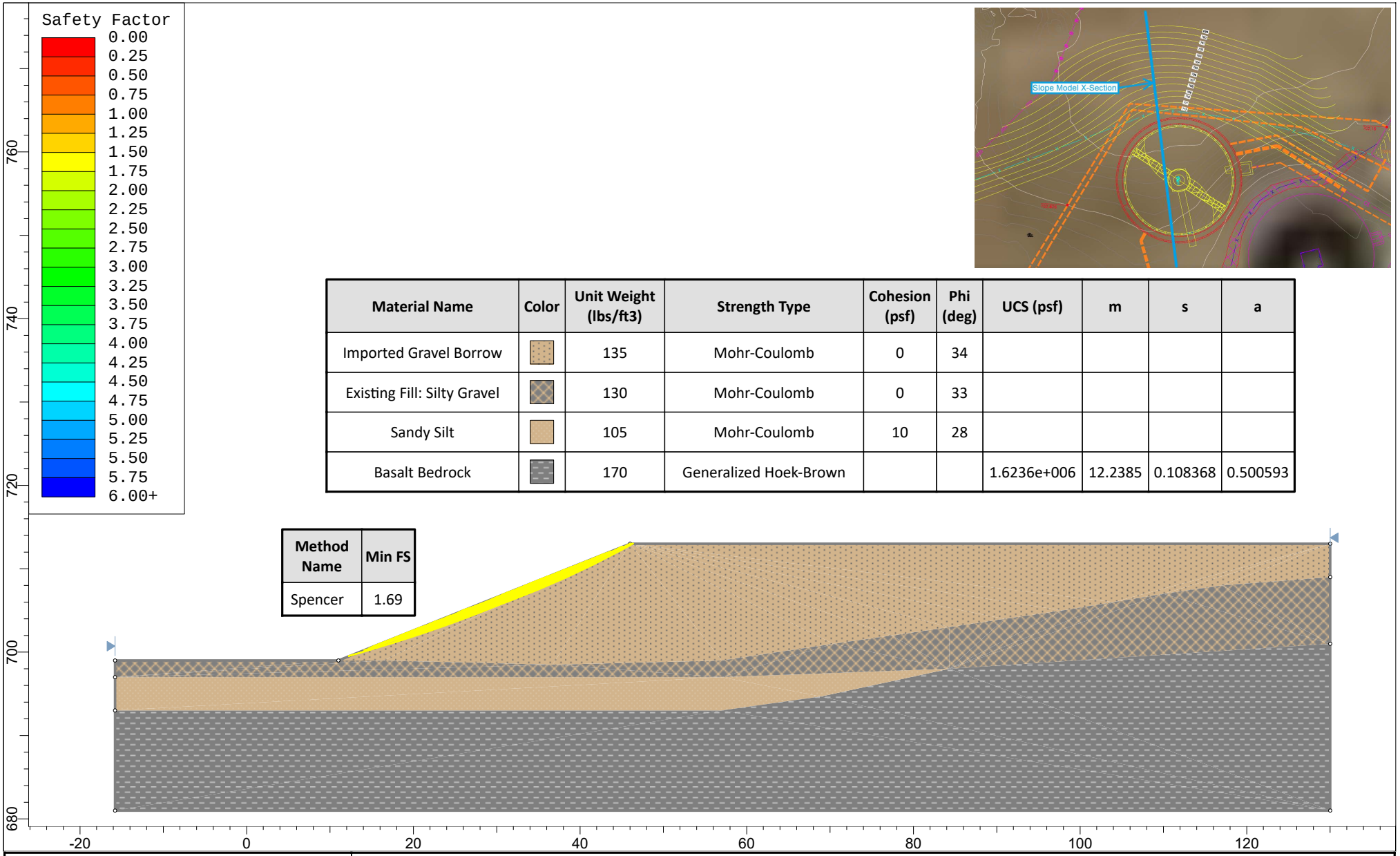
GEOPHYSICAL SURVEY LLC

City of Grandview WWTP
Grandview, Washington

FIGURE 3
P-Wave Velocity Profiles (SL-3 and SL-4)

Appendix VI

Slope Stability Analysis Outputs



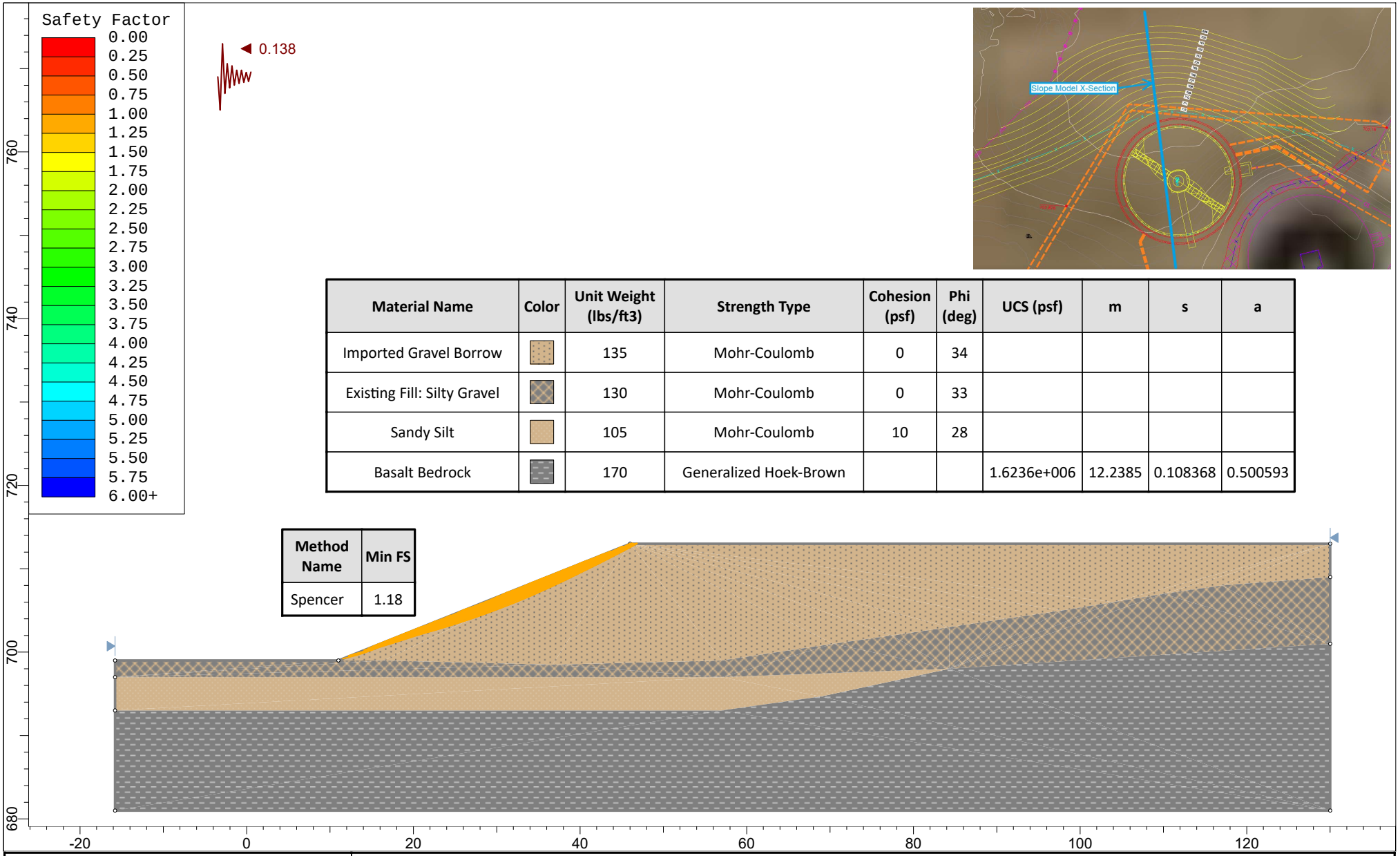
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	m	s	a
Imported Gravel Borrow		135	Mohr-Coulomb	0	34				
Existing Fill: Silty Gravel		130	Mohr-Coulomb	0	33				
Sandy Silt		105	Mohr-Coulomb	10	28				
Basalt Bedrock		170	Generalized Hoek-Brown			1.6236e+006	12.2385	0.108368	0.500593

Method Name	Min FS
Spencer	1.69

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

SLIDEINTERPRET 7.038

Project	City of Grandview WWTP Upgrades Project		
Analysis Description	Proposed 2.5H:1V Fill Slope north of New Secondary Clarifier - Spencer Method - Static		
Drawn By	KAH	Scale 1:191	Company GN Northern, Inc.
Date			File Name Proposed North Slope 2.5to1.slim



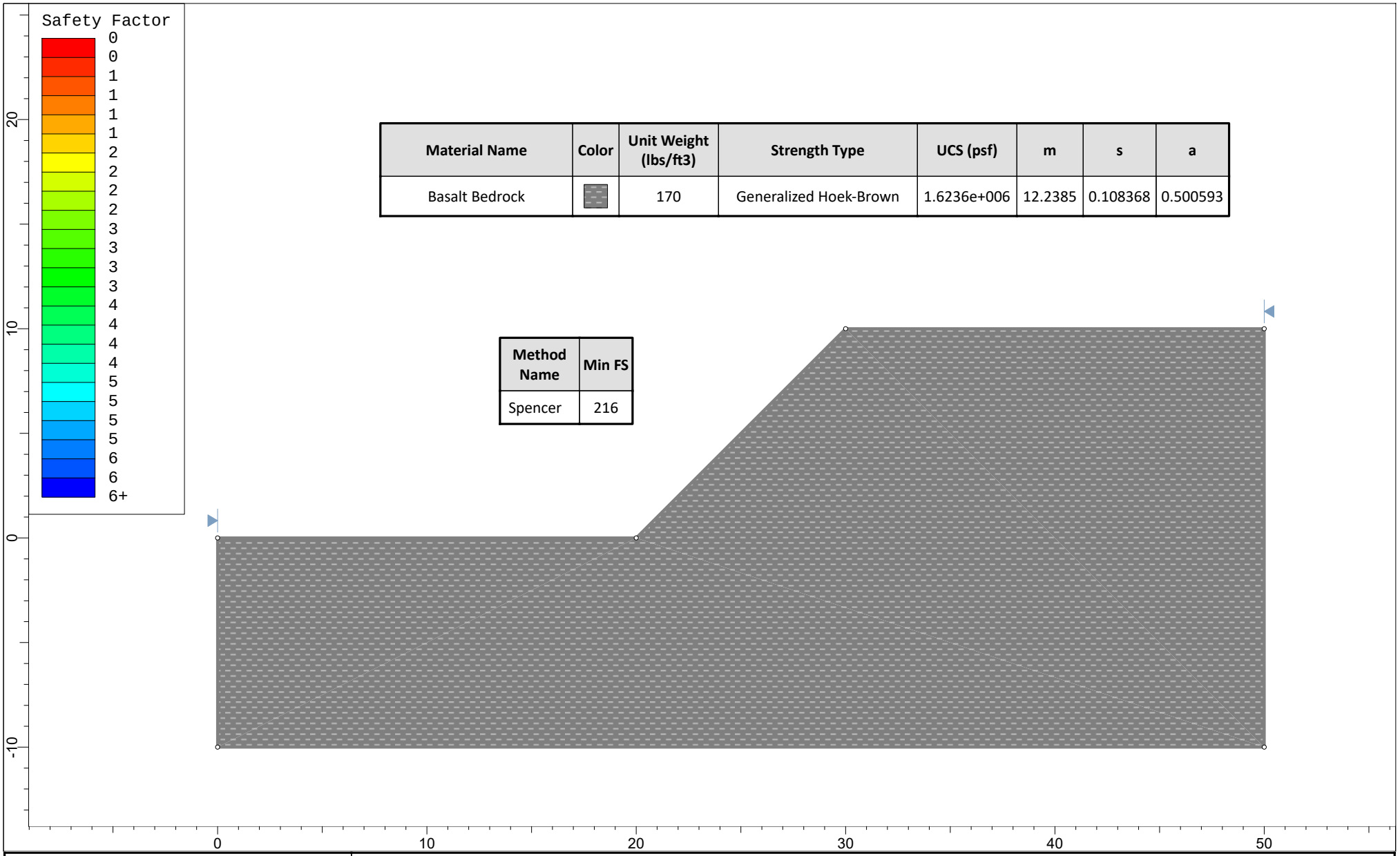
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	m	s	a
Imported Gravel Borrow		135	Mohr-Coulomb	0	34				
Existing Fill: Silty Gravel		130	Mohr-Coulomb	0	33				
Sandy Silt		105	Mohr-Coulomb	10	28				
Basalt Bedrock		170	Generalized Hoek-Brown			1.6236e+006	12.2385	0.108368	0.500593

Method Name	Min FS
Spencer	1.18

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

SLIDEINTERPRET 7.038

Project	City of Grandview WWTP Upgrades Project		
Analysis Description	Proposed 2.5H:1V Fill Slope north of New Secondary Clarifier - Spencer Method - Seismic		
Drawn By	KAH	Scale 1:191	Company GN Northern, Inc.
Date			File Name Proposed North Slope 2.5to1.slim



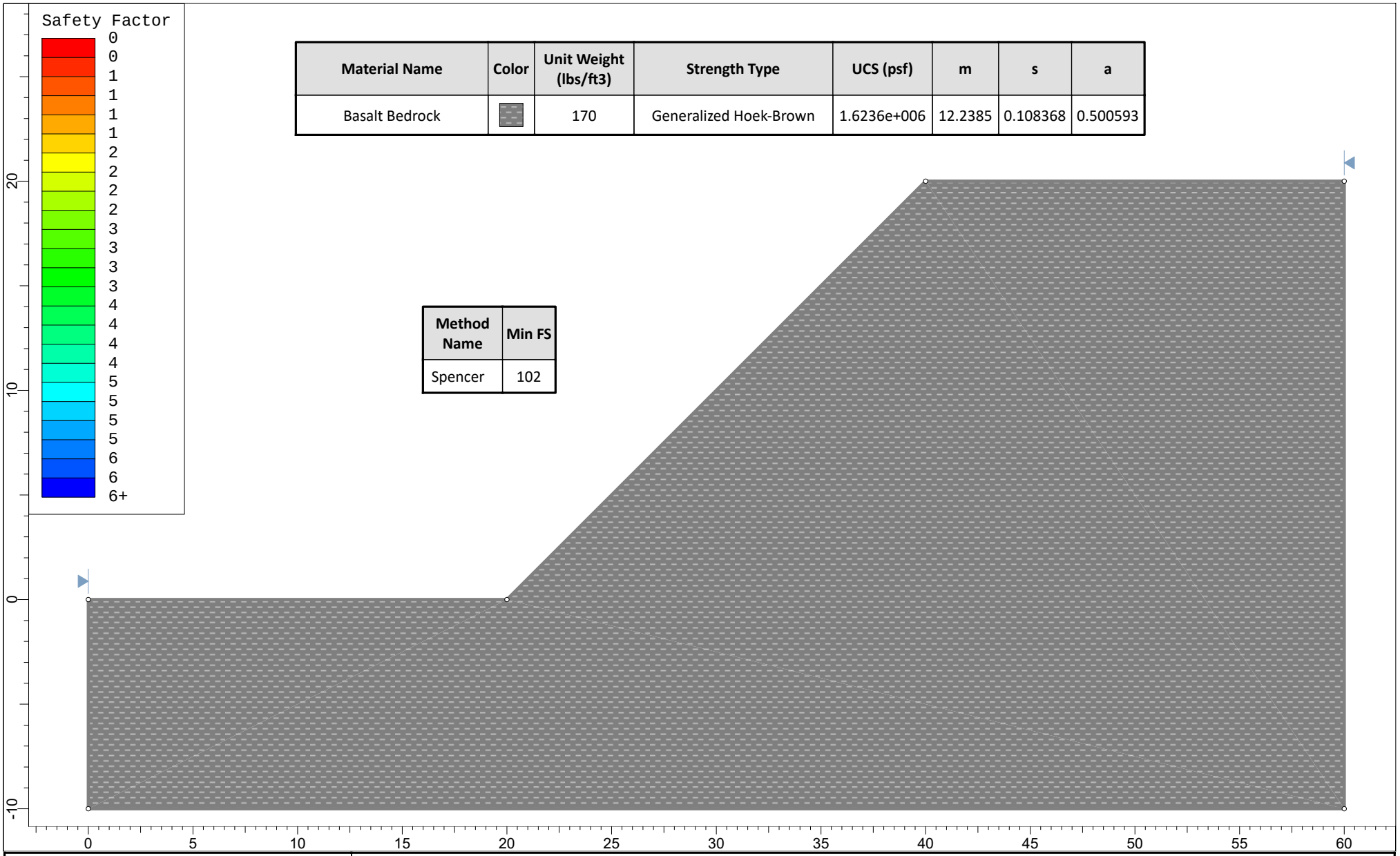
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
Basalt Bedrock		170	Generalized Hoek-Brown	1.6236e+006	12.2385	0.108368	0.500593

Method Name	Min FS
Spencer	216

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

SLIDEINTERPRET 7.038

Project	City of Grandview WWTP Upgrades Project		
Analysis Description	Presumed 1H:1V (10-foot tall) Cut Slope for New Lagoon Embankments - Spencer Method - Static		
Drawn By	KAH	Scale 1:76	Company GN Northern, Inc.
Date			File Name Lagoon Cut Slope 1to1 10ft.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
Basalt Bedrock		170	Generalized Hoek-Brown	1.6236e+006	12.2385	0.108368	0.500593

Method Name	Min FS
Spencer	102

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

SLIDEINTERPRET 7.038

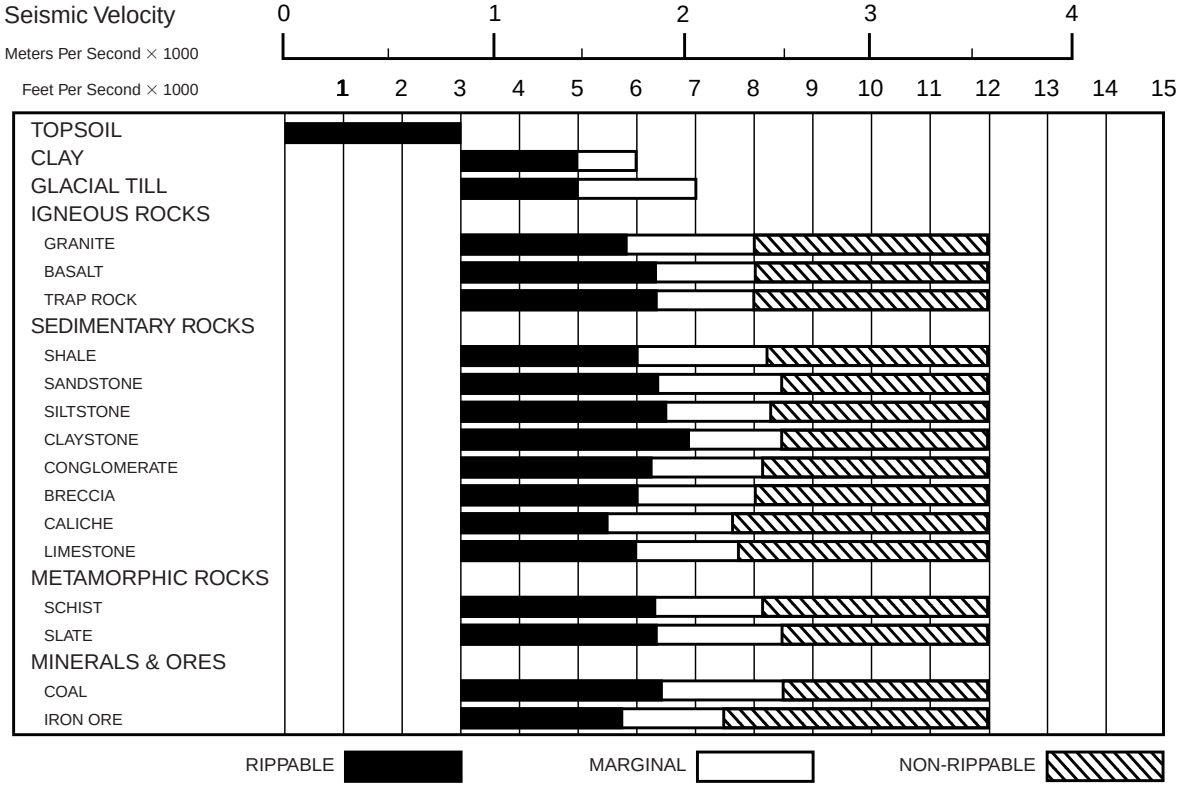
Project	City of Grandview WWTP Upgrades Project		
Analysis Description	Presumed 1H:1V (20-foot tall) Cut Slope for New Lagoon Embankments - Spencer Method - Static		
Drawn By	KAH	Scale 1:76	Company GN Northern, Inc.
Date			File Name Lagoon Cut Slope 1to1 20ft.slim

Appendix VII

CAT Rippability Charts

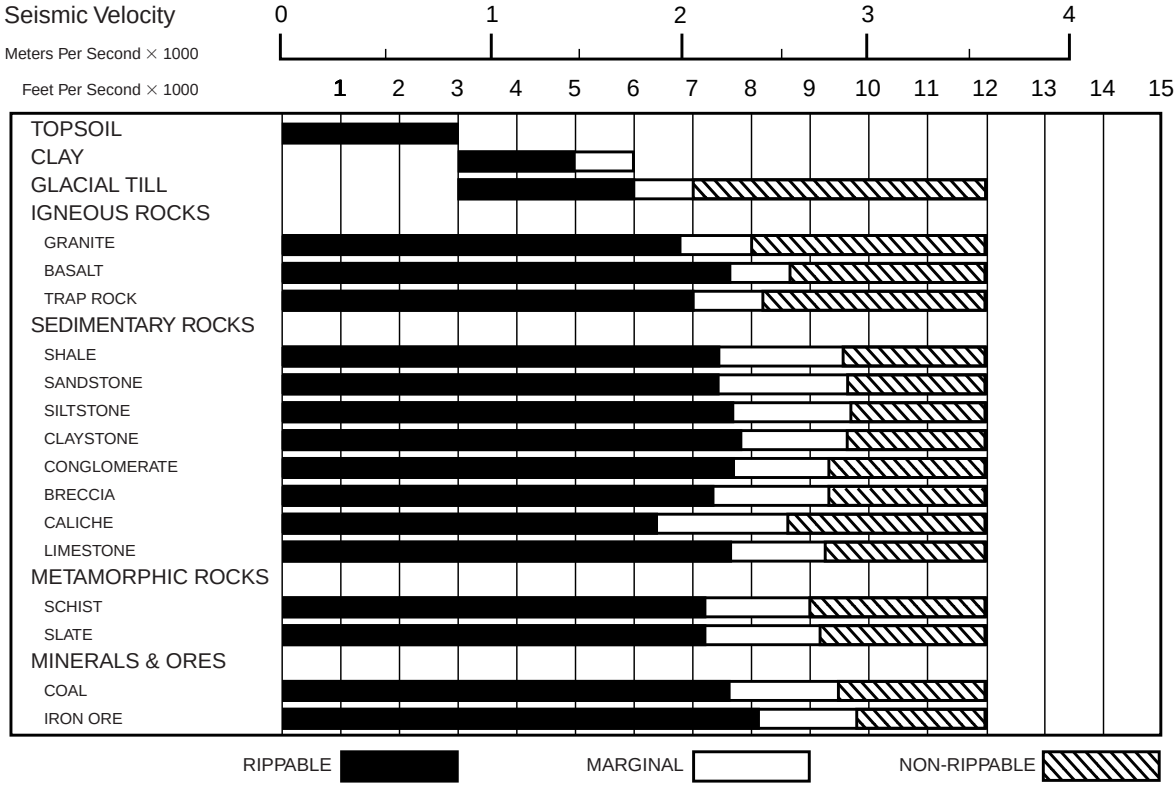
D8R

- **Multi or Single Shank No. 8 Ripper**
- **Estimated by Seismic Wave Velocities**



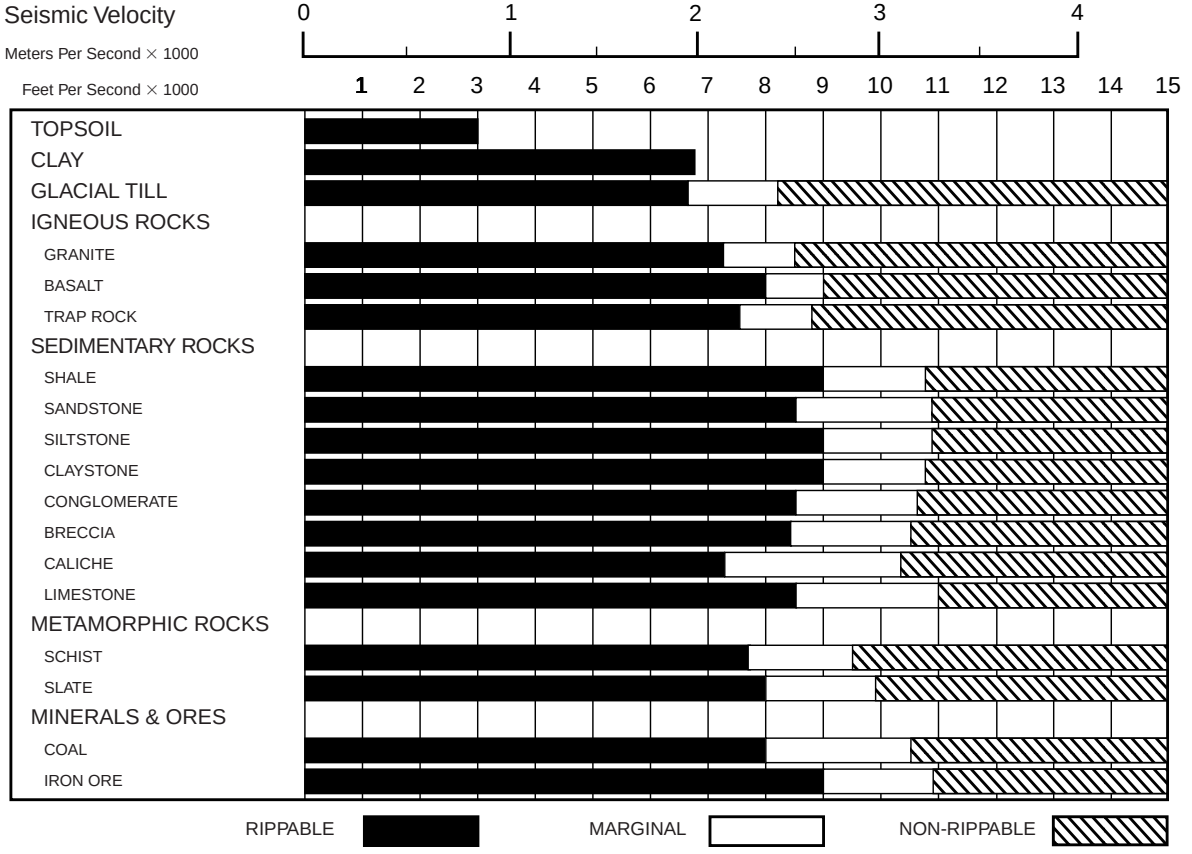
D9R

- **Multi or Single Shank No. 9 Ripper**
- **Estimated by Seismic Wave Velocities**



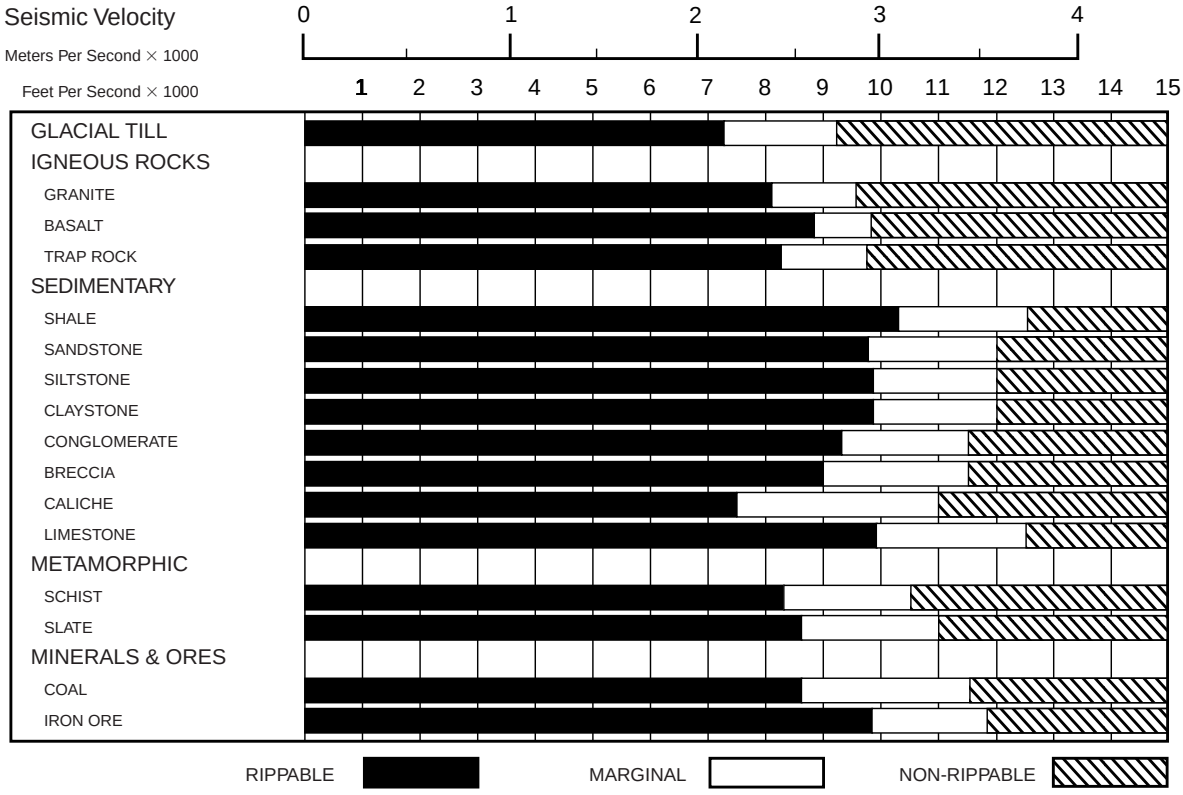
D10R

- **Multi or Single Shank No. 10 Ripper**
- **Estimated by Seismic Wave Velocities**



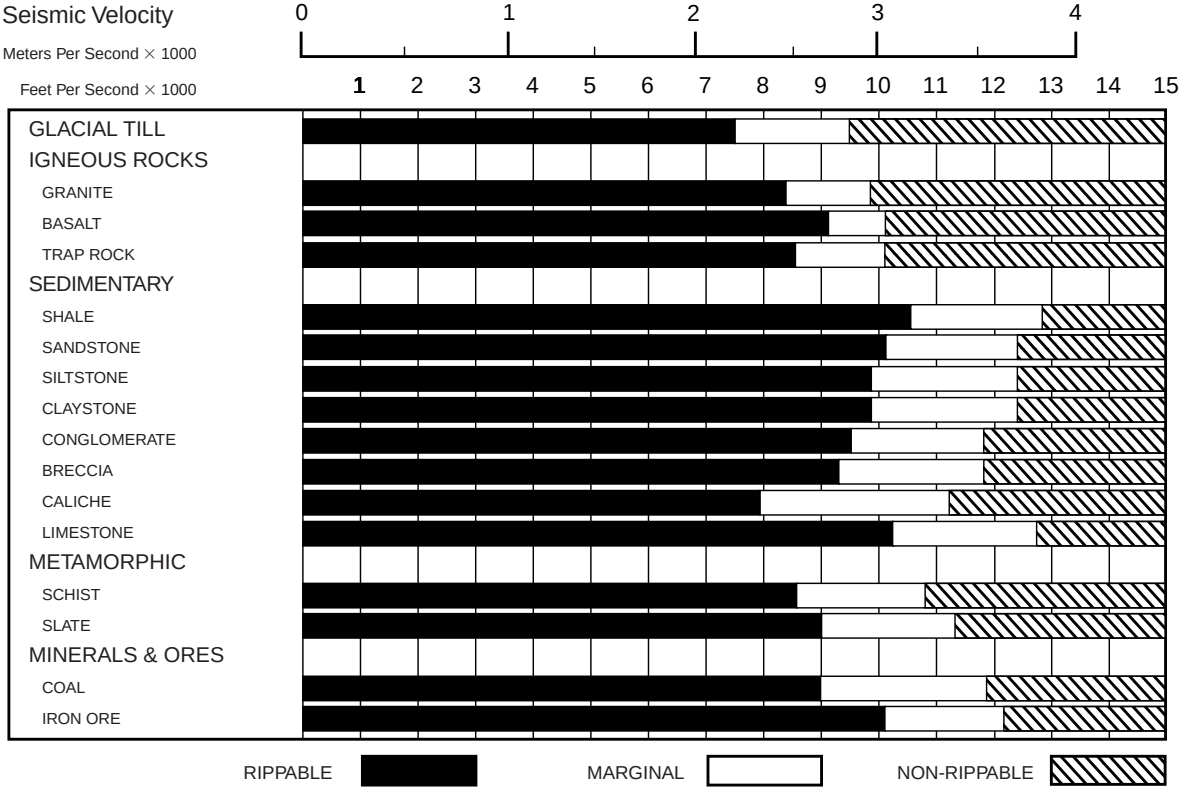
D11R

- **Multi or Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**



D11R CD

- **Single Shank No. 11 Ripper**
- **Estimated by Seismic Wave Velocities**



Northern, Inc.

Appendix VIII

NRCS Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

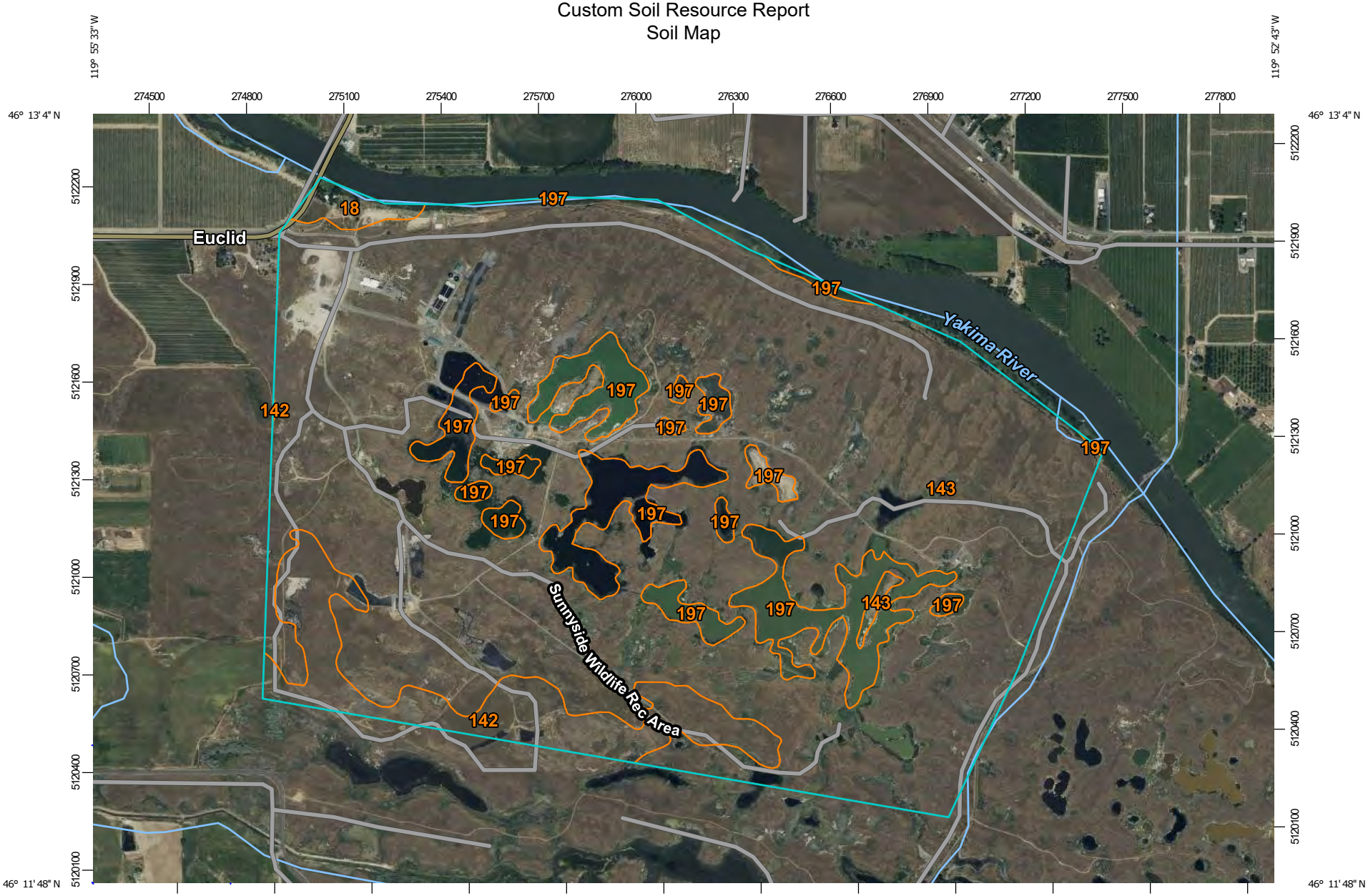
Custom Soil Resource Report for Yakima County Area, Washington

Waste Water Treatment Plant Grandview, WA



July 19, 2024

Custom Soil Resource Report
Soil Map



Map Scale: 1:16,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 200 400 800 1200

Feet
0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Yakima County Area, Washington

18—Cleman very fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 29rt
Elevation: 400 to 2,000 feet
Mean annual precipitation: 8 to 12 inches
Mean annual air temperature: 48 to 54 degrees F
Frost-free period: 135 to 200 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Cleman and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cleman

Setting

Landform: Flood plains, alluvial fans
Parent material: Alluvium

Typical profile

H1 - 0 to 10 inches: very fine sandy loam
H2 - 10 to 40 inches: stratified loamy fine sand to silt loam
H3 - 40 to 60 inches: stratified sand to loamy sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R007XY930WA - Loamy Bottom
Hydric soil rating: No

142—Starbuck silt loam, 2 to 15 percent slopes

Map Unit Setting

National map unit symbol: 29qh

Elevation: 400 to 2,700 feet
Mean annual precipitation: 6 to 12 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 115 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition
Starbuck and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Starbuck

Setting
Landform: Structural benches, hillslopes
Parent material: Loess and residuum derived from basalt

Typical profile
H1 - 0 to 9 inches: silt loam
H2 - 9 to 16 inches: gravelly silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities
Slope: 2 to 15 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.8 inches)

Interpretive groups
Land capability classification (irrigated): 6s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R007XY120WA - Stony
Hydric soil rating: No

143—Starbuck-Rock outcrop complex, 0 to 45 percent slopes

Map Unit Setting
National map unit symbol: 29qj
Elevation: 400 to 2,700 feet
Mean annual precipitation: 6 to 12 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 115 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition
Starbuck and similar soils: 50 percent
Rock outcrop: 25 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Starbuck

Setting

Landform: Structural benches, hillslopes
Parent material: Loess and residuum derived from basalt

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 16 inches: gravelly silt loam
H3 - 16 to 20 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 45 percent
Depth to restrictive feature: 12 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R007XY120WA - Stony
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

R - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 45 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

197—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Northern, Inc.

Appendix IX

Washington Department of Ecology Well Logs

3729

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 033543

Water Right Permit No. 5

(1) OWNER: Name City of Grandview Address Waste Water Plant

(2) LOCATION OF WELL: County Yakima NE ¼ SE ¼ Sec 2 T. 8 N., R. 23 W.M.

(2a) STREET ADDRESS OF WELL (or nearest address)

(3) PROPOSED USE: ☐ Domestic ☐ Irrigation ☐ DeWater ☐ Industrial ☐ Test Well ☒ Municipal ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) MW 203

Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐ Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8" inches. Drilled 123' feet. Depth of completed well 92' ft.

(6) CONSTRUCTION DETAILS:

Casing installed: ____" Diam. from ____ ft. to ____ ft.
Welded ☐ Liner installed ☐ Threaded ☒ 2" Diam. from -2½ ft. to 92 ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name ArdVark
Type Slotted PVC Model No.
Diam. 2" Slot size 30 from 87 ft. to 77 ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☒ No ☐ Size of gravel 8/12
Gravel placed from 92' ft. to 67' ft.

Surface seal: Yes ☒ No ☐ To what depth? 67' ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ____ ft.
Static level 23 ft. below top of well Date
Artesian pressure ____ lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Airtest ____ gal./min. with stem set at ____ ft. for ____ hrs.
Artesian flow ____ g.p.m. Date
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Silt Sand	0'	1'
Basalt	1'	78'
Broken Basalt Sand-Stone Clay	78'	113'
Blue Clay Broken Basalt	113'	123'

RECEIVED
SEP 10 1990
DEPARTMENT OF ECOLOGY
CENTRAL REGION OFFICE

ENTERED

Work started 8/27, 19. Completed 8/28, 1990

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME ONWEGO Drilling (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address Rt. 14 Box 3010 Kenn WA

(Signed) Brad Wade (WELL DRILLER) License No. 1494

Contractor's Registration No. ONWEGDC120D8 Date Sept 7, 1990

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

89673

RECEIVED
AUG 18 2000

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. W108726
Unique Well I.D. # AEQ268
Water Right Permit No.

(1) OWNER: Name CITY OF GRANDVIEW Address 207 WEST SECOND STREET GRANDVIEW,, WA

(2) LOCATION OF WELL: County YAKIMA - NE 1/4 SE 1/4 Sec 2 T 8 N., R 23W WM

(2a) STREET ADDRESS OF WELL (or nearest address) ,

5

(3) PROPOSED USE: DOMESTIC

(4) TYPE OF WORK: Owner's Number of well (If more than one)
NEW WELL Method: ROTARY

(5) DIMENSIONS: Diameter of well 8 inches
Drilled 180 ft. Depth of completed well 180 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 8 " Dia. from +2 ft. to 155 ft.
WELDED " Dia. from ft. to ft.
" Dia. from ft. to ft.

Perforations: NO
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: YES
Manufacturer's Name JOHNSON
Type SLOTTED Model No. STAINLESS
Diam. 8 slot size 10 from 155 ft. to 170 ft.
Diam. slot size from ft. to ft.

Gravel packed: NO Size of gravel
Gravel placed from ft. to ft.

Surface seal: YES To what depth? 20 ft.
Material used in seal BENTONITE
Did any strata contain unusable water? NO
Type of water? Depth of strata ft.
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level ... ft.
Static level 65 ft. below top of well Date 05/24/00
Artesian Pressure lbs. per square inch Date
Artesian water controlled by

(9) WELL TESTS: Drawdown is amount water level is lowered below static level.
Was a pump test made? NO If yes, by whom?
Yield: gal./min with ft. drawdown after hrs.

Recovery data
Time | Water Level | Time | Water Level | Time | Water Level

Date of test / /
Bailer test gal/min. ft. drawdown after hrs.
Air test 100+ gal/min. w/ stem set at 180 ft. for 3 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? NO

(10) WELL LOG

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change in formation.

MATERIAL	FROM	TO
PEA GRAVEL FILL	0	6
BASALT HARD	6	63
BASALT SOFT	63	80
FINE SANDSTONE W/WATER	80	88
SAND SANDSTONE GRAVEL	88	95
SANDSTONE CLAY GREEN	95	105
FRACTURED SHALE GREEN	105	161
W/WATER	161	
SAND FINE W/WATER	161	163
FRACTURED BASALT W/WATER	163	170
BASALT HARD	170	180
	180	

8" Ring at bottom of hole

Drill pin at bottom of screen assembly

Work started 05/17/00 Completed 05/24/00

WELL CONSTRUCTOR CERTIFICATION:
I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME FOGLE PUMP & SUPPLY, INC.
(Person, firm, or corporation) (Type or print)

ADDRESS POB 1450, AIRWAY HTS. WA.

[SIGNED] Marty Kuge 8/17 License No. 2038

Contractor's Registration No. FOGLEPSO95L4 Date 06/05/00

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

Application No. ____

Permit No. GB-20385P

(1) **OWNER:** Name City of GRANDVIEW Address [illegible]

(2) **LOCATION OF WELL:** County Yakima NW SE SE NE ¼ Sec. 3 T. 8 N., R. 23 W.M.

Bearing and distance from section or subdivision corner 625 FT N of & 384' W of E¼ CORNER of Sec 3

PROPOSED USE: Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ____
New well ☒ Method: Dug ☐ Bored ☐
Deepened ☒ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 150' ft. Depth of completed well 700' ft.

(6) CONSTRUCTION DETAILS: 6" ID
Casing installed: 6¼" Diam. from 700' ft. to 690' ft.
Threaded ☐ ____" Diam. from ____ ft. to ____ ft.
Welded ☐ ____" Diam. from ____ ft. to ____ ft.

Perforations: Yes ☐ No ☒
Type of perforator used ____
SIZE of perforations ____ in. by ____ in.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.
____ perforations from ____ ft. to ____ ft.

Screens: Yes ☐ No ☒
Manufacturer's Name ____
Type ____ Model No. ____
Diam. ____ Slot size ____ from ____ ft. to ____ ft.
Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel packed: Yes ☐ No ☒ Size of gravel: ____
Gravel placed from ____ ft. to ____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 16 ft.
Material used in seal ____
Did any strata contain unusable water? Yes ☐ No ☐
Type of water? ____ Depth of strata ____
Method of sealing strata off ____

(7) PUMP: Manufacturer's Name Fairbanks Horse
Type: Submersible [illegible]

(8) WATER LEVELS: Land-surface elevation above mean sea level 760
Static level 75 ft. below top of well Date ____
Artesian pressure ____ lbs. per square inch Date ____
Artesian water is controlled by ____ (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☒ If yes, by whom? ____
Yield: 45 gal./min. with 80 ft. drawdown after 10 hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test No
Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.
Artesian flow No g.p.m. Date ____
Temperature of water ____ Was a chemical analysis made? Yes ☐ No ☐

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Grey BASALT	200	627
Caliche + Brown Rock	627	625
SANDSTONE & CLAY	625	605
Blue Shale	605	561
SANDSTONE	561	550

Work started ____ 19 ____ Completed ____ 19 ____

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Crove (Person, firm, or corporation) (Type or print)
Address ____
[Signed] ____ (Well Driller)
License No. ____ Date ____ 19 ____

S. F. No. 7356—OS—(Rev. 4-71). (USE ADDITIONAL SHEETS IF NECESSARY)

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

Appendix X

ASCE 7-16 Seismic Parameters

ASCE Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	46.213802
Risk Category:	III	**Longitude:**	-119.91262
Soil Class:	B - Rock	**Elevation:**	708.683367002014 ft (NAVD 88)





Seismic

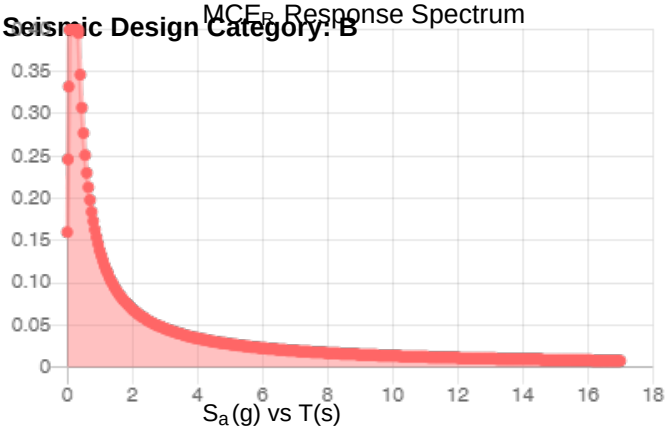
Site Soil Class: B - Rock

Results:

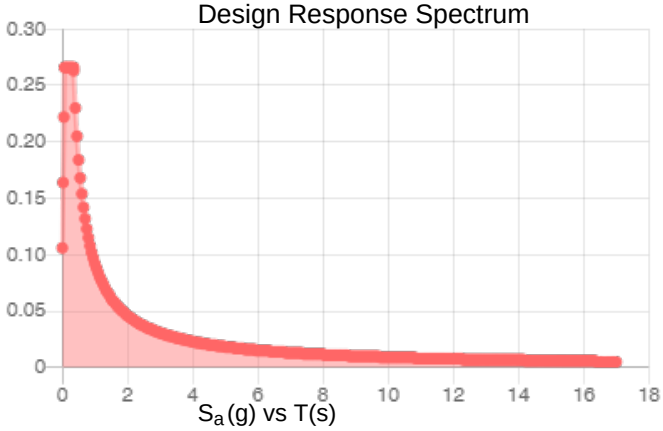
S_S :	0.443	S_{D1} :	0.092
S_1 :	0.173	T_L :	16
F_a :	0.9	PGA :	0.199
F_v :	0.8	PGA_M :	0.179
S_{MS} :	0.399	F_{PGA} :	0.9
S_{M1} :	0.138	I_e :	1.25
S_{DS} :	0.266	C_v :	0.848

Seismic Design Category: B

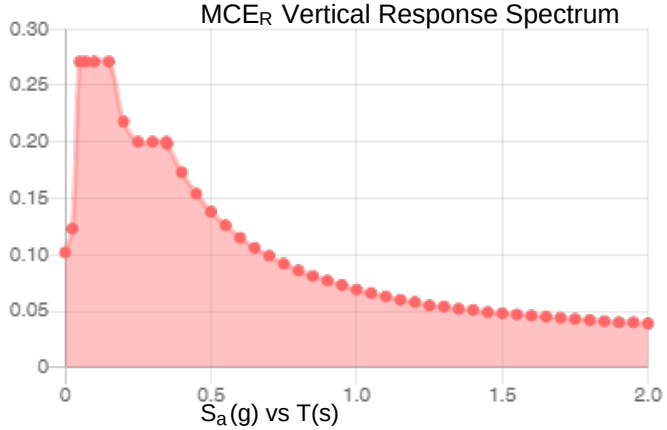
MCE_R Response Spectrum



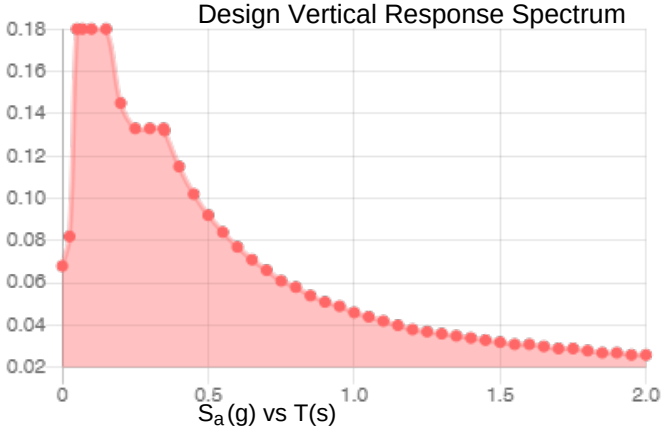
Design Response Spectrum



MCE_R Vertical Response Spectrum



Design Vertical Response Spectrum



Data Accessed: **Fri Aug 02 2024**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

APPENDIX C

EQUIPMENT, VALVE, AND INSTRUMENTATION LISTS

Equipment List

Type	Reliability	HLA Tag ID #	Description	New or Existing	Location	Motor	Design Point	Control Description	Make and Model Design Basis
Submersible Pump	1 pump per 1.5 trains. 1 redundant	04 PMP 01	Influent Lift Station Pump No.1	New	New Influent Pump Station	15 hp, 460V, 3 ph	800 gpm @ 47ft TDH	On/off from SCADA	
Submersible Pump	1 pump per 1.5 trains. 1 redundant	04 PMP 02	Influent Lift Station Pump No.2	New	New Influent Pump Station	15 hp, 460V, 3 ph	800 gpm @ 47ft TDH	On/off from SCADA	
Submersible Pump	1 pump per 1.5 trains. 1 redundant	04 PMP 03	Influent Lift Station Pump No.3	New	New Influent Pump Station	15 hp, 460V, 3 ph	800 gpm @ 47ft TDH	On/off from SCADA	
Submersible Pump	1 pump per 1.5 trains. 1 redundant		Influent Lift Station Pump No. 4	(Future)	New Influent Pump Station	15 hp, 460V, 3 ph	800 gpm @ 47ft TDH	On/off from SCADA	
Ultraviolet Disinfection Bank	100% Capacity with 1 bank out of service	08 UV 01	UV Bank 1	New	UV Building UV Room	7 kW, 460V, 3 phase	2 banks treat 2.25 MGD @ 55% UVT	Manufacturer control panel, connect into SCADA	Aquaray 40 HO VLS
Ultraviolet Disinfection Bank	100% Capacity with 1 bank out of service	08 UV 02	UV Bank 2	New	UV Building UV Room	7 kW, 460V, 3 phase	2 banks treat 2.25 MGD @ 55% UVT	Manufacturer control panel, connect into SCADA	Aquaray 40 HO VLS
Sludge Holding Tank Mixer	Not required	10 MXR 01	Sludge Holding Tank Mixer No. 1	New	Existing Sludge Holding Tank	5 hp, 460V, 3 phase	1.5% Solids, No Air	Operates continuously down to 6' water over the mixer body.	Invent HyperClassic HCM 2500-22
Sludge Holding Tank Mixer	Not required	10 MXR 02	Sludge Holding Tank Mixer No. 2	New	Existing Sludge Holding Tank	5 hp, 460V, 3 phase	1.5% Solids, No Air	Operates continuously down to 6' water over the mixer body.	Invent HyperClassic HCM 2500-22
Sludge Holding Tank Mixer	Not required	10 MXR 03	Sludge Holding Tank Mixer No. 3	New	New Sludge Holding Tank	10 hp, 460V, 3 phase	1.5% Solids, No Air	Operates continuously down to 6' water over the mixer body.	Invent HyperClassic HCM 2500-30
Sludge Holding Tank Mixer	Not required	10 MXR 04	Sludge Holding Tank Mixer No. 4	New	New Sludge Holding Tank	10 hp, 460V, 3 phase	1.5% Solids, No Air	Operates continuously down to 6' water over the mixer body.	Invent HyperClassic HCM 2500-30
Sludge Holding Tank Mixer	Not required	10 MXR 05	Sludge Holding Tank Mixer No. 5	New	New Sludge Holding Tank	10 hp, 460V, 3 phase	1.5% Solids, No Air	Operates continuously down to 6' water over the mixer body.	Invent HyperClassic HCM 2500-30
Sludge Holding Tank Mixer	Not required	10 MXR 06	Sludge Holding Tank Mixer No. 6	New	New Sludge Holding Tank	10 hp, 460V, 3 phase	1.5% Solids, No Air	Operates continuously down to 6' water over the mixer body.	Invent HyperClassic HCM 2500-30
Centrifugal or Positive Displacement Blower	Assume 1 redundant	11 B 01	Sludge Holding Tank Blower No. 1	Existing - To Be Demo'd	Blower Room	75 hp, 460V, 3 phase	1000 scfm	Not needed in upgraded plant - Equipment to be demolished.	
Centrifugal or Positive Displacement Blower	Assume 1 redundant	11 B 02	Sludge Holding Tank Blower No. 2	Existing - To Be Demo'd	Blower Room	75 hp, 460V, 3 phase	1000 scfm	Not needed in upgraded plant - Equipment to be demolished.	
WAS Pump	1 Redundant	11 PMP 01	Gormann Rupp WAS Pump No. 1	Existing	New Dewatering Building	3 hp, 460V, 3 phase	160 gpm @ 20 ft TDH	VFD Control from SCADA	Gormann Rupp T4A3S-B
WAS Pump	1 Redundant	11 PMP 02	Gormann Rupp WAS Pump No. 2	Existing	New Dewatering Building	3 hp, 460V, 3 phase	160 gpm @ 20 ft TDH	VFD Control from SCADA	Gormann Rupp T4A3S-B
WAS Pump	1 Redundant	11 PMP 03	Gormann Rupp WAS Pump No. 3	Existing	New Dewatering Building	3 hp, 460V, 3 phase	160 gpm @ 20 ft TDH	VFD Control from SCADA	Gormann Rupp T4A3S-B
Chemical Pump	None	11 PMP 04	Polymer Chemical Pump	New	New Dewatering Building	1/3 hp	0.5 - 3.0 gpm	Manufacturer control panel	FKC
Chemical Pump	None	11 PMP 05	Polymer Chemical Pump	New	New Dewatering Building	1/3 hp	0.5 - 3.0 gpm	Manufacturer control panel	FKC
Chemical Pump	None	11 PMP 06	Polymer Chemical Pump	New	New Dewatering Building	1/3 hp	0.5 - 3.0 gpm	Manufacturer control panel	FKC
Drain Pump	1 Redundant	11 PMP 07	Drain Pump No. 1	New	New Drain Pump Station	5 hp, 460V, 3 phase	420 gpm @ 15 ft TDH	Manufacturer control panel	Flygt 3315-420
Drain Pump	1 Redundant	11 PMP 08	Drain Pump No. 2	New	New Drain Pump Station	5 hp, 460V, 3 phase	420 gpm @ 15 ft TDH	Manufacturer control panel	Flygt 3315-420
Screw Press	1 Redundant	11 SP 01	Screw Press No. 1	New	New Dewatering Building	3 hp, 460V, 3 phase	700 dry lbs per hour, 160 gpm at 1.5% solids	VFD - Manufacturer control panel	FKC Screwpress BHX 1100 x 6000L
Screw Press	1 Redundant	11 SP 02	Screw Press No. 2	New	New Dewatering Building	3 hp, 460V, 3 phase	700 dry lbs per hour, 160 gpm at 1.5% solids	VFD - Manufacturer control panel	FKC Screwpress BHX 1100 x 6000L
Screw Press	1 Redundant	11 SP 03	Screw Press No. 3	New	New Dewatering Building	3 hp, 460V, 3 phase	700 dry lbs per hour, 160 gpm at 1.5% solids	VFD - Manufacturer control panel	FKC Screwpress BHX 1100 x 6000L
Floculation Tank Mixer	None	11 MXR 01	Floculation Tank No. 1	New	New Dewatering Building	1.5 hp, 460V, 3 phase	-	Operates in tandem with screw press 01	FKC Model 540 Gal Tank
Floculation Tank Mixer	None	11 MXR 02	Floculation Tank No. 2	New	New Dewatering Building	1.5 hp, 460V, 3 phase	-	Operates in tandem with screw press 02	FKC Model 540 Gal Tank
Floculation Tank Mixer	None	11 MXR 03	Floculation Tank No. 3	New	New Dewatering Building	1.5 hp, 460V, 3 phase	-	Operates in tandem with screw press 03	FKC Model 540 Gal Tank
Inclined Sludge Conveyor	None	11 SC 01	9-inch Shaftless Screw	New	New Dewatering Building	3 hp, 460V, 3 phase	-	Operates in tandem with screw press 01	FKC Conveyor 9-inch Stainless, 25' Long
Inclined Sludge Conveyor	None	11 SC 02	9-inch Shaftless Screw	New	New Dewatering Building	3 hp, 460V, 3 phase	-	Operates in tandem with screw press 02	FKC Conveyor 9-inch Stainless, 25' Long
Inclined Sludge Conveyor	None	11 SC 03	9-inch Shaftless Screw	New	New Dewatering Building	3 hp, 460V, 3 phase	-	Operates in tandem with screw press 03	FKC Conveyor 9-inch Stainless, 25' Long
Horizontal Sludge Conveyor	None	11 SC 04	9-inch Shaftless Screw	New	New Dewatering Building	3 hp, 460V, 3 phase	-	Selective alternative dumping location - at City option.	FKC Conveyor 9-inch Stainless, 30' long
Belt Filter Press	PiltPF	11 BFP 01	Belt Filter Press	Existing	Existing Sludge Handling Building		3,800 lb/hr solids. 300 gpm at 2.5% solids	Manufacturer control panel	
Belt Filter Press	PiltPF	11 BFP 02	Belt Filter Press	Existing	Existing Sludge Handling Building		3,800 lb/hr solids. 300 gpm at 2.5% solids	Manufacturer control panel	

Note: Lists in Appendix C are provided for Contractor reference only and does not necessarily constitute a comprehensive list of equipment, valves, and instrumentation to be supplied on the project.

Instrument List

Type	HLA Tag ID #	Size (in)	DESCRIPTION	Spec Section	Location	Operation	New or Existing
Float Switch	04 FS 01	N/A	Influent Pump Station Low Level Float	40 70 11	New Influent Lift Station	Passive	New
Float Switch	04 FS 02	N/A	Influent Pump Station Emergency Low Level Float	40 70 11	New Influent Lift Station	Passive	New
Submerssible Transducer	04 LT 01	N/A	Influent Pump Station Submerisble Level Transducer	40 70 11	New Influent Lift Station	Passive	New
Electromagnetic Flow Meter	04 FM 01	12	Influent Pump Station Flow Meter	40 70 11	New Influent Lift Station	Passive	New
Ultrasonic Level Sensor	07 LT 01	N/A	Effluent Flow Meter	40 70 11	UV Effluent Channel	Passive	Existing
Submerssible Transducer	10 LT 01	N/A	Existing Sludge Tank Submerisble Level Transducer	40 70 11	Existing Sludge Tank	Passive	New
Submerssible Transducer	10 LT 02	N/A	New Sludge Tank Submerisble Level Transducer	40 70 11	New Sludge Tank	Passive	New
Magnetic Flow Meter	11 FM 01	4	Influent To Floc. Tank	40 70 11	Dewatering Building	Passive	New
Magnetic Flow Meter	11 FM 02	4	Influent To Floc. Tank	40 70 11	Dewatering Building	Passive	New
Magnetic Flow Meter	11 FM 03	4	Influent To Floc. Tank	40 70 11	Dewatering Building	Passive	New
Magnetic Flow Meter	11 FM 04	6"	Drain Pump Station Flow Meter	40 70 11	Drain Pump Station Valve Vault	Passive	New
Ultrasonic Level Sensor	07 LS 01	N/A	Effluent Flow Meter	40 70 11	UV Channel	Passive	Existing

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Valve List

Type	HLA Tag ID #	Size (in)	P&ID	Description	Spec Section	Location	Operation	New or Existing
Gate	04GT01	18"	G-9	Control Box C Level Bypass	40 20 12 - 2.21	Control Box C	Manual	Existing
Gate	04GT02	36"	G-9	Aqua Level Setting	40 20 12 - 2.21	Control Box C	Manual	Existing
Duckbill Check Valve	04V01	3" FL	G-9	Influent Pump Station Valve Vault Drain	40 20 12 - 2.13	Influent Pump Station Wetwell	Passive	New
Check Valve	04V02	8" FL x FL	G-9	Influent Pump Station Valve Vault	40 20 12 - 2.08	Influent Pump Station Valve Vault	Passive	New
Check Valve	04V03	8" FL x FL	G-9	Influent Pump Station Valve Vault	40 20 12 - 2.08	Influent Pump Station Valve Vault	Passive	New
Check Valve	04V04	8" FL x FL	G-9	Influent Pump Station Valve Vault	40 20 12 - 2.08	Influent Pump Station Valve Vault	Passive	New
Plug Valve	04V05	8" FL x FL	G-9	Influent Pump Station Valve Vault	40 20 12 - 2.06	Influent Pump Station Valve Vault	Manual	New
Plug Valve	04V06	8" FL x FL	G-9	Influent Pump Station Valve Vault	40 20 12 - 2.06	Influent Pump Station Valve Vault	Manual	New
Plug Valve	04V07	8" FL x FL	G-9	Influent Pump Station Valve Vault	40 20 12 - 2.06	Influent Pump Station Valve Vault	Manual	New
Gate	07GT01		G-10	UV Bypass Gate	40 20 12 - 2.21	UV Room	Manual	Existing
Plug Valve	07V01	18"	G-10	UV Bypass Valve	40 20 12 - 2.06	UV Room	Manual	Existing
Air Relief Valve	07V02	1"	G-10	UV Inlet Valve	40 20 12 - 2.18	UV Room	Manual	New
Butterfly Valve	07V03	16"	G-10	UV Outlet Isolation	40 20 12 - 2.04	UV Room	Manual	New
Butterfly Valve	07V04	16"	G-10	UV Outlet Isolation	40 20 12 - 2.04	UV Room	Manual	New
Butterfly Valve	07V05	16"	G-10	UV Inlet Isolation	40 20 12 - 2.04	UV Room	Manual	New
Butterfly Valve	07V06	16"	G-10	UV Inlet Isolation	40 20 12 - 2.04	UV Room	Manual	New
Plug Valve	10 V 01	6" MJ x 6" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	10 V 02	8" MJ x 8" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	10 V 03	6" MJ x 6" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	10 V 04	6" MJ x 6" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	10 V 05	6" MJ x 6" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	10 V 06	6" MJ x 6" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	10 V 07	6" MJ x 6" MJ		Sludge Holding Tank Isolation Valve	40 20 12 - 2.06	Between Sludge Holding Tanks	Manual	New
Plug Valve	11 V 01	4" FL x FL	G-11	Feed To Polymer Pump	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 02	4" FL x FL	G-11	Feed To Polymer Pump	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 03	4" FL x FL	G-11	Feed To Polymer Pump	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 04	4" FL x FL	G-11	Feed To Polymer Pump	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 05	4" FL x FL	G-11	Feed To Polymer Pump	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 06	4" FL x FL	G-11	Feed To Polymer Pump	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 07	4" FL x FL	G-11	Feed To Floc. Tank	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 08	4" FL x FL	G-11	Feed To Floc. Tank	40 20 12 - 2.06	Dewatering Building	Manual	New
Plug Valve	11 V 09	4" FL x FL	G-11	Feed To Floc. Tank	40 20 12 - 2.06	Dewatering Building	Manual	New
Check Valve	11 V 10	4" FL x FL	G-11	Feed To Sludge Pumps	40 20 12 - 2.08	Dewatering Building	Passive	New
Plug Valve	11 V 11	6" FL x FL	G-11	Feed To Floc. Tank	40 20 12 - 2.06	Drain Pump Station	Manual	New
Plug Valve	11 V 12	6" FL x FL	G-11	Feed To Floc. Tank	40 20 12 - 2.06	Drain Pump Station	Manual	New
Check Valve	11 V 13	6" FL x FL	G-11	Feed To Sludge Pumps	40 20 12 - 2.08	Drain Pump Station	Passive	New
Check Valve	11 V 14	6" FL x FL	G-11	Feed To Sludge Pumps	40 20 12 - 2.08	Drain Pump Station	Passive	New
Duckbill Check Valve	11 V 15	3" FL	G-11	Drain Pump Station Valve Vault Drain	40 20 12 - 2.13	Drain Pump Station	Passive	New

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