SPECIAL PROVISIONS

FOR

CITY OF SAN LUIS OBISPO

CALLE JOAQUIN LIFT STATION REPLACEMENT

Specification No. 91118A

October 2021

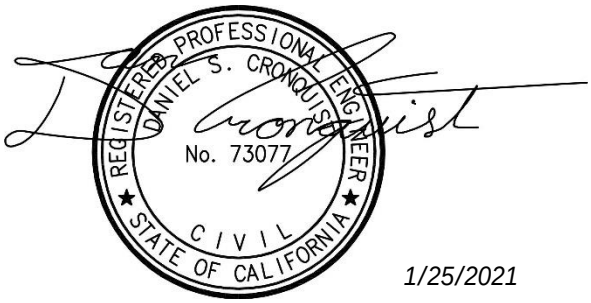
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

919 Palm Street
San Luis Obispo, CA 93401
(805) 781-7200

Calle Joaquin Lift Station Replacement

Specification No. 91118A

Approval Date: Council Approval _____



1/25/2021

Project Manager & Civil

1/25/2021

Structural

1/25/2021

Electrical

BID SUBMISSION

A **MANDATORY** pre-bid job walk will be held at the lift station site at 1625 Calle Joaquin, San Luis Obispo on **10:00 AM on November 3, 2021**. Contractors must wear proper personal protective equipment (PPE) at the Pre-Bid job walk and maintain 6 feet physical distancing.

Sealed bids must be MAILED to the following address:

City of San Luis Obispo
Public Works Department
919 Palm Street
San Luis Obispo, CA 93401
Attn: Jennifer Metz

Bids delivered in person will not be accepted. Bids may be mailed by postal carriers such as UPS, FedEX, DHL, etc. Regular courier companies not affiliated with the postal system are not acceptable. All mailed bids must be delivered and in possession of the Project Manager by:

2:00 p.m. on November 30, 2021

At which time they will be publicly opened and read aloud via Microsoft Teams video conference and conference call. In-person attendance of the bid opening will not be permitted in adherence to social distancing measures. Use the following link:

https://teams.microsoft.com/dl/launcher/launcher.html?url=%2F_%23%2Fl%2Fmeetup-join%2F19%3Ameeting_Nzk4NmU5ODItZGUwMS00NzE4LWIyNjUtYWQ5Njc0M2FiNmU3%40thread.v2%2F0%3Fcontext%3D%257b%2522Tid%2522%253a%2522a78b182d-94e4-4507-a9a9-330dcb148164%2522%252c%2522Oid%2522%253a%2522731f7aa7-816c-4100-abb2-0b608c4d79fd%2522%257d%26CT%3D1632758159224%26OR%3DOutlook-Body%26CID%3D68027078-EE69-4218-90A1-117D95202CC2%26anon%3Dtrue&type=meetup-join&deeplinkId=39b96630-f3f9-4a78-bbf1-0730f1f3299a&directDl=true&msLaunch=true&enableMobilePage=false&suppressPrompt=tru

or join by phone with this number: 1(209)645-4165 with Conference ID: 539 126 614#

Submit bid in a sealed envelope plainly marked:

Calle Joaquin Lift Station Replacement, Specification 91118A

Any bid received after the time and date specified will not be considered and will be returned to the bidder unopened.

By submission of bid you agree to comply with all instruction and requirements in this notice and the contract documents.

All bids must be submitted on the Bid Item List form(s) provided and submitted with all other Bid Forms included in these Special Provisions.

Each bid must be accompanied by either a:

1. certified check
2. cashier's check
3. bidder's bond

made payable to the City of San Luis Obispo for an amount equal to ten percent of the bid amount as a guaranty. Guaranty will be forfeited to the City San Luis Obispo if the bidder, to whom the contract is awarded, fails to enter into the contract.

The City of San Luis Obispo reserves the right to accept or reject any or all bids or waive any informality in a bid.

All bids are to be compared on the basis of the City Engineer's estimate of the quantities of work to be done, as shown on the Bid Item List.

Bids will only be accepted from bidders that are licensed in compliance with the provisions of Chapter 9, Division III of Business and Professions Code.

The award of the contract, if awarded, will be to the lowest responsive bid submitted by a responsible contractor whose bid complies with the requirements prescribed. If the contract is awarded, the contract will be awarded within 60 calendar days after the opening of the bids.

Failure to raise defects in the notice to bidders or bid forms prior to bid opening constitute a waiver of those defects.

BID DOCUMENTS

A copy of the plans and special provisions may be downloaded, free of charge, from the City's website at: http://www.slocity.org/publicworks/bids.asp

Standard Specifications and Engineering Standards referenced in the Special Provisions may be downloaded, free of charge, from the City's website at:
http://www.slocity.org/publicworks/slostandards.asp

You are responsible to obtain all issued addenda prior to bid opening. Addenda will be available to download at the City's website listed above or at the office of the City Engineer.

Contact the project manager, Jennifer Metz at (805) 781-7239 or Public Works Department at (805) 781-7200 prior to bid opening to verify the number of addenda issued.

You are responsible to verify your contact information is correct on the plan holders list located on the City's website at: http://www.slocity.org/publicworks/bids.asp.

PROJECT INFORMATION

The work involves construction of a new 6-inch and 12-inch gravity sewers, 10-inch sewer forcemain, San Luis Obispo Creek crossing consisting of a 6-inch double-barrel inverted siphon by horizontal directional drilling methods, 30-inch jack and bore under US-101, duplex pumping station with wet well and immersible pumps, and associated piping and manhole improvements, and removal, demolition, and abandonment of the existing lift station, equipment, piping and appurtenances. Additive work includes construction of a 16-inch jack and bore under two box culverts.

The project estimated construction cost is $6.0 Million.

Contract time is established as 300 working days. The following milestone items shall be completed within the time period defined below.

Milestone A

Completion of the submittal process, fabrication, factory testing, and delivery to the job site of the following major equipment shall occur within 200 working days from the Notice to Proceed:

- Immersible Pumps
- Electrical Switchgear Equipment
- Fiberglass Wet Well & Valve Vault
- Generator
- Magnetic Flow Meter

- Ductile Iron Pipe and Fittings
- Valves (plug, air release, etc.)
- Slide Gate
- HDPE Pipe

The fixed liquidated damages amount is established at $500 per day for failure to complete Milestone A within the contract time.

The fixed liquidated damages amount is established at $3,000 per day for failure to complete the work within the contract time.

In compliance with section 1773 of the Labor Code, the State of California Department of Industrial Relations has established prevailing hourly wage rates for each type of workman. Current wage rates may be obtained from the Division of Labor web site:
www.dir.ca.gov/DLSR/PWD/

QUALIFICATIONS

You must possess a valid Class A Contractor's License at the time of the bid opening.

You and any subcontractors required to pay prevailing wage, must be registered with the Department of Industrial Relations pursuant to Section 1725.5 of the Labor Code.

You must have experience constructing projects similar to the work specified for this project. Provide three similar reference projects completed as either the prime or subcontractor. One of the three reference projects must have been completed under contract with a City, County, State or Federal Government agency as the prime contractor. All referenced projects must be completed within the last five years from this project's bid opening date.

Referenced projects must include at least one each of lift station construction, sheet piling, dewatering, jack & bore, horizontal direction drilling, gravity pipeline, pressure pipeline, and projects requiring sewer diversion pumping.

Failure to provide reference projects as specified in this section and as required on the qualification form is cause to reject a bid as being non-responsive.

The City reserves the right to reject any bid based on non-responsiveness if a bidder fails to provide a bid that complies with all bidding instructions.

The City reserves the right to reject a responsive bid based on the non-responsibility of the bidder if the Director of Public Works or Designee finds, after providing notice and a hearing to the bidder, that the bidder lacks the

1. knowledge
2. experience,
3. or is otherwise not responsible

as defined in Section 3.24 of the San Luis Obispo Municipal Code to complete the project in the best interest of the City.

Rejected bidders may appeal this determination. Appeal must comply with the requirements in this Notice to Bidders.

It is the City of San Luis Obispo's intent to award the contract to the lowest responsive bid submitted by a responsible bidder. If in the bidder's opinion the contract has been or may be improperly awarded, the bidder may protest the contract award.

Protests must be filed no later than five working days after either:

1. bid opening date
2. notification of rejected bid.

Protest must be in writing and received by the project manager located at:

919 Palm Street
San Luis Obispo, CA 93401.

Valid protests must contain the following information:

1. the reasons for the protest
2. any supporting documentation
3. the ruling expected by the City to remedy the protest.

Any protest not containing all required information will be deemed invalid and rejected.

The City will consider additional documentation or other supporting information regarding the protest if submitted in compliance to the specified time limits. Anything submitted after the specified time limit will be rejected and not be considered.

The Director of Public Works or Designee may request additional information to be submitted within three days of the request, unless otherwise specified, and will notify the protester of ruling within ten days of determination.

In the event that protester is not satisfied with ruling, the protester may appeal the ruling to the City Council in compliance with Chapter 1.20 of the City of San Luis Obispo Municipal Code.

Pursuant to the Public Records Act (Government Code, § 6250, et seq.), the City will make public records available upon request.

AWARD

The lowest bidder will be determined using the TOTAL OF THE BASE BID PLUS THE ADDITIVE WORK.

As a condition to executing a contract with the City, two bonds each equal to one hundred percent of the total contract price are required in compliance with Section 3-1.05 of the Standard Specifications.

You may substitute securities for moneys withheld under the contract in compliance with the provisions of the Public Contract Code, Section 10263.

ACCOMMODATION

If any accommodations are needed to participate in the bid process, please contact Argelia Chang at (805) 781-7200. Telecommunications Device for the Deaf (805) 781-7107. Requests should be made as soon as possible to allow time for accommodation.

All bid forms must be completed and submitted with your bid. Failure to submit these forms and required bid bond will be cause to reject the bid as nonresponsive. Staple all bid forms together.

THE UNDERSIGNED, agrees that they have carefully examined:

1. the location of the proposed work
2. the plans and specifications
3. read the accompanying instructions to bidders

and propose to furnish all:

4. materials
5. labor

to complete all the required work satisfactorily in compliance with

6. plans
7. specifications
8. special provisions

for the prices set forth in the bid item list:

BID ITEM LIST FOR CALLE JOAQUIN LIFT STATION REPLACEMENT
SPECIFICATION NO. 91118A

Item No.	Item Description	Unit of Measure	Estimated Quantity	Item Price (in figures)	Total (in figures)
1.	Mobilization and Demobilization	LS	1	----	
2.	Storm Water Pollution Prevention	LS	1	----	
3.	Sheeting, Shoring and Bracing	LS	1	----	
4.	OSHA Compliance	LS	1	----	
5.	Permits and Temporary Construction Easement Compliance	LS	1	----	
6.	Dewatering	LS	1	----	
7.	Utility Location and Potholing	LS	1	----	
8.	Traffic Control, Detours, and Access	LS	1	----	
9.	Relocate Motel 6 Sewer Lateral	LS	1	----	
10.	Relocate Motel 6 Water Service	LS	1	----	
11.	Gas Service for Standby Generator	LS	1	----	
12.	Recycled Water Service and Meter	LS	1	----	
13.	Construction Surveying	LS	1	----	
14.	Demolition, Removal, and Abandonment	LS	1	----	
15.	48-Inch Sewer Manhole	EA	1		
16.	72-Inch Sewer Manhole	EA	2		
17.	Approach Manhole	EA	1		
18.	12-Inch HDPE DR17 Sewer (STA 1+42 to STA 6+04)	LF	458		
19.	12-Inch HDPE DR17 Sewer (STA 109+81 to STA 111+00)	LF	103		

Item No.	Item Description	Unit of Measure	Estimated Quantity	Item Price (in figures)	Total (in figures)
20.	Jack and Bore 30-inch Steel Casing	LF	460		
21.	Temporary Sewer Connection to Existing Wet Well	LS	1	----	
22.	10-inch HDPE DR17 Sewer Forcemain	LF	105		
23.	Temporary Sewer Bypass Pumping	LS	1	----	
24.	Lift Station Site Work - Concrete	LS	1	----	
25.	Lift Station Site Work – Walls	LS	1	----	
26.	Lift Station Site Work – Earthwork and Grading	LS	1	----	
27.	Lift Station Site Work – Wet Well, Piping, and Valves	LS	1	----	
28.	Lift Station Site Work – Pumps and Prerotation Basins	LS	1	----	
29.	Lift Station Site Work – Hand Rails, Fencing, Guard Posts, and Miscellaneous Metal	LS	1	----	
30.	Electrical and Instrumentation	LS	1	----	
31.	Commissioning and Startup	LS	1	----	
32.	Communications Manholes and Conduit	LS	1	----	
33.	Double Barrel Siphon (STA 6+06 to STA 8+50)	LS	1	----	
34.	12-Inch HDPE Gravity Sewer (STA 8+50 to STA 10+32)	LF	178		
35.	Connection to Existing Manhole	EA	2		
36.	Remove and Replace Existing Caltrans Fence, Relocate Caltrans Gate, and Revegetation	LS	1	----	
37.	Pipe Trench Foundation/ Subgrade Stabilization (rock refill encased in filter fabric) – As needed, and as directed by the City Representative	LF	250		
38.	Perform Authorized Pipe Trench Foundation/Subgrade Stabilization (compaction of in-situ subgrade material) – As needed, and as directed by the City Representative	LF	250		
			Total	**$**	
Additive Bid Items					
1.	Mobilization and Demobilization	LS	1	----	
2.	Sheeting, Shoring and Bracing	LS	1	----	

Item No.	Item Description	Unit of Measure	Estimated Quantity	Item Price (in figures)	Total (in figures)
3.	Dewatering	LS	1	----	
4.	Traffic Control, Detours, and Access	LS	1	----	
5.	6-Inch HDPE DR17 Sewer (STA 100+08 to STA 109+81)	LF	959		
6.	Jack and Bore 16-inch Steel Casing	LF	40		
7.	48-Inch Sewer Manhole	EA	2		
			Total	**$**	
Company Name:					

Notes:

1. All bid items must be completed for the bid to be valid.

LIST OF SUBCONTRACTORS

Pursuant to Section 4100 of the Public Contracts Code and section 2-1.33C of the standard specifications, the Bidder is required to furnish the following information for each Subcontractor performing more than 1/2 percent (0.5%) of the total base bid. Do not list alternative subcontractors for the same work. Subcontracting must not total more than fifty percent (50%) of the submitted bid except as allowed in section 5-1.13 of the standard specifications.

For Streets & Highways projects, subcontractors performing less than ten thousand dollars ($10,000) worth of work need not be mentioned. **Subcontractors required to pay prevailing wage, must be registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 to be listed.**

NOTE: If there are no subcontractors, write "NONE" and submit with bid.

Name Under Which Subcontractor is Licensed	License Number	Address and Phone Number of Office, Mill or Shop	Specific Description of Subcontract	% of Total Base Bid

Attach additional sheets as needed.

(Rev 9-07)

PUBLIC CONTRACT CODE SECTION 10285.1 STATEMENT

In compliance with Public Contract Code Section 10285.1 (Chapter 376, Stats. 1985), the bidder hereby declares under penalty of perjury under the laws of the State of California that the bidder, or any subcontractor to be engaged by the bidder, **has ____, has not** ____ been convicted within the preceding three years of any offenses referred to in that section, including any charge of fraud, bribery, collusion, conspiracy, or any other act in violation of any state or federal antitrust law in connection with the bidding upon, award of, or performance of, any public works contract, as defined in Public Contract Code Section 1101, with any public entity, as defined in Public Contract Code Section 1100, including the Regents of the University of California or the Trustees of the California State University. The term "bidder" is understood to include any partner, member, officer, director, responsible managing officer, or responsible managing employee thereof, as referred to in Section 10285.1.

NOTE: The bidder must place a check mark after "has" or "has not" in one of the blank spaces provided. The above Statement is part of the Bid. Signing this Bid on the signature portion constitute signature of this Statement. Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

PUBLIC CONTRACT CODE SECTION 10162 QUESTIONNAIRE

In compliance with Public Contract Code Section 10162, the Bidder must complete, under penalty of perjury, the following questionnaire:

Has the bidder, any officer of the bidder, or any employee of the bidder who has a proprietary interest in the bidder, ever been disqualified, removed, or otherwise prevented from bidding on, or completing a federal, state, or local government project because of a violation of law or a safety regulation?

Yes _____ No _____

If the answer is yes, attach a letter explaining the circumstances

PUBLIC CONTRACT CODE SECTION 10232 STATEMENT

In compliance with Public Contract Code Section 10232, you hereby states under penalty of perjury, that no more than one final unappealable finding of contempt of court by a federal court has been issued against you within the immediately preceding two-year period because of your failure to comply with an order of a federal court which orders you to comply with an order of the National Labor Relations Board.

NOTE: The above Statement and Questionnaire are part of the Bid. Signing this Bid on the signature portion constitute signature of this Statement and Questionnaire. Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

LABOR CODE SECTION 1725.5 STATEMENTS

The bidder has delinquent liability to an employee or the state for any assessment of back wages or related damages, interest, fines, or penalties pursuant to any final judgement, order or determination by a court or any federal, state, or local administrative agency, including a confirmed arbitration award. Any judgment,

order or determination that is under appeal is excluded, provided that the contractor has secured the payment of any amount eventually found due through a bond or other appropriate means.

_____ Yes _____ No

The bidder is currently debarred under section 1777.1 or under any other federal or state law providing for the debarment of contractors from public works.

_____ Yes _____ No

Attach documentation of registration with the Department of Industrial Relations and date of registration per Labor Code Section 1725.5(a)(1).

NOTE: The above Statement and Questionnaire are part of the Bid. Signing this Bid on the signature portion constitute signature of this Statement and Questionnaire. Bidders are cautioned that making a false certification may subject the certifier to criminal prosecution.

NONCOLLUSION DECLARATION

I, _____, declare that

I am _____ of_____,

the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone refrained from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

Executed on _____, 20_____, in _____

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

_____

(Signature and Title of Declarant)

(SEAL)

Subscribed and sworn to before me
this _____day of _____, 20_____

_____

Notary Public

Company Name:_____

Bidder Acknowledgements

By signing below, the bidder acknowledges and confirms that this bid is based on the information contained in all contract documents, including the notice to bidders, plans, specifications, special provisions, and addendum number(s) _____. **(Note: You are responsible to verify the number of addenda prior to the bid opening.)**

The undersigned further agrees that in case of default in executing the required contract, with necessary bonds, within eight days, (not including Saturdays, Sundays, and legal holidays), after having received a mailed notice that the contract is ready for signature, the proceeds of the check or bond accompanying his bid will become the property of the City of San Luis Obispo.

Licensed in accordance with an act providing for the registration of contractors, License No._____, Expiration Date _____.

The above statement is made under penalty of perjury, and any bid not containing this information "will be considered non-responsive and will be rejected" by the City.

Signature of Bidder _____

_____
(Print Name and Title of Bidder)

Business Name (DBA): _____

Owner/Legal Name: _____

Indicate One: ☐Sole-proprietor ☐ Partnership ☐Corporation

List Partners/Corporate Officers: _____
Name Title

_____
Name Title

_____
Name Title

Business Address _____

Street Address _____

Mailing Address _____

City, State, Zip Code _____

Phone Number _____

Fax Number _____

Email Address _____

Date _____

Qualifications

Failure to furnish complete reference information ON THIS FORM, as specified in this project's Notice to Bidders and indicated below, is cause to reject the bid. Additional information may be attached, but is not a substitute for this form.

Reference Number 1

Customer Name & Contact Individual	
Telephone & Email	
Project Name (Site Address):	
Is this similar to the project being bid or did this project include lift station construction, steel piping, dewatering, jack & bore, pressure, gravity, or sewer pumping activity? Yes ☐ No ☐	Describe the services provided and how this project is similar to that which is being bid:
Was this contract for a public agency? Yes ☐ No ☐	Date project completed:

Reference Number 2

Customer Name & Contact Individual	
Telephone & Email	
Project Name (Site Address):	
Is this similar to the project being bid or did this project include lift station construction, steel piping, dewatering, jack & bore, pressure, gravity, or sewer pumping activity? Yes ☐ No ☐	Describe the services provided and how this project is similar to that which is being bid:
Was this contract for a public agency? Yes ☐ No ☐	Date project completed:

Reference Number 3

Customer Name & Contact Individual
Telephone & Email
Project Name (Site Address):

Is this similar to the project being bid or did this project include lift station construction, steel piping, dewatering, jack & bore, pressure, gravity, or sewer pumping activity? Yes ☐ No ☐	Describe the services provided and how this project is similar to that which is being bid:
Was this contract for a public agency? Yes ☐ No ☐	Date project completed:

ATTACH BIDDER'S BOND TO ACCOMPANY BID

Know all men by these presents:

That we _____, AS PRINCIPAL, and

_____, AS SURETY, are held and firmly bound unto the City of San Luis Obispo in the sum of:

_____ Dollars (_____) to be paid to said City or its certain attorney, its successors and assigns; for which payment, well and truly to be made, we bind ourselves, our heirs, executors and administrators, successors or assigns, jointly and severally, firmly by these presents:

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the certain bid of the above

bounden _____

to construct _____
(insert name of street and limits to be improved or project)

dated _____ is accepted by the City of San Luis Obispo, and if the above

bounden _____, his heirs, executors, administrators, successors, and assigns shall duly enter into and execute a contract for such construction and shall execute and deliver the two bonds described within ten (10) days (not including Saturdays, Sundays, or legal holidays) after the above bounden,

_____, has received notice by and from the said City of San Luis Obispo that said contract is ready for execution, then this obligation shall become null and void; otherwise, it shall be and remain in full force and virtue.

IN WITNESS WHEREOF, we hereunto set our hands and seals this ___ day of _____, 20____.

Bidder Principal:

_____

Signature Date
Title:

Surety:

_____

Bidder's signature is not required to be notarized. Surety's signature must be notarized.
Equivalent form may be substituted
(Rev. 6-30-14)

ORGANIZATION

Special provisions are under headings that correspond with the main section heading of the Standard Specifications. Each special provision begins with a revision clause that describes or introduces a revision to the Standard Specifications. Any paragraph added or deleted by a revision clause does not change the paragraph number of the Standard Specifications for any other reference to a paragraph of the Standard Specifications.

DIVISION I GENERAL PROVISIONS

1 GENERAL

Add to Section 1-1.01 General
The work must be done in compliance with the City of San Luis Obispo, Department of Public Works:

1. Calle Joaquin Lift Station Replacement, Specification No. 91118A Special Provisions
2. City of San Luis Obispo Engineering Standards and Standard Specifications – 2020 edition
3. State of California, Department of Transportation Standard Specifications and Standard Plans – 2015 edition

In case of conflict between documents, governing ranking must comply with section 5-1.02 of the City of San Luis Obispo's Standard Specifications.

Failure to comply with the provisions of these sections is a material breach of contract:

1. Sections 6 through 8 of the Standard Specifications
2. Section 12 through 15 of the Standard Specifications
3. Section 77-1 of the Standard Specifications
4. Section 81 of the Standard Specifications
5. authorized working hours
6. OSHA compliance

2 BIDDING

Replace Section 2-1.33A with:
Furnish bid using blank forms provided in the Special Provisions. Bid must include all forms and must be signed by the bidder.

4 SCOPE OF WORK

Add to Section 4-1.03 Work Description
Comply with the provisions of Section 12, 77 for general, material, construction, and payment specifics.

5 CONTROL OF WORK

Add to Section 5-1.01 Control of Work General
Adjustments to working hours may be imposed due to public traffic impacts in compliance with section 7-1.03B.

Hours of work may be limited, or expanded in certain areas as a requirement other sections of these Special Provisions. For those areas not restricted, work hours are Monday through Friday between 7:00 a.m. and 4 p.m. unless otherwise approved by the Engineer, and construction noise is limited to the hours of 7:00 a.m. to 4 p.m. unless otherwise approved by the Community Development Director. If Contractor

works longer than an 8 hour day in any given day, Contractor is responsible for overtime rate for the inspector.

Add to Section 5-1.13A Sub-Contracting General
A representative of the prime contractor must be on site when any subcontractor is performing contract work. Contract work will not be allowed to continue until prime contractor's representative is on site.

Add to Section 5-1.20A Coordination with Other Entities
You are responsible to coordinate your work with the contractors completing work on any other nearby projects.

Add to Section 5-1.36D Nonhighway Facilities
Existing third party (non City-owned) utilities are shown on project plans for information purposes only. It is your responsibility to contact "Underground Service Alert USA" and have site marked prior to start of excavation or sawcutting. The City of San Luis Obispo is not responsible for any:

1. damages
2. costs
3. delay
4. expenses

resulting from a third party underground facility operator's failure to comply with stipulations as set forth in 4216.7.(c) of California Government Code.

Add to Section 5-1.43A Potential Claims and Dispute Resolution General
Potential claim forms are located on the City's website:

http://www.slocity.org/publicworks/slostandards.asp

7 LEGAL RELATIONS AND RESPONSIBILITY TO THE PUBLIC

Add to Section 7-1.02K(6)
7-1.02K(6)(e) Health and Safety Plan
The sewer system has H_2S associated with it. High concentrations are known to exist in the manholes. The Contractor must comply with any provisions for safety related to the presence of this gas.

Add to Section 7-1.03B Traffic Control Plan
Work hours are restricted to 7:00 p.m. to 7:00 a.m. for any work impacting traffic on Los Osos Valley Road. Calle Joaquin is always to be open to traffic. During weekday business hours, one lane is always to be open, and flagging is required along Calle Joaquin. During weekends and nights, two-way traffic is required due to church operations along Calle Joaquin. Special consideration will need to be given to the excavation and shoring plan around the lift station and in Calle Joaquin to accommodate the public passage through that area during all construction phases.

Refer to Caltrans Permit No. 0521 NUJ 0174 for restrictions pertaining to impacts on traffic for work done within the Caltrans rights-of-way found in Appendix H.

Provide traffic control plan and traffic control application at or before the preconstruction meeting. Traffic control plan must be drawn to scale. Traffic control application may be obtained on the City's website:

http://www.slocity.org/publicworks/documents/trafficcontrolapp.pdf

Upon approval of the traffic control plan, the City will issue a no-fee Encroachment Permit. Permittee is responsible to comply with all conditions of the traffic control plan. Complete work using due diligence in order to restore free flowing of traffic.

Replace Section 7-1.06 with:

7-1.06A General
Procure and maintain for the duration of the contract, insurance against claims for:

1. injuries to persons
2. damages to property

which may arise from or in connection with the performance of the work by your:

1. agents
2. representatives
3. employees
4. subcontractor

Provide:

1. Commercial General Liability Insurance
2. Commercial General Liability Insurance Endorsement
3. Automotive Liability Insurance
4. Automotive Liability Insurance Endorsement
5. Workers' Compensation Insurance

The Contractor agrees to defend, indemnify and hold harmless the City from and against any and all fines or mitigation measures imposed on the City arising out of the Contractor's actual or alleged violation of any local, state or federal regulation, as well as all attorney fees, costs and expenses of any kind which directly or indirectly arise out of or are in any way associated with enforcing this indemnity provision against the Contractor.

7-1.06B Minimum Scope of Insurance
Coverage must be at least as broad as:

1. Insurance Services Office Commercial General Liability coverage:
   a. CG 20 10 Prior to 1993
   b. CG 20 10 07 04 with CG 20 37 10 01
2. Insurance Services Office form number CA 0001 (January 1987 Edition) covering Automobile Liability, code 1 (any auto).
3. Workers' Compensation insurance as required by the State of California and Employer's Liability Insurance.

7-1.06C Minimum Limits of Insurance
Maintain insurance limits no less than:

1. General Liability:
   a. $1,000,000 per occurrence for bodily injury, personal injury and property damage.
   b. If Commercial General Liability or other form with a general aggregate limit is used, either the
   c. general aggregate limit must apply separately to this project/location
   d. the general aggregate limit must be twice the required occurrence limit.
2. Automobile Liability:
   a. $1,000,000 per accident for bodily injury and property damage.
3. Employer's Liability:
   a. $1,000,000 per accident for bodily injury or disease.

7-1.06D Deductibles and Self-Insured Retentions
Any deductibles or self-insured retentions must be declared to and approved by the City. At the option of the City, either:

1. the insurer must reduce or eliminate the deductibles
2. procure a bond guaranteeing payment of:
   a. losses and related investigations
   b. claim administration and defense expenses.

7-1.06E Other Insurance Provisions

The general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:

1. The City, its officers, officials, employees, agents and volunteers are to be covered as insureds as respects:
   a. liability arising out of activities performed by or on behalf of you
   b. your products and completed operations
   c. premises owned, occupied or used by you
   d. automobiles owned, leased, hired or borrowed by you
2. The coverage must not contain special limitations on the scope of protection afforded to the City and its:
   a. officers
   b. officials
   c. employees
   d. agents
   e. volunteers
3. For any claims related to this project, your insurance coverage will be the primary insurance for the City and its:
   a. officers
   b. officials
   c. employees
   d. agents
   e. volunteers.
4. Any insurance or self-insurance maintained by the City is in excess to your insurance and will not contribute to it.
5. Any failure to comply with reporting or other provisions of the policies including breaches of warranties must not affect coverage provided to the City and its
   a. officers
   b. officials
   c. employees
   d. agents
   e. volunteers
6. Your insurance must apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.
7. Each insurance policy required must be endorsed to state that coverage will not be:
   a. Suspended
   b. Voided
   c. canceled by either party
   d. reduced in coverage or in limits

except after thirty days prior written notice provided by certified mail with return receipt requested has been given to the City.

8. Coverage may not extend to any indemnity coverage for the active negligence of the additional insured in any case where an agreement to indemnify the additional insured would be invalid under Subdivision (b) of section 2782 of the Civil Code.

7-1.06F Acceptability of Insurers

Insurance is to be placed with insurers with a current A.M. Best's rating of no less than A:VII.

7-1.06 G Verification of Coverage
Furnish the City with a certificate of insurance showing required insurance coverage. Original endorsements effecting general liability and automobile liability coverage must be provided. The endorsements are to be signed by a person authorized by that insurer to bind coverage on its behalf. All endorsements are to be received and approved by the City before work commences.

7-1.06H Subcontractors
Include all subcontractors as insured under its policies or provide separate certificates and endorsements for each subcontractor. All insurance coverage for subcontractors are subject to same requirements as the prime contractor.

8 PROSECUTION AND PROGRESS

Section 8-1.02A Schedule
Provide a Level 2 critical path method schedule for this work.

Dewatering plan shall be submitted within 15 working days from Notice of Award.

Stormwater Pollution Prevention Plan shall be submitted within 15 working days from Notice of Award.

Add to Section 8-1.03 Pre-Construction Conference
All listed subcontractors performing contract work must attend the preconstruction meeting.

At a minimum, provide the following submittals at the preconstruction meeting:

1. emergency contact list
2. representative at the site of work authorized to sign extra work tickets
3. representative authorized to sign change orders
4. Caltrans equipment rental rates for equipment used to complete work
5. critical path method construction schedule
6. traffic control application
7. traffic control plans
8. location of construction yard
9. location of disposal site
10. evidence construction yard is correctly permitted if construction yard is not your business address
11. evidence disposal yard is correctly permitted.
12. door hanger for notification of adjacent properties

Section 8-1.05A Partial Completion Time
Complete all work within the San Luis Obispo Creek area as specified in the project permits (Appendix I). The time limit specified for the completion of the work may be insufficient to permit completion of the work by working a normal number of hours per day or week on a single shift basis. Should Contractor fail to maintain the progress of the work in conformance with "Progress Schedule (Critical Path Method)" of these Special Provisions, Contract must provide additional shifts as necessary to ensure that the work is completed within the time limit specified at no additional cost to the City.

9 PAYMENT

Add to Section 9-1.23 City Billing
After given the opportunity, you fail to complete any of the following:

1. maintain the project site,
2. complete project work,
3. any other cause which requires City staff to complete work at the project site

you must reimburse the City in compliance with section 9-1.23.

Each lump sum bid items includes all work necessary to complete the bid item. No additional compensation will be granted. If no bid item is listed for a specific item of work, it is to be paid under other bid items. Please see Technical Specifications Section 012000, Measurement and Payment.

99 BUILDING CONSTRUCTION

Add to Section 99
Calle Joaquin Lift Station Replacement Project Technical Specifications.

APPENDIX A - FORM OF AGREEMENT

THIS AGREEMENT, made on this _____ day of _____, 20__, by and between the City of San Luis Obispo, a municipal corporation and charter city, San Luis Obispo County, California (hereinafter called the Owner) and COMPANY NAME (hereinafter called the Contractor).

WITNESSETH:

That the Owner and the Contractor for the consideration stated herein agree as follows:

ARTICLE 1, SCOPE OF WORK: The Contractor shall perform everything required to be performed, shall provide and furnish all of the labor, materials, necessary tools, expendable equipment, and all utility and transportation services required to complete all the work of construction of

NAME OF PROJECT, SPEC NO.

in strict compliance with the plans and specifications therefor, including any and all Addenda, adopted by the Owner, in strict compliance with the Contract Documents hereinafter enumerated.

It is agreed that said labor, materials, tools, equipment, and services shall be furnished and said work performed and completed under the direction and supervision and subject to the approval of the Owner or its authorized representatives.

ARTICLE II, CONTRACT PRICE: The Owner shall pay the Contractor as full consideration for the faithful performance of this Contract, subject to any additions or deductions as provided in the Contract Documents, the contract prices as follows:

Item No.	Item	Unit of Measure	Estimated Quantity	Item Price (in figures)	Total (in figures)
1.					
2.					
3.					

BID TOTAL: $ .00

Payments are to be made to the Contractor in compliance with and subject to the provisions embodied in the documents made a part of this Contract.

Should any dispute arise respecting the true value of any work omitted, or of any extra work which the Contractor may be required to do, or respecting the size of any payment to the Contractor, during the performance of this Contract, said dispute shall be decided by the Owner and its decision shall be final, and conclusive.

ARTICLE III, COMPONENT PARTS OF THIS CONTRACT: The Contract consists of the following documents, all of which are as fully a part thereof as if herein set out in full, and if not attached, as if hereto attached:

1. Notice to Bidders and information for bidders.
2. Standard Specifications, Engineering Standards, Special Provisions, and any Addenda.
2. Accepted Bid.
4. Public Contract code Section 10285.1 Statement and 10162 Questionnaire.
5. Noncollusion Declaration.
6. Plans.

7. List of Subcontractors.
8. Agreement and Bonds.
9. Insurance Requirements and Forms.

ARTICLE IV. It is further expressly agreed by and between the parties hereto that should there be any conflict between the terms of this instrument and the bid of said Contractor, then this instrument shall control and nothing herein shall be considered as an acceptance of the said terms of said bid conflicting herewith.

IN WITNESS WHEREOF, the parties to these presents have hereunto set their hands this year and date first above written.

CITY OF SAN LUIS OBISPO
A Municipal Corporation

Derek Johnson, City Manager

APPROVED AS TO FORM

Christine Dietrick
City Attorney

CONTRACTOR

NAME OF COMPANY
NAME OF CAO/PRESIDENT

Rev. 12-28-09

CITY OF SAN LUIS OBISPO
CALLE JOAQUIN LIFT STATION REPLACEMENT

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SECTION 007300 SUPPLEMENT TO STANDARD SPECIFICATIONS

1.01 DEFINITIONS

The following defined terms shall be added to Standard Specifications. Whenever the following terms occur in the contract documents, their meaning is as follows:

CONSULTANT	AECOM and its directors, officers, employees and subconsultants Consultant is not an agent of the City.
OWNER	City of San Luis Obispo, CA
CITY'S REPRESENTATIVE/ OWNER'S REPRESENTATIVE	The authorized individual, consultant, or other entity, selected and hired by the City to perform tasks on behalf of the City during construction of the City's Project.
CITY'S PROJECT	Calle Joaquin Lift Station Replacement
CONTRACTOR	The individual, partnership, corporation, joint-venture, or other legal entity with whom the City has executed the construction contract.
STANDARD SPECIFICATIONS	City of San Luis Obispo Standard Specifications dated 2020.
SPECIAL PROVISIONS	Numbered Sections contained within this specification package.

1.02 TERMS

A. Command type sentences used in the contract documents refer to and are directed to the Contractor.

B. Terms and Conditions contained in this section prevail over the Standard Specifications.

1.03 AUTHORITY FOR THE WORK

The drawings, specifications, and other contract documents for the work were approved and adopted by the Governing Body of the City.

1.04 PROJECT REPORTS

The following reports which have been prepared for the Owner are available for review:

A. Geotechnical Engineering Report Calle Joaquin and Laguna lift Station Replacements, San Luis Obispo, California, June 12, 2012, Earth Systems Pacific and the 2021 addendum to the report.

The Contractor is advised that a geotechnical report was prepared for the design of this Project, and such information was referenced in the design of this Work. This Report was prepared by Earth Systems Pacific, and is entitled "Geotechnical Engineering Report, Calle Joaquin and Laguna Lift Station Replacements, San Luis Obispo, California", dated June 12, 2012, an addendum to this report was prepared, and dated August 3, 2021. This report, including the addendum is available for review at the City Public Works Office at 919 Palm Street, and is also available online at http://www.slocity.org/publicworks/bids.asp

Such investigations were made only for the purpose of study and design. The conditions indicated by such investigations apply only at the time the borings or excavations were made. Where such investigations have been made, the Contractor shall inspect the records as to such investigations subject to and upon the conditions hereinafter set forth in accordance with Section 2-1.30 "Jobsite and Document Examination" of the Standard Specifications.

The records of such investigations are not a part of these Contract Documents and are shown solely for informational purposes for the Contractor. It is expressly understood and agreed that the City, the Engineer and their consultants assume no responsibility whatsoever in respect to the sufficiency or accuracy of the investigations; the records thereof; or of the interpretations set forth therein or made by the City's consultants, the Engineer or his consultants in the use thereof by the Engineer, and there is no warranty or guarantee, either express or implied, that the conditions indicated by such investigations or records thereof are representative of those existing throughout such areas, or any part thereof, or that unlooked-for developments may not occur, or that materials other than, or in proportions different from, those indicated may not be encountered.

B. Mitigated Negative Declaration in compliance with CEQA.

A Mitigated Negative Declaration was completed for the Calle Joaquin Lift Station Replacement Project in compliance with the California Environmental Quality Act (CEQA). Conditions and mitigation measures are listed in Appendix A.

1.05 UTILITIES

The Consultant has endeavored to determine the existence of utilities along the project alignment from the records of owners of known utilities in the vicinity of the work. The positions of these utilities as derived from such records are shown on the plans. Note, service laterals and connections are not all shown on the plans. The Contractor is responsible for locating, protecting, and maintaining the operation of all existing utilities (including service laterals).

The Contractor shall conduct his own utility investigation in advance of the work to be performed to locate and determine the true horizontal and vertical locations of existing subsurface utilities in the vicinity of the project. The Contractor shall field locate and expose underground utilities by potholing or other acceptable non-destructive methods.

If the Contractor discovers conflicting utility facilities not identified in the plans or specifications or in a position different from that shown in the plans and specifications, he shall immediately notify by phone and in writing the City's Representative and the owner of the utility facility.

See Specification Section 020120 and the Standard Specifications for City of San Luis Obispo requirements and procedures regarding the removal, relocation, protection, and temporary maintenance of utility facilities not identified in the Contract Documents.

1.06 GENERAL SAFETY

In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for conditions of the jobsite, including safety of all persons and property during performance of the work, and the Contractor shall fully comply with all state, federal and other laws, rules, regulations, and orders relating to safety of the public and workers.

The right of the Owner or the Owner's Representative to conduct construction review or observation of the Contractor's performance will not include review or observation of the adequacy of the Contractor's safety measures in, on, or near the construction site.

1.07 CALIFORNIA AND LOCAL REGULATIONS

A. The Contractor is solely responsible for accomplishing all work in a safe manner, complying with, but not limited to, the following regulations:

1. CAL/OSHA, Title 8, Industrial Relations, Chapter 4, division of Industrial Safety Orders, Subchapter 4, Construction Safety Order.

2. Title 8, CCR, General Industrial Safety Orders (GISO), Section 5156, Scope & Definitions, and Section 5159, Confined Space Operations.

3. Title 8, CCR, Construction Safety Orders, Article 4, Sections 1528 to 1531, Dusts, Fumes, Mists, Vapor, and Gases.

B. Contractor shall submit a notarized letter signed by a principal officer of the corporation or company certifying the Contractor fully complies with California Code of Regulations pertaining to the Construction Safety Orders (CSO) and General Industry Safety Orders (GISO). Review of Contractor’s safety plan by Engineer does not imply that Owner accepts responsibility for such plans or safety activities.

1.08 WORKER PROTECTION

A. Conform to all federal, state, county, and City safety and environmental protection codes and regulations. Do not create conditions for which the Owner is subject to citations by any regulatory agency. Should the Owner be cited for a condition under the control of the Contractor, the Contractor will be responsible for payment and settlement of said citation. All safety equipment, including that for confined space entry, shall be provided by the Contractor at his expense, including safety equipment necessary for use by the Owner's Representative.

B. Comply with all applicable regulations for properly storing, handling, transporting, and disposing of any hazardous waste.

C. Maintain a full-time standby hole watch in case of an emergency. This employee shall be certified in CPR and have confined space certification and shall be able to comply with GISO 5157 (Operating Procedures and Employee Training) and GISO 5158 (Pre-Entry). This employee shall also be fully equipped to operate within the directives of GISO 5159 (Confined Space Operations). This person shall have his own personal safety equipment and operating telephone (not the jobsite telephone).

1.09 EXCAVATION SHEETING, SHORING, AND BRACING PLANS FOR WORKER PROTECTION REQUIRED BY LABOR CODE SECTION 6705

A. The Contractor shall submit to the Owner's Representative for acceptance, in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation. The plan shall be prepared by a registered civil or structural engineer. As a part of the plan, a note shall be included stating that the registered civil or structural engineer certifies that the plan complies with the CAL/OSHA Construction Safety Orders, 29CFR1926 Subpart P-Excavations, or that the registered civil or structural engineer certifies that the plan is not less effective than the shoring, bracing, sloping, or other provisions of the Safety Orders.

B. The City or their consultants may have made investigations of subsurface conditions in areas where the work is to be performed. If so, these investigations are identified in the Contract Documents and the records of such investigations are available for inspection at the office of the City Engineer of Work The detailed plan showing the design of shoring, etc., which the Contractor is required to submit to the City's Representative for acceptance in advance of excavation will not be accepted by the City if the plan is based on subsurface conditions which are more favorable than those revealed by the investigations made by the City or their consultants; nor will the plan be accepted if it is based on soils-related design criteria which is less restrictive than the criteria set forth in the report on the aforesaid investigations of subsurface conditions.

C. The detailed plan showing the design of shoring, etc., shall include surcharge loads for nearby embankments and structures, for spoil banks, and for construction equipment and other construction loadings. The plan shall indicate for all trench conditions the

minimum horizontal distances from the side of the trench at its top to the near side of the surcharge loads.

D. Nothing contained in this article shall be construed as relieving the City's Contractor of the full responsibility for providing shoring, bracing, sloping, or other provisions which are adequate for worker protection.

1.10 PERSONAL LIABILITY

No director, officer, employee, or agent of the Consultant or their subconsultants shall be personally responsible for any liability arising under or by virtue of the contract.

END OF SECTION

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SECTION 010000 MOTEL 6 PROJECT BANNER

Project shall include a banner reading “Motel 6 open for business during construction” hung on the fence. Banner shall be placed South of the Motel 6 driveway entrance in view of the general public driving South on Calle Joaquin. Banner shall be 40-inch x 48-inch and constructed of vinyl material. Banner shall be constructed for outdoor use and maintained in excellent condition throughout the course of the project. Contractor to attach sign to fence using zip ties. Prior to fabrication and placement, the banner placement and signage to be fabricated shall be approved by the Engineer. The cost of the sign is incidental to the contract price. The sign shall remain the property of the Owner.

END OF SECTION

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SECTION 011100 COORDINATION OF WORK, PERMITS, AND REGULATIONS

1.01 DESCRIPTION

This section generally describes the project and includes work sequence and schedule, Contractor's use of premises, permits, and regulations.

1.02 CONTRACTOR'S USE OF PREMISES

A. The Contractors use of the premises shall not impede normal operation of the existing facilities. Contractor must advise Owner at least 7 days in advance of any activity that could potentially interfere with the existing lift station.

B. Maintain site security and operator access to the existing facilities at all times per plans and these specifications. This is intended to be accomplished with temporary security fencing around the limits of the work and by maintaining adequate security.

C. Perform video documentation of pre-existing conditions at and around the project site per the General Notes on the plans. Submit video to Owner’s Representative prior to start of construction.

D. Do not encroach into California Department of Transportation rights-of-way, unless required and specified by the Caltrans Double Permit shown in provided in Appendix H.

1.03 PERMITS

A. The following permit is being obtained by the Owner:

1. Central Coast Regional Water Quality Control Board, Waste Discharge Requirements pursuant to Order No. 2004-0004.

B. Obtain and pay the fees for the following permits:

Name or Type of Permit	**Name, Address, Telephone Number of Permitting Agency**
City of San Luis Obispo: Encroachment Permit	Public Works Department 919 Palm Street San Luis Obispo, CA 93401 805-781-7015
State of California, Department of Industrial Relations, Division of Occupational Safety and Health (DOSH): Permit for Trenching/Excavations Exceeding 5-feet in depth	CAL/OSHA Field Office Ventura County 1655 Mesa Verde, Room 125 Ventura, CA 93003 805-654-4581

Caltrans Encroachment Permit	District 05 50 Higuera Street San Luis Obispo, CA 93401 805-549-3152 805-549-3062 FAX
Department of Industrial Relations Mining and Tunneling (M&T) Unit Request pre-job safety conference	Enforcement Branch, Region 5 2424 Arden Way, Suite 125 Sacramento, CA 85825 916-574-2540 916-574-2542 FAX https://www.dir.ca.gov/dosh/mining-and-tunneling-unit.html

Contact the permitting agencies listed above for current fees associated with each permit.

C. The permits contain requirements that affect the cost of project work and some permanent permits require supplementary work permits and fees to execute construction. Comply with the permit requirements and obtain and pay the fees involved with the supplementary work permits.

1.04 RIGHTS-OF-WAY

Construction activities shall be limited to public rights-of-way, temporary construction easements (TCE), and permanent utilities easements shown on the drawings, unless additional arrangements are made with adjacent property owners. These public rights-of-way, temporary construction easements, and permanent easements shown on the drawings collectively constitute the work area. The Contractor will not be allowed to acquire additional land for construction of the project without consultation and coordination with the Owner. The Contractor shall also coordinate with and obtain the support of residents living or doing business in the immediate area of such land acquisitions. See Appendices B and C for easement descriptions.

END OF SECTION

SECTION 012000 MEASUREMENT AND PAYMENT

1.01 WORK LISTED IN THE SCHEDULE OF WORK ITEMS

A. Work under this contract will be paid on a unit price or lump-sum basis as outlined on the Bid Form for the quantity of work installed.

B. The unit prices and lump-sum prices include full compensation for furnishing the labor, materials, tools, and equipment and doing all the work involved to complete the work included in the contract documents.

C. The application for payment will be for a specific item based on the percentage completed or quantity installed. The percentage complete will be based on the value of the partially completed work relative to the value of the item when entirely completed and ready for service.

D. The City shows a bid item quantity as a final pay item for payment purposes only. For a final pay item, accept payment based on the Bid Item List quantity, regardless of the actual quantity used unless dimensions are changed by the Engineer.

1.02 WORK NOT LISTED IN THE SCHEDULE OF WORK ITEMS

A. The Standard Specifications and items in the Special Provisions, general requirements, and specifications which are not listed in the schedule of work items of the Bid Form are, in general, applicable to more than one listed work item, and no separate work item is provided therefor. Include the cost of work not listed but necessary to complete the project designated in the contract documents in the various listed work items of the Bid Form.

B. The bids for the work are intended to establish a total cost for the work in its entirety. Should the Contractor feel that the cost for the work has not been established by specific items in the Bid Form, include the cost for that work in some related bid item so that the Proposal for the project reflects the total cost for completing the work in its entirety.

1.03 BID ITEMS

A. Bid Item 1 - Mobilization and Demobilization (LS)

This item is a lump-sum bid for preparatory work and operations. The bid price shall include, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for obtaining permits, bonds, and insurance; and for all other work and operations which must be performed, or costs incurred prior to beginning work on the various contract items on the project site. Also included is demobilization of all equipment, personnel, supplies, and materials from the site. This bid item is limited to a maximum of 5% of the construction cost. A maximum of 80% of the bid amount shall be paid for mobilization and shall be paid with the first regular monthly pay request.

B. Bid Item 2 – Storm Water Pollution Prevention (LS)

This lump-sum bid item includes but is not limited to the following: all costs for implementing the Storm Water Pollution Prevention Plan included as Appendix F. Bid price shall include, but not be limited to, sampling, preparing and implementing a Rain Event Action Plan, the cost of constructing and maintaining BMPs as shown on the SWPPP plans. Full compensation shall be prorated over the term of the construction contract. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

C. Bid Item 3 – Sheeting, Shoring, and Bracing (LS)

This lump-sum bid item includes but is not limited to the following: equipment, labor, and materials necessary to erect, operate, and removing sheeting shoring and bracing in compliance with Cal/OSHA requirements. Payment for this lump sum bid item shall be prorated based on the Contractor's schedule for excavation. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

D. Bid Item 4 – OSHA Compliance (LS)

This lump-sum bid item includes but is not limited to the following: compliance with federal, state, and local health orders and Cal/OSHA requirements other than Sheeting, Shoring, or Bracing. Full compensation shall be prorated over the term of the construction contract. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted.

E. Bid Item 5 – Permits and Temporary Construction Easement Compliance (LS)

This lump-sum bid item includes but is not limited to the following: compliance with permits obtained from federal, state, and local agencies, agreements with Motel 6 and other landowners, and temporary construction easements (Permits are included in Appendices H and I). Full compensation shall be prorated over the term of the construction contract. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

F. Bid Item 6 –Dewatering (LS)

This lump-sum bid item includes but is not limited to the following: completing an acceptable dewatering plan, furnishing the labor, materials, tools, and equipment and doing all the work to dewater trenches and excavations for the work, including transporting water to the location identified in the permits for this project, and obtaining and complying with the requirements of the City's pretreatment permit and monitoring. (Refer to the SWPPP for additional pretreatment requirements in Appendix F.) Full compensation shall be prorated based on the duration of dewatering activities as provided for in the

Contractor's schedule. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

G. Bid Item 7 – Utility Location and Potholing (LS)

This lump-sum bid item includes but is not limited to the following: excavate all utilities and Caltrans piles prior to construction and determine location, depth, size, material type, and utility owner. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

H. Bid Item 8 – Traffic Control, Detours, and Access (LS)

This lump-sum bid item includes but is not limited to the following: preparing a traffic control plan, constructing, maintaining, and removing temporary paved detours, establishing, maintaining, and discontinuing temporary alternate routes, detours, providing and maintaining traffic control, providing access to properties in the vicinity of work, and provide for the convenience and safety of the public and public traffic. Full compensation shall be prorated over the term of the construction contract. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

I. Bid Item 9 – Relocate Motel 6 Sewer Lateral (LS)

This lump-sum bid item includes but is not limited to the following: installing HDPE pipe, pavement patch, cleanouts, fittings, and connections to existing pipelines. Full compensation shall be prorated based on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

J. Bid Item 10 – Relocate Motel 6 Water Service (LS)

This lump-sum bid item includes but is not limited to the following: installing water pipe, fittings, pavement trench patch. Full compensation shall be prorated based on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

K. Bid Item 11 – Gas Service for Standby Generator (LS)

This lump-sum bid item includes but is not limited to the following: installing gas pipe, fittings, and appurtenances for the standby generator. Full compensation shall be prorated based on a percent complete basis. All work necessary to complete this bid item is included

in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

L. Bid Item 12 –Recycled Water Service and Meter (LS)

This lump-sum bid item includes but is not limited to the following: installing recycled service, water meter, and pavement trench patch. Full compensation shall be prorated based on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

G. Bid Item 13 – Construction Surveying (LS)

This lump-sum bid item includes but is not limited to the following: construction surveying, staking, and laying out. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

H. Item 14 – Demolition, Removal, and Abandonment (LS)

This lump-sum bid item includes but is not limited to: demolition, removal, disposal, and abandonment of manholes, sewer pipelines, and the existing lift station. Sixty percent (60%) of this lump sum bid item shall be paid after demolition of the existing lift station, which will occur after successful completion of commissioning and startup. Forty percent (40%) of this lump-sum bid item will be for all other demolition, removal, and abandonment. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

I. Bid Item 15 – 48-inch Sewer Manhole (EA)

This item is a unit-price bid for furnishing and installing SSMH #6, which is a 48-inch diameter sewer manhole per City of San Luis Obispo Standard Drawing 6610, complete in place, where shown on the plans and as specified herein. The unit costs shall include, but not be limited to the following: pre-cast concrete manhole, frame and cover, coatings, excavation, backfill, compaction, fittings, connections, and testing. Full compensation shall be on a unit cost basis per manhole.

J. Bid Item 16 – 72-inch Sewer Manhole (EA)

This item is a unit-price bid for furnishing and installing 72-inch diameter sewer manholes per City of San Luis Obispo Standard Drawing 6610, complete in place, where shown on the plans and as specified herein. The unit costs shall include, but not be limited to the following: pre-cast concrete manhole, frame and cover, coatings, excavation, backfill, compaction, fittings, connections, and testing. Full compensation shall be on a unit cost basis per manhole.

K. Bid Item 17 – Approach Manhole (EA)

This item is a unit-price bid for furnishing and installing an approach manhole, complete in place, where shown on the plans and specified herein. The unit costs shall include but is not limited to, full compensation for the following: pre-cast concrete manhole, frame and cover, coatings, excavation, backfill, compaction, fittings, connections, testing, slide gate, rock base and geotextile. Full compensation shall be on a unit cost basis per manhole.

L. Bid Item 18 – 12-Inch HDPE DR17 Sewer (STA 1+42 to STA 6+04) (LF)

This item is a unit-price bid for furnishing and installing the 12-inch-diameter HDPE, DR17 sewer, complete in place, where shown on the plans and as specified herein. The unit costs shall include but not be limited to the following: HDPE pipe, excavation, backfill, compaction, fittings, connections, casing spacers, testing, and post-construction CCTV inspection. This item also includes furnishing and installing asphalt concrete pavement resurfacing to the thickness of the original pavement or as shown in City Engineering Standards, whichever is greater. Pavement placed in excess of the maximum cross section will not be considered for payment without prior written authorization from the Owner. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing through fittings, but not including manholes.

M. Bid Item 19 – 12-Inch HDPE DR17 Sewer (STA 109+81 to STA 111+00) (LF)

This item is a unit-price bid for furnishing and installing the 12-inch-diameter HDPE, DR17 sewer, complete in place, where shown on the plans and as specified herein. The unit costs shall include but not be limited to the following: HDPE pipe, excavation, backfill, compaction, fittings, connections, casing spacers, testing, and post-construction CCTV inspection. This item also includes furnishing and installing asphalt concrete pavement resurfacing to the thickness of the original pavement or as shown in City Engineering Standards, whichever is greater. Pavement placed in excess of the maximum cross section will not be considered for payment without prior written authorization from the Owner. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing through fittings, but not including manholes.

N. Bid Item 20 – Jack and Bore 30-Inch Steel Casing (LF)

This item is unit-price bid for furnishing and installing the 30-inch-diameter steel casing, complete and in place where shown on the plans and as specified herein. The unit costs shall include but not be limited to and furnishing all labor, materials, tools, and equipment required to jack and bore, and the steel casing. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing.

O. Bid Item 21 – Temporary Sewer Connection to Existing Wet Well (LS)

This lump-sum bid item includes but is not limited to the following: installing HDPE pipe, excavation, backfill, compaction, fittings, connections, testing, and pavement patch. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional

compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

P. Bid Item 22 – 10-inch HDPE DR17 Sewer Forcemain (LF)

This item is a unit-price bid for furnishing and installing the 10-inch-diameter HDPE, DR17 sewer forcemain, complete in place, where shown on the plans and as specified herein. The unit costs shall include but not be limited to the following: HDPE pipe, excavation, backfill, compaction, fittings, connections, casing spacers, and testing. This item also includes furnishing and installing asphalt concrete pavement resurfacing to the thickness of the original pavement or as shown in City Engineering Standards, whichever is greater. Pavement placed in excess of the maximum cross section will not be considered for payment without prior written authorization from the Owner. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing through fittings, but not including manholes.

Q. Bid Item 23 – Temporary Sewer Bypass Pumping (LS)

This lump-sum bid item includes but is not limited to the following: prepare bypass pumping plan, piping, valves, pumps, fuel, maintenance, and operation. Full compensation shall be prorated based on the Contractor's anticipated bypass pumping schedule. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

R. Bid Item 24 – Lift Station Site Work - Concrete (LS)

This lump-sum bid item includes but is not limited to the following: concrete, curbs, gutters, sidewalk, and steel reinforcement. Full compensation for concrete shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

S. Bid Item 25 – Lift Station Site Work - Walls (LS)

This lump-sum bid item includes but is not limited to the following: CMU block, mortar, steel reinforcement, concrete, and stucco. Full compensation for walls shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

T. Bid Item 26 – Lift Station Site Work – Earthwork and Grading (LS)

This lump-sum bid item includes but is not limited to the following: site preparation, excavation, compaction, subgrade preparation, crushed gravel, aggregate base, geotextile fabrics, imported soil, and disposal of excavated soil. Full compensation for earthwork

and grading shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

U. Bid Item 27 – Lift Station Site Work – Wet Well, Piping, and Valves (LS)

This lump-sum bid item includes but is not limited to the following: FRP wet well including the concrete base, valves, vaults, hatches, guide rails and brackets, lifting cables, ductile iron pipe, and stainless steel pipe. Full compensation for wet well, piping, and valves shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

V. Bid Item 28 – Lift Station Site Work – Pumps and Prerotation Basins (LS)

This lump-sum bid item includes but is not limited to the following: submersible raw sewage pumps and prerotation basins. Full compensation for pumps and prerotation basins shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

W. Bid Item 29 – Lift Station Site Work – Hand rails, Fencing, Guard Posts and Miscellaneous Metal (LS)

This lump-sum bid item includes but is not limited to the following: chain link fencing, gates, hand rails, guard posts, stairs, and miscellaneous metal for the lift station site. Full compensation for hand rails, fencing, guard posts, and miscellaneous metal shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

X. Bid Item 30 – Electrical and Instrumentation (LS)

This lump-sum bid item includes but is not limited to the following: motor control center, conduits, wiring, antennae, lights, sensors, flowmeter, and instrumentation. Full compensation for the electrical and instrumentation shall be made on a percent complete basis, based on the lump sum amount for this item. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

Y. Bid Item 31 –Commissioning and Startup (LS)

This lump-sum bid item includes but is not limited to the following: completing the startup and commissioning for all mechanical, electrical, and instrumentation equipment supplied

for this project as described in these Contract Documents and per Section 018100. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

Z. Bid Item 32 – Communications Manholes and Conduit (LS)

This lump-sum bid item includes but is not limited to the following: communications five communications manholes, distance designated mule tape, and HDPE conduit, as shown in the plans and as specified herein. The conduit run is from the motor control center to SSMH #D. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

AA. Bid Item 33 – Double Barrel Siphon (STA 6+06 to STA 8+50) (LS)

This lump-sum bid item includes but is not limited to the following: HDPE pipe, horizontal directional drilling, bore pit excavation/backfill, communications conduit, and post-construction CCTV inspection. Distance may vary dependent upon the contractor means and methods. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

BB. Bid Item 34 – 12-Inch HDPE Gravity Sewer (STA 8+50 to STA 10+32) (LF)

This item is a unit-price bid for furnishing and installing the 12-inch HDPE gravity sewer, complete in place, where shown on the plans and as specified herein. The unit costs shall include but not be limited to the following: HDPE pipe, trenching and backfill, and post-construction CCTV inspection. Distance could be reduced depending on contractors means and methods in Pay Item 33. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing through fittings, but not including manholes. Any stationing length utilized by the HDD method for the siphon will be decreased from the LF quantity of the gravity sewer.

CC. Bid Item 35 – Connection to Existing Manholes (EA)

This item is a unit-price bid for furnishing and installing the connections to the existing sewer manholes, complete in place, where shown on the plans and as specified herein. The unit costs shall include but not be limited to the following: repairs and replacements

required to return manhole to operating condition. Full compensation shall be on a unit cost basis per each connection to an existing manhole.

DD. Bid Item 36 – Remove and Replace Existing Caltrans Fence, Relocate Caltrans Gate, and Revegation (LS)

This lump-sum bid item includes but is not limited to the following: removal and replacement of the existing Caltrans fence, and relocation of the Caltrans gate per the Caltrans Standard Plans and Specifications to allow access to the new manhole #B at Station 6+06.00, as well as revegetation of the impacted area off of the US 101 offramp per the RQWCB permit. Full compensation for this lump sum bid item shall be made on a percent complete basis. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

EE. Bid Item 37 – Pipe Trench Foundation/Subgrade Stabilization (rock refill encased in filter fabric) – As needed, and as directed by the City Representative (LF)

This item is a unit-price bid to perform trench subgrade/foundation stabilization by over-excavating soft, yielding, and unstable soils and installing rock refill encased in filter fabric in conformance with the Technical Specifications. The unit cost shall include, but not be limited to, furnishing all labor, materials, including rock refill material and soil stabilization fabric, tools, equipment, additional trench excavation, trench shaping, additional shoring, and additional asphalt pavement repair required to complete the authorized subgrade stabilization. Full compensation for this item shall be on a linear foot basis. Maximum depth below the pipe foundation line shall be 24 inches.

The City's Representative shall be the sole judge as to the necessity, the limits, and the depth of additional refill material required for trench foundation/subgrade stabilization in any given situation. Rock refill that may be used by the Contractor for his convenience, but not authorized by the City's Representative, will not be measured for payment but shall be at the Contractor's sole expense.

FF. Bid Item 38 – Perform Authorized Pipe Trench Foundation/Subgrade Stabilization (Compaction of in-situ subgrade material) – As needed, and as directed by the City Representative (LF)

This item is a unit-price bid to perform trench subgrade/foundation stabilization by moisture conditioning and compacting the in-situ trench subgrade material to a minimum 90% relative compaction (RC) unless indicated otherwise by the City's Representative. This bid item is representative of a level of effort beyond the standard required by the plans and specifications. The unit cost shall include, but not be limited to, furnishing all labor, materials, tools, equipment, required to complete the authorized subgrade stabilization. Full compensation for this item shall be on a linear foot basis.

1.04 ADDITIVE BID ITEMS

The following bid items shall not be included in the base bid, but may be required as part of this work effort. The Contract must notify and obtain written authorization from the City's representative before conducting the activities listed below.

A. Additive Bid Item 1 - Mobilization and Demobilization (LS)

This item is a lump-sum bid for preparatory work and operations. The bid price shall include, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for obtaining permits, bonds, and insurance; and for all other work and operations which must be performed, or costs incurred prior to beginning work on the various contract items on the project site. Also included is demobilization of all equipment, personnel, supplies, and materials from the site. This bid item is limited to a maximum of 5% of the construction cost. A maximum of 80% of the bid amount shall be paid for mobilization and shall be paid with the first regular monthly pay request.

D. Additive Bid Item 2 – Sheeting, Shoring, and Bracing (LS)

This lump-sum bid item includes but is not limited to the following: equipment, labor, and materials necessary to erect, operate, and removing sheeting shoring and bracing in compliance with Cal/OSHA requirements. Payment for this lump sum bid item shall be prorated based on the Contractor's schedule for excavation. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

E. Additive Bid Item 3 –Dewatering (LS)

This lump-sum bid item includes but is not limited to the following: completing an acceptable dewatering plan, furnishing the labor, materials, tools, and equipment and doing all the work to dewater trenches and excavations for the work, including transporting water to the location identified in the permits for this project, and obtaining and complying with the requirements of the City's pretreatment permit and monitoring. (Refer to the SWPPP for additional pretreatment requirements in Appendix F.) Full compensation shall be prorated based on the duration of dewatering activities as provided for in the Contractor's schedule. All work necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

F. Additive Bid Item 4 – Traffic Control, Detours, and Access (LS)

This lump-sum bid item includes but is not limited to the following: preparing a traffic control plan, constructing, maintaining, and removing temporary paved detours, establishing, maintaining, and discontinuing temporary alternate routes, detours, providing and maintaining traffic control, providing access to properties in the vicinity of work, and provide for the convenience and safety of the public and public traffic. Full compensation shall be prorated over the term of the construction contract. All work

necessary to complete this bid item is included in this pay item and no additional compensation will be granted. If no bid item is listed for a specific item of work, it will be paid under other bid items.

B. Additive Bid Item 5 – 6-Inch HDPE DR17 Sewer (STA 100+08 to STA 109+81) (LF)

This item is a unit-price bid for furnishing and installing the 6-inch-diameter HDPE, DR17 sewer, complete in place, where shown on the plans and as specified herein. The unit costs shall include but not be limited to the following: HDPE pipe, excavation, backfill, compaction, fittings, connections, casing spacers, testing, and post-construction CCTV inspection. This item also includes furnishing and installing asphalt concrete pavement resurfacing to the thickness of the original pavement or as shown in City Engineering Standards, whichever is greater. Pavement placed in excess of the maximum cross section will not be considered for payment without prior written authorization from the Owner. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing through fittings, but not including manholes.

C. Additive Bid Item 6 – Jack and Bore 16-Inch Steel Casing (LF)

This item is unit-price bid for furnishing and installing the 16-inch-diameter steel casing, complete and in place where shown on the plans and as specified herein. The unit costs shall include but not be limited to and furnishing all labor, materials, tools, and equipment required to jack and bore, and the steel casing. Full compensation for this item shall be made per linear foot of pipe installed along horizontal stationing.

D. Additive Bid Item 7 – 48-inch Sewer Manhole (EA)

This item is a unit-price bid for furnishing and installing SSMH#2 and SSMH#3, which are both 48-inch diameter sewer manholes per City of San Luis Obispo Standard Drawing 6610, complete in place, where shown on the plans and as specified herein. The unit costs shall include, but not be limited to the following: pre-cast concrete manhole, frame and cover, coatings, excavation, backfill, compaction, fittings, connections, and testing. Full compensation shall be on a unit cost basis per manhole.

END OF SECTION

SECTION 013216 CRITICAL PATH METHOD (CPM) CONSTRUCTION SCHEDULE REQUIREMENTS

1.01 DESCRIPTION

A. Prepare and submit a detailed CPM Construction Schedule and associated Schedule of Values as set forth in this Section.

B. The Construction Schedule shall indicate the time of starting and completion of each major structure or phase of the project and such intermediate phases as will serve for well-defined control points. These phases and control points shall be placed in chronological order on the Construction Schedule. The schedule shall demonstrate the Contractor's plan for fulfilling all Contract requirements. Indicate the anticipated date of receipt of major items of equipment, and all items of equipment receipt and installation of which is critical to the scheduled progress of the project. Fully identify the critical path for all activities. Account for limited days of dewatering per the Geotechnical Report.

C. Update and resubmit the schedule as indicated herein. With each schedule update, identify all slippages and missed milestones and provide a narrative description of proposed corrective actions.

D. All schedules and updates are to be submitted both in paper form and electronic files. The electronic files shall be provided in the language or program used to prepare the schedule, and not in pdf files.

1.02 SUBMITTALS

A. Initial Submittal:

1. Within 14 days after receipt of Notice of Award, submit for review six (6) copies of the complete CPM Construction Schedule for review and approval.

2. Within seven (7) days of receipt of initial CPM Construction Schedule, Owner will meet with Contractor for review of the proposed approach. If revisions are needed, Contractor will submit a revised CPM Construction Schedule within seven (7) working days of review meeting.

3. Acceptance of the CPM Construction Schedule is not a concurrence by Owner that schedule is reasonable or achievable.

B. Subsequent Submittals:

1. Every thirty (30) days or as required per conditions described below, submit for review six (6) copies of the complete CPM Construction Schedule with updates and narratives as needed.

2. Conditions prompting required schedule revision:

a. The CPM Construction Schedule does not represent actual progress of work.

b. Delays for any reason make re-scheduling necessary.

c. Delay in completion of any work item or sequence of work items resulting in an estimated extension of project completion by seven (7) days or more.

d. Approved contract modification necessitates re-scheduling.

3. Provide brief narrative describing the status of work, any existing or anticipated problems and recommended corrective action needed.

1.03 CONTRACTOR'S REPRESENTATIVE

Designate an individual who shall have the authority to act on behalf of the Contractor in fulfilling the requirements of preparing the CPM Construction Schedule in a comprehensive and professional manner demonstrating competence in use of the Construction Schedule. The Contractor's representative will be responsible for review of the schedule with the Owner and/or Engineer for the duration of the Contract.

1.04 ORDER OF WORK (ADD ADDITIONAL)

Certain items cannot be constructed, removed, replaced, abandoned, or demolished until certain other work has been accomplished. The following table describes the other work to be accomplished before such work may be performed. All work in the San Luis Obispo Creek for the receiving pit for the tie in from the freeway crossing to the sewer siphon (vegetation removal, excavation, dewatering, etc.) is restricted to occur from June 1 to September 30. Items identified in Milestone A found in the "Project Information" Section of the Special Provisions shall be completed within 200 working days from the Notice to Proceed.

No.	Task Description	Work by Others
1	Prepare SWPPP and dewatering plans for bore and receiving pits, wet well excavation, and for sewer installation.	City will submit contractor provided SWPPP and dewatering plan to Regional Water Quality Control Board. It is estimated that 3 submittals of the dewatering plan will be necessary. The estimated review schedule is 2 weeks for the state to review the draft plans, 1 week to review the revised plan, and 1 week to review the final plan and provide approval.
	Pothole utilities, including the piles for the US-101 retaining wall.	n/a
2	Install dewatering equipment for excavations. Excavate bore and receiving pits.	n/a
	Install gravity sewer across US-101 and sewer siphon across San Luis Obispo Creek.	n/a
3	Install temporary connection between the new gravity sewer pipe at the existing wet well. The intent is to minimize bypass pumping.	n/a
4	Abandon existing gravity sewer pipe under US-101 and the sewer siphon within San Luis Obispo Creek.	Authorization to proceed with abandonment shall be provided by the City in writing after temporary connection is successfully completed and in operation.
5	Abandonment of existing lift station shall occur after completion of startup and commissioning of the new lift station.	Authorization to proceed with abandonment shall be provided by the City in writing.

1.05 PRELIMINARY SCHEDULE OF VALUES

The preliminary Schedule of Values listing shall include, at a minimum, the work components listed in the Bid Form.

1.06 DETAILED SCHEDULE OF VALUES

A. Base the detailed Schedule of Values on the accepted preliminary schedule of values for major work components. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM schedule activities, provide sufficient detailed breakdown to meet this requirement. The Owner's Representative shall be the sole judge of acceptable numbers, details, and description of values established. If, in the opinion of the Owner's Representative, a greater number of Schedule of Values items than proposed by the Contractor is necessary, the Contractor shall add the additional items so identified by the Owner's Representative as a condition to processing the payment requests.

B. The minimum detail of breakdown of the major work components is as detailed in the Bid Form.

C. The Contractor and Owner's Representative shall meet and jointly review the detailed Schedule of Values within 7 days of the submittal. The value allocations and extent of detail shall be reviewed to determine any necessary adjustments to the values and to

determine if sufficient detail has been proposed to provide cost loading of the CPM schedule activities. Make any adjustments deemed necessary to the value allocation or level of detail, and submit a revised detailed Schedule of Values within 14 days from the date of the review meeting.

D. Following acceptance of the detailed Schedule of Values, incorporate the values into the cost loading portion of the CPM schedule. The CPM activities and logic shall have been developed concurrent with development of the detailed schedule of values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual schedule activities. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM schedule activities, where interfacing these two documents will require changes to each document. Schedule activities may need to be added to accommodate the detail of the schedule of values. Schedule of value items may need to be added to accommodate the detail of the CPM schedule activities. Where such instances arise, the Contractor shall propose changes to the Schedule of Values and to the CPM schedule activities to satisfy the CPM schedule cost loading requirements.

1.07 INCORPORATION OF SCHEDULE OF VALUES INTO CPM SCHEDULE

A. In conjunction with each submittal of the construction schedule, submit a cash flow projection indicating estimated earnings by month during the entire contract period and a schedule of values of the work using the Schedule of Values described above, including quantities and prices. The aggregate of these extended prices shall equal the contract price. Costs shall include all materials, labor, equipment, and appurtenant items necessary to accomplish the work in accordance with the contract documents. This schedule shall be satisfactory in form and substance to the Owner's Representative and shall subdivide the work into the specified component parts. Upon review by the Owner's Representative, incorporate the schedule into the form for Application for Payment. The Owner reserves the right to delete (or add) items of work from the contract and the total contract amount shall be reduced (or increased) by the total amount shown in the Schedule of Values.

B. Develop the Schedule of Values (lump-sum price breakdown) and incorporate into the cost loading function of the CPM Construction Schedule. Determine monthly progress payment amounts from the monthly progress updates of the CPM Construction Schedule activities. Develop the Schedule of Values independent but simultaneous with the development of the CPM Construction Schedule activities and logic.

1.08 CROSS-REFERENCE LISTING

A. To assist in the correlation of the Schedule of Values and the CPM Construction Schedule, provide a cross-reference listing, furnished in two parts. The first part shall list each scheduled activity with the breakdown of the respective valued items making up the total cost of the activity. The second part shall list the valued item with the respective scheduled activity or activities that make up the total cost indicated. In the case where a number of schedule items make up the total cost for a valued item (shown in the schedule of values), the total cost for each scheduled item should be indicated.

B. Update and submit these listings in conjunction with each CPM Construction Schedule monthly submittal.

C. Incorporate executed change orders reflected in the CPM Construction Schedule into the schedule of values as a single unit identified by the change order number.

1.09 CHANGES TO SCHEDULE OF VALUES

A. Changes to the CPM Construction Schedule which add activities not included in the original schedule but are included in the original work (schedule omissions) shall have values assigned as reviewed by the Owner's Representative. Other activity values shall be reduced to provide equal value adjustment increases for added activities as approved by the Owner's Representative.

B. In the event that the Contractor and Owner's Representative 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.

1.10 MEASUREMENT AND PAYMENT

Full compensation for conforming to the requirements of this Section shall be considered as being included in the total Contract price and no additional compensation shall be made therefore.

END OF SECTION

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SECTION 013300 SUBMITTALS

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. CPM Construction Schedule Requirements: 013216.

B. Operation and Maintenance Manuals: 019310.

1.02 SHOP DRAWINGS

A. Submit shop drawings in accordance with the Standard Specifications and as described below.

B. The use of contract drawing reproductions for shop drawings is subject to rejection.

C. Submit shop drawings electronically in .PDF format compatible with Adobe Acrobat, indexed, and word searchable. Files 5MB or less in size may be submitted to the Owner’s Representative via email. Files larger than 5MB shall be submitted by means of a FTP server, or USB flash drive, or as approved by the Owner’s Representative. Pages shall be scanned at a resolution necessary for legibility. Scans shall be in color where necessary for clarity.

D. If the Contractor submits shop drawings of equipment by manufacturers other than those listed in the specifications, provide the following information with the submittal:

1. The name and address of at least three companies or agencies that are currently using the equipment.

2. The name and telephone number of at least one person at each of the above companies or agencies whom the Owner's Representative may contact.

3. A description of the equipment that was installed at the above locations. The description shall be in sufficient detail to allow the Owner's Representative to compare it with the equipment that is proposed to be installed in this project.

E. For materials originating outside of the United States for which tests are required, provide recertification and retesting by an independent domestic testing laboratory.

1.03 SUBMITTAL REQUIREMENTS

A. Make submittals promptly in such sequence as to cause no delay in the work. Schedule submission a minimum of 30 calendar days before reviewed submittals will be needed.

B. Submittals shall contain:

1. The date of submission and the dates of any previous submissions.

2. The project title and number.

3. Contract identification.

4. The names of:

   a. Contractor.

   b. Supplier.

   c. Manufacturer.

5. Identification of the product, with the specification section number.

6. Field dimensions, clearly identified as such.

7. Relationship to adjacent or critical features of the work or materials.

8. Identification of deviations from contract documents.

9. Identification of revisions on resubmittals.

10. A 5-inch by 5-inch blank space for stamps of the Owner's Representative.

11. Contractor's stamp, initialed or signed, shall certify Contractor's review of submittal, verification of products, field measurements and field construction criteria, and coordination of the information within the submittal that the product meets the requirements of the work and of the contract documents.

1.04 SUBMITTAL FORMAT

A. Provide separate submittal for each item/material.

B. Each submittal shall have a transmittal form. Every page in a submittal shall be numbered in sequence.

C. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with all pertinent data, capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Present a sufficient level of detail for assessment of compliance with the contract documents.

D. Each submittal shall be assigned a unique number. Submittals shall be numbered in the chronological order of the submittal, followed by the specification section number represented by the submittal. The submittal numbers shall be clearly noted on the transmittal. Resubmittals shall bear an alphanumeric system which consists of the, submittal number for that item, followed by a letter of the alphabet to represent that it is a subsequent submittal of the original. For example, if the first Submittal 01-030500 requires a resubmittal, the first resubmittal will bear the designation "01-030500-A" and the second resubmittal will bear the designation "01-030500-B" and so on.

E. Disorganized submittals that do not meet the requirements above will be returned without review.

1.05 RESUBMITTALS

Resubmittal of submittals will be reviewed and returned in the same review period as for the original submittal. It is considered reasonable that the Contractor shall make a complete and acceptable submittal by the second submission of a submittal item. The Owner’s Representative reserves the right to withhold monies due to the Contractor to cover additional costs of any review beyond the second submittal.

1.06 CONTRACTOR'S JOBSITE DRAWINGS

Provide and maintain on the jobsite one complete set of prints of all drawings which form a part of the contract. Immediately after each portion of the work is installed, indicate all deviations from the original design shown in the drawings either by additional sketches or ink thereon. Make jobsite drawings available for monthly review by the Owner’s Representative prior to release of progress payment. Upon completion of the job, deliver this record set to the Owner's Representative.

END OF SECTION

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SECTION 015100 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.01 CONSTRUCTION WATER

A. Related Work Specified Elsewhere:

1. Earthwork: 312300.

2. Trenching, Backfilling, and Compacting: 312316.

3. General Concrete Construction: 030500.

4. Pressure Testing of Force Main Piping: 400515.

B. The Contractor is required to use recycled water for all non-potable uses.

C. Recycled water shall be obtained from the City of San Luis Obispo Wastewater Treatment Plant.

D. The Contractor shall review and comply with all requirements of the "Procedures for Recycled Water Use" adopted by the City of San Luis Obispo, which is available at https://www.slocity.org/home/showdocument?id=4376

E. The Contractor shall make his own arrangements for labor and equipment to collect, load, transport, and apply water as necessary for compaction of materials, concrete construction operations, testing, dust control, and other construction use.

F. Include the cost of construction water in the appropriate bid item to which it is appurtenant. The cost shall include full compensation for furnishing all labor, materials, tools, and equipment and doing all the work necessary to furnish the necessary equipment for applying the water as described in these specifications.

1.02 ELECTRICAL POWER--CONSTRUCTION PHASE

Provide for the purchase of power or provide portable power for the construction of the project where existing outlets are not available. Provide for the extension of utility lines to the point of usage. The cost of power shall be included in the appropriate bid items to which it is appurtenant and shall include full compensation for furnishing all labor, materials, tools, and equipment required to obtain and distribute power for construction purposes.

1.03 DUST CONTROL

Perform dust control operations to prevent construction operations from producing dust in amounts harmful to persons or causing a nuisance to persons living nearby or occupying buildings in the vicinity of the work. Use water or dust preventative to control dust.

1.04 FIRE DANGER

Minimize fire danger in the vicinity of and adjacent to the construction site. Provide labor and equipment to protect the surrounding private property from fire damage resulting from construction operations.

1.05 TRAFFIC REGULATION

Per Section 015526.

1.06 CONSTRUCTION STAKING

Furnish and install necessary grade control and stakes, or marks required for horizontal and vertical control as specified in the Standard Specifications.

END OF SECTION

SECTION 015526 TRAFFIC REGULATION

1.01 DESCRIPTION

This section describes procedures for traffic regulation during construction in public streets and highways.

1.02 STANDARD SPECIFICATIONS

Wherever reference is made to the State Specifications and Plans, such reference shall mean the City of San Luis Obispo Standard Specifications dated 2018. This shall be understood to include Appendix G “Guidelines for Construction Zones”.

1.03 SUBMITTALS

The Contractor shall submit a traffic control plan not less than 14 working days prior to start of construction operation, prepared, signed, and sealed by a California licensed civil engineer to the Owner’s Representative for approval. Preparation of any additional traffic control plans or detail that may be required by Caltrans, and the City of San Luis Obispo during the course of the work shall be the Contractor's responsibility. No work shall begin until a traffic control plan is approved. Refer to Appendix H for the Caltrans permit.

1.04 GENERAL

A. Provide safe and continuous passage for pedestrian and vehicular traffic at all times.

B. Control traffic at those locations indicated and in conformance with the approved traffic control plans and specifications.

C. Furnish, construct, maintain, and remove detours, road closures, traffic signal equipment, lights, signs, barricades, fences, K-rail, flares, solar-powered flashing arrow signs, miscellaneous traffic devices, flagmen, drainage facilities, paving, and such other items and services as are necessary to adequately safeguard the public from hazard and inconvenience. All such work shall comply with the ordinances, directives, and regulations of authorities with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor. After devices have been installed, maintain and keep them in good repair and working order until no longer required. Replace such devices that are lost or damaged, to such an extent as to require replacement, regardless of the cause of such loss or damage.

D. Prior to the start of construction operations, notify the police and fire department in whose jurisdiction the project lies, giving the expected starting date, completion date, and the names and telephone numbers of two responsible persons who may be contacted at any hour in the event of a condition requiring immediate emergency service to remove, install, relocate, and maintain warning devices. In the event these persons do not promptly respond or the authority deems it necessary to call out other forces to

accomplish emergency service, the Contractor will be held responsible for the cost of such emergency service.

E. Provide a minimum of 48 hours' notice to Caltrans and the City of San Luis Obispo for any work within their respective rights-of-way. In the event that any underground utilities, traffic devices, pipes, or conduits are damaged and require emergency repair, all costs incurred in making such repairs, plus 15% for administration costs, shall be paid by the Contractor.

F. Post temporary "No Parking - Tow Away" signs 48 hours prior to work in areas where parking is normally permitted. The City of San Luis Obispo Police Department shall be notified 48 hours prior to the posting of any temporary parking restrictions along the pipeline route.

G. Post the construction information signs at least 2 weeks prior to construction.

1.05 TRAFFIC CONTROL DEVICES AND SIGNS

A. Traffic control devices and temporary striping shall conform to the California Manual of Uniform Traffic Control Devices (California MUTCD). Construction signs shall conform to the latest edition of the FHA publication “Standard Highway Signs” and the State of California Sign Specification Sheets.

B. The placement of construction signing, striping, barricades, and other traffic control devices used for handling traffic and public convenience shall conform to the California MUTCD.

C. Signs shall be illuminated or reflectorized when they are used during hours of darkness. Cones and portable delineators used for night lane closures shall have reflective sleeves. Equip barricades used in the diversion of traffic with flashers if in place during hours of darkness.

D. During the duration of a detour, cover existing signs not in accordance with the traffic control plan. Relocate existing signs that are in force to provide visibility from all relocated traffic lanes.

1.06 TEMPORARY STEEL PLATE BRIDGING, WITH A NONSKID SURFACE

A. When backfilling operations of an excavation in the traveled way, whether transverse or longitudinal, cannot be properly completed within a workday, provide steel plate bridging with a nonskid surface and shoring to preserve unobstructed traffic flow. In such cases, the following conditions shall apply:

1. Steel plates used for bridging shall extend a minimum of 12 inches beyond the edges of the trench.

2. Install steel plate bridging to operate with minimum noise.

3. Shore the trench to support the bridging and traffic loads.

4. Use temporary paving with cold asphalt concrete to feather the edges of the plates if plate installation by Method 2 is used.

5. Secure bridging against displacement by using adjustable cleats, shims, or other devices.

B. Install steel plate bridging and shoring using either Method 1 or 2:

1. Method 1 (For Speeds More Than 45 mph): The pavement shall be cold planed to a depth equal to the thickness of the plate and to a width and length equal to the dimensions of the plate.

2. Method 2 (For Speeds 45 mph or Less): Attach approach plate(s) and ending plate (if longitudinal placement) to the roadway by a minimum of two dowels predrilled into the corners of the plate and drilled 2 inches into the pavement. Butt subsequent plates to each other. Compact fine graded asphalt concrete to form ramps, maximum slope 8.5% with a minimum 12-inch taper to cover all edges of the steel plates. When steel plates are removed, backfill the dowel holes in the pavement with either graded fines of asphalt concrete mix or concrete slurry.

C. Maintain the steel plates, shoring, and asphalt concrete ramps.

D. The following table shows the required minimal thickness of steel plate bridging required for a given trench width:

Trench Width (feet)	**Minimum Plate Thickness (inches)**
1	1/2
1-1/2	3/4
2	7/8
3	1
4	1-1/4

E. For spans greater than 4 feet, prepare a structural design by a registered civil engineer and submit to the Owner's Representative for review.

F. Design steel plate bridging for HS20-44 truck loading per Caltrans Bridge Design Specifications Manual. Maintain on the steel plate a nonskid surface having a minimum coefficient of friction equivalent to 0.35 as determined by California Test Method No. 342. The Contractor may use standard steel plate with known coefficient of friction equal or exceeding 0.35.

1.07 VEHICULAR TRAFFIC CONTROL

A. Complete backfill, compaction, testing, and the first lift of permanent paving for any segment of pipe constructed in phases. Shoring members, beams, or other obstructions shall not be permitted within a 2-foot clearance between the edge of excavation and the edge of any traffic lane. At construction areas where an open trench exists and/or where traffic detour will be in existence during night hours, replace delineators with barricades or K-rail.

B. Accomplish construction by detouring traffic from its normal patterns as necessary for complete installation. Restore traffic to normal patterns upon completion of the pipeline construction.

C. Transition traffic lane transitions from permanent lanes to construction zone patterns in accordance with the requirements for the normal posted speed limit and per Caltrans and City of San Luis Obispo requirements.

D. Unless otherwise shown in the drawings or allowed by the City of San Luis Obispo within whose jurisdiction the work is being performed, limit construction activities to 7 a.m. to 5 p.m. Monday through Friday. Return roadways and sidewalks to unrestricted vehicle and pedestrian usage when construction is not underway.

E. During the peak traffic volume hours of the day, from 6:00 a.m. to 8:30 a.m. and 3:30 p.m. to 7:00 p.m. on weekdays only, limit construction activities within the construction zone to those which will not impact the free movement of vehicular traffic in its detoured pattern. Construction equipment or trucks shall not use or travel adjacent to traffic lanes during these time periods. Truck operations in and out of construction and staging areas shall be controlled by flagmen at all times.

1.08 PEDESTRIAN TRAFFIC CONTROL

A. Maintain and delineate a minimum of one 4-foot-wide pedestrian walkway along each public street at all times during construction. Maintain existing pedestrian accesses at intersections at all times. When existing crosswalks are blocked by construction activity, install signs directing pedestrian traffic to the nearest alternative crosswalk.

B. Erect a fence or provide other means of securement to preclude unauthorized entry to any excavation during all nonworking hours on a 24-hour basis including weekends and holidays. Said fence shall be a minimum of 7 feet high around the entire excavation, consisting of a minimum 9-gauge chain-link type fence fabric and shall be sturdy enough to prohibit toppling by children or adults. There shall be no openings under the wire large enough for any child to crawl through. Lock any gates if no adult is in attendance. Place warning signs spaced on 50-foot centers on the outside of the fence with the statement "DEEP HOLE DANGER."

C. Place a guard during normal school hours whose prime responsibility is to provide safe guidance for children and adults past the construction area.

1.09 ACCESS TO ADJACENT PROPERTIES

Maintain reasonable access as determined by the engineer, from public streets to adjacent properties at all times, during construction. Prior to restricting normal access from public streets to adjacent properties, notify each property owner or responsible person, informing him of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access route for that particular property.

The requirements related to Right of Way Agreement included as Appendix B shall be applicable to this project. Comply with requirements.

1.10 PERMANENT TRAFFIC CONTROL DEVICES

A. Existing permanent traffic control signs, and barricades shall remain in effective operation unless a substitute operation is arranged for and approved as a portion of vehicular traffic control above. Traffic signal modification and restoration work shall be in accordance with Section 86 of the State Specifications.

B. Completely restore traffic signals affected by the construction of the pipeline to its original operation immediately upon completion of the work requiring the signal modification.

C. Restriping of Streets: Permanent restriping shall be in accordance with the requirements of the agencies having jurisdiction. Place and remove temporary striping required for traffic control during construction by sandblasting. Temporary striping includes any striping required on any pavement replaced prior to the final surface course. Replace any damaged or obliterated raised pavement markers in accordance with the standards of the agency having jurisdiction.

END OF SECTION

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SECTION 015723 STORM WATER POLLUTION PREVENTION PLAN

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes work necessary by the Contractor to allow the Owner to comply with the California State Water Resources Control Board (SWRCB) Construction Activities Storm Water General Permit (Construction General Permit [CGP]), Order No. 2009-0009-DWQ (NPDES No. CAS000002) as amended by 2010-0014-DWQ and 2012-0006-DWQ for discharges of storm water associated with construction activities. Specifically, this includes the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) and abiding by the general requirements provided in the SWPPP prepared by Cannon, found in Appendix F. The Contractor shall demonstrate experience, resources, and capabilities in determining and meeting the requirements of the CGP under Type 3 LUP requirements, including receiving water and bioassessment monitoring, if required, and adjustments to best management practices (BMPs) outlined in the SWPPP, as needed.

B. Disposal of construction-related water from operations such as groundwater dewatering, and water used for testing and flushing pipelines is not part of the work under this section. Refer to Sections 312300, 312316, and 400515 for permit requirements for those discharges.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Supplement to General Provisions: 007300.

B. Coordination of Work and Permits: 011100.

C. Measurement & Payment: 012000.

D. Submittals: 013300.

E. Construction Facilities and Temporary Controls: 015100.

F. Earthwork: 312300.

G. Trenching, Backfilling, and Compacting: 312316.

H. Pressure Testing of Force Main Piping: 400515.

1.03 SUBMITTALS

Submit the CGP-compliant SWPPP in electronic format following the procedure described for shop drawings in Section 013300. The Contractor shall submit a draft SWPPP 15 working days from the notice of award.

1.04 GENERAL CONSTRUCTION ACTIVITY STORM WATER PERMIT

A. Determine the LUP project type (per Section VIII of the CGP) using the LUP Project Area or Project Section Type Determination flowchart in Attachment A.1 of the CGP.

B. Prepare a draft SWPPP compliant with the appropriate LUP type requirements specified in CGP Attachment A, Section J, and submit to the Owner for review and comment. Once finalized, submit the final SWPPP to the Owner submittal to the SWRCB. The Owner will be responsible for submitting the final SWPPP and other permit registration documents (PRDs) along with appurtenant fee to the State Water Resources Control Board (SWRCB).

C. No work on the project site shall commence prior to the Owner submitting the PRDs and obtaining a Waste Disposal Identification (WDID) number from the SWRCB. The Owner will notify the Contractor once the WDID has been issued and work can commence.

D. The Qualified SWPPP Developer (QSD) and Qualified SWPPP Practitioners (QSPs) responsible for creating, revising, overseeing, and implementing the SWPPP shall have attended a SWRCB -sponsored or -approved QSP/QSD training course and have an active certification.

E. The SWPPP shall be appropriate for the type and complexity of the project and shall be developed and implemented to address project-specific conditions. The project SWPPP shall identify specific BMPs needed to address all possible generated pollutants. The Contractor is responsible for adjusting BMPs as determined by the QSD, QSP or regulatory authority to bring the project into compliance with the CGP.

F. The Contractor is responsible for implementation of the project SWPPP, including inspections, monitoring and installation and maintenance of BMPs, to ensure CGP compliance until final stabilization of the site has been achieved and termination of permit coverage is approved by the SWRCB.

G. The Contractor is responsible for project compliance with all applicable requirements of the CGP.

H. Compliance with the requirements contained in the CGP may require the use of erosion and sedimentation control procedures outside the limits of immediate construction activity.

1.05 NOTICE OF INTENT (NOI)

The Owner will file an NOI with the SWRCB as part of the PRD submittal process. A copy of the NOI will be provided to the Contractor for inclusion in the onsite SWPPP.

1.06 EROSION CONTROL PROTOCOL

A. Implement erosion and sediment control measures as outlined in the project SWPPP.

B. Make adjustments to erosion and sediment control measures as needed for CGP compliance.

1.07 MEASUREMENT AND PAYMENT

A. Costs to the Contractor for preparing and implementing the SWPPP shall be stated in the bid item included in in Section 012000 for that purpose.

B. In addition, the Contractor shall be responsible for all of its costs associated with project compliance with the CGP and the implementation of the SWPPP, SWPPP amendments, and coordination with the Owner for regulatory reporting. These costs shall be included in the prices shown for the other related bid items.

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

3.01 GENERAL

A. Develop and submit a CGP-compliant SWPPP for review and acceptance by the Owner. The Owner will be responsible for submitting the final SWPPP and other PRDs to the SWRC). Construction activities may not commence until the SWRCB has approved all PRDs, including the project SWPPP, and has issued the WDID. Refer to "Time for Completion" in Section 007300.

B. Comply with the conditions identified in the CGP that apply to the work under this contract, including the performance of any subcontracted work.

C. Keep the SWPPP and all associated forms and documents, on site throughout the construction activity period. Make it available upon request of an RWQCB representative and/or other regulatory agency.

D. SWPPP amendments or any other changes of information shall be communicated to the owner for submittal to the SWRCB.

3.02 DUTY TO COMPLY

A. Comply with the conditions identified in the CGP and the project SWPPP. Nonadherence with the conditions specified in the CGP may constitute a violation of the Clean Water Act and the Porter-Cologne Water Quality Control Act and may be grounds for enforcement action by the California Regional Water Quality Control Boards (RWQCB).

3.03 COMPLIANCE CERTIFICATION

A. An officer or other authorized representative of the Contractor shall certify in writing to the Owner annually and at the completion of construction, if it occurs before the next annual report, that its construction activity is and has been in compliance or has been modified to comply with the requirements of the CGP and the SWPPP.

B. If compliance with any of the CGP and SWPPP requirements cannot be certified, notify the Owner immediately. The notification shall identify the type of noncompliance, describe the actions necessary to achieve compliance, and include a time schedule when compliance will be achieved. Submit each noncompliance notification to the Owner within 15 days of identification of the event.

END OF SECTION

SECTION 015800 TEMPORARY SEWAGE BYPASS PUMPING

PART 1 - GENERAL

1.01 DESCRIPTION

This specification covers work and equipment required for temporarily diverting sewage around work areas or interrupting flow for a short duration. Bypass pumping includes furnishing, installing, operating and maintaining all power, primary and standby pumps, appurtenances, bypass piping, and all the tools, labor, supervision, materials, and equipment necessary to maintain existing sewer flows and services and conforming with the Contractor's submitted Bypass Pumping Plan and Spill Prevention Control and Countermeasure Plan. The Contractor shall schedule work to minimize service outages.

The Contractor may perform short duration shutdowns as specified herein. Performing Short Duration Shutdowns includes furnishing, installing, operating and maintaining all power, standby pumps, appurtenances, standby piping, and all the tools, labor, supervision, materials, and equipment necessary to conform to the Contractor's submitted Short Duration Shutdown Plan and Spill Prevention Control and Countermeasure Plan. The maximum duration of a planned short duration sewer shutdown shall be 4 hours and shall occur in coordination with the Owner and only during the Contractor's working hours while work necessitating the shutdown is performed. In addition to submitting the shutdown plan(s), the Contractor shall provide a minimum of 72 hours written notice prior to the actual need for sewer shutdowns.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Commissioning: 018100.

1.03 SUBMITTALS

Submit a Bypass Pumping Plan and/ or a Change Over Plan and Short Duration Shutdown Plan depending on the Contractor's plan of action.

A. Bypass Pumping Plan.

Submit a bypass pumping plan prepared by a licensed California Professional Engineer to the Owner's Representative for review a minimum of 10 days prior to any planned bypass. The Owner's written permission shall be obtained prior to bypass pumping. The bypass pumping plan shall consist of the following information, at a minimum, for each bypass pumping setup:

1. Sequence of sewage flow interruption, bypass and tie-ins.

2. Plans indicating the location of temporary sewer plugs and bypass discharge lines. Drawings shall clearly indicate the proposed intake-to-discharge pumping sequence and shall be coordinated to minimize impact to existing plant operations.

3. Capacities of pumps, prime movers, and standby equipment. At least two (2) pumps shall be provided.

4. Design calculations proving adequacy of the system and selected equipment. This is to include any flow metering data collected, method used to establish design flows, and design flows used for sewer bypass system sizing.

5. Pump make, model, pump curve, design head (TDH) calculations, horsepower requirement, and noise rating.

6. Sewage bypass pipe material, fitting types, and details on necessary appurtenances, including pipe plugs.

7. Method for securing plugs to prevent floating downstream.

8. Plans showing details of proposed method of temporary handling of sewage flow, routing of bypass lines, containment areas, equipment location, schematic of pump set-up and discharge, and proposed sequencing.

9. Electrical, controls, and instrumentation.

10. Spill Prevention, control, and countermeasure plan.

11. Traffic Control Plan must identify any delineation needed for bypass equipment and piping.

B. Change Over Plan

Submit a written change-over plan to the Owner's Representative for review a minimum of 14 days prior to decommissioning any segment of the existing sewer or process equipment and/ or constructing tie-in connections for new sewer or process equipment. The Owner's written permission shall be obtained prior to any shutdowns. The change-over plan shall consist of the following information, at a minimum:

1. Sequence of flow interruption, short duration shutdowns, construction of tie-ins, construction of interference manhole, and abandonment or removal of existing sewers and manholes.

2. Plans indicating the location of temporary sewer plugs, standby pump(s), discharge lines and other standby equipment.

3. Capacities of pumps and standby equipment.

4. Checklist for equipment, material and manpower required to complete the change-over in a timely fashion in conformance with the plans and specifications. All equipment, material and manpower shall be on-site and ready prior to initiating the change-over. The Contractor shall also have backup equipment and material on

hand and shall be prepared to pursue the completion of the change-over in an efficient diligent and timely manner.

5. Spill Prevention, control, and countermeasure plan.

C. Short Duration Shutdown Plan

Submit a written short duration shutdown plan to the Owner's Representative for review a minimum of 10 days prior to any planned shutdowns. The Owner's written permission shall be obtained prior to any shutdowns. The short duration shutdown plan shall consist of the following information, at a minimum, for each setup:

1. Sequence of flow interruption and construction of tie-ins, including new manholes and sewers.

2. Location and duration of planned short duration shutdowns.

3. Plans indicating the location of temporary sewer plugs, standby pump(s), discharge lines and other standby equipment.

4. Capacities of pumps and standby equipment.

5. Checklist for equipment, material and manpower required to complete the tie-in in a timely fashion in conformance with the plans and specifications. All equipment, material and manpower shall be on-site and ready prior to initiating the sewer shutdown. The Contractor shall also have backup equipment and material on hand and shall be prepared to pursue the completion of the tie-in in an efficient diligent and timely manner.

6. Spill Prevention, control, and countermeasure plan.

1.04 JOB CONDITIONS

A. Bypass equipment shall be capable of handling a peak hour flow rate of 1.06 million gallons per day (MGD).

B. Schedule the order of work to minimize bypass pumping and/or shutdown durations.

C. Protection

No bypassing to the ground surface, receiving streams, storm drains, or bypassing which may result in groundwater contamination or potential health hazards shall be permitted.

D. Bypass conditions

1. Each bypass pump shall be capable of handling a Peak Hour Flow of 0.53 million gallons per day. Confirm Peak Hour Flow with Owner's Representative prior to preparing bypass plan.

PART 2 - MATERIALS

2.01 PUMPING EQUIPMENT

Engines shall be muffled in such a manner that the maximum noise level will not exceed 80 dBA at a distance of eight feet from motors. Temporary electrical services may be used by coordinating with local electrical service at the Contractor's expense. Implement sound damping measures. Standby pumping equipment shall be at the site continuously during bypass pumping or short duration shutdown to provide 100 percent standby pumping capacity. The standby pumps shall be connected to piping such that if the bypass duty pump fails or if interrupted sewage accumulates beyond an acceptable level, the standby pump will be online immediately.

2.02 BYPASS PIPING

Bypass piping shall be aluminum, galvanized steel, or fusion-welded solid wall HDPE.

PART 3 - EXECUTION

3.01 SEWER BYPASSING

A. Sewer bypassing shall be accomplished by pumping or diverting the upstream flow around the work.

B. Provide temporary pumps, bypass pipe, and other equipment to bypass the sewer flow. Furnish the necessary labor, tools, equipment, and supervision to set up, operate, and monitor the pumping and bypass system. Pumps and bypass lines shall be of adequate capacity and size to handle projected flows. All bypassed flow shall be discharged into a downstream manhole, pond, distribution box, infiltration basin, or other structure to maintain treatment. Pumps and entire bypass line shall have a sandbag berm to act as a temporary containment area.

C. Under no circumstances shall sewage or solids be deposited onto the ground surface, streets, or into ditches, catch basins, storm drains or natural drainage ways. Sewage shall be handled in a manner so as not to create a health hazard. Swales and drainage paths in the vicinity of the bypass shall be sandbagged prior to and during bypass pumping.

D. Maintain continuity of treatment works connected to the bypassed sewer during the execution of the work. In the event that sewage backup occurs during Contractor bypass pumping, the Contractor shall cleanup, repair, pay property damage costs, pay fines imposed by jurisdictional authorities, and handle all claims arising therefrom. All spills shall be contained and returned to the sewer system.

E. Provide a designated employee(s) who is to be responsible for monitoring the bypassing operation, and all related equipment.

F. Complete a bypassing checklist prior to bypassing operation. The checklist will demonstrate the step-by-step inspection of the pumps, pipes, hold-down cables, plugs, and other equipment or appurtenances that will be used in the operation and sign the checklist.

3.02 STANDBY EQUIPMENT

Maintain on site sufficient equipment and materials to ensure continuous and successful operation of the bypass and dewatering systems. Standby pumps shall be fueled and operational at all times. Maintain on site a sufficient number of valves, tees, elbows, connections, tools, sewer plugs, piping and other parts or system hardware to ensure immediate repair or modification of any part of the system as necessary.

3.03 SPILL PREVENTION, CONTROL AND COUNTERMEASURE PLAN

Prepare, submit and carry out a spill prevention, control and countermeasure plan that incorporates the following:

A. Include or reference in the plan, materials provided as submittals per Part 1.02 above.

B. Provide in the plan a description of all emergency equipment for bypassing flow, containment, cleanup, and repair of any damage. Specifics shall include as applicable, but are not limited to:

1. Pipe patch kits

2. Sand bags

3. Rubber matting

4. Bypass pipes, pumps, and other relevant equipment

5. Extra pumps

6. Secondary containment in trench or other surrounding land relief

C. Maintain equipment on site.

D. Provide the Owner with at least two (2) people who can be contacted 24 hours per day by phone and be at the site within 1 hour to address onsite emergencies. Provide notification of any substitution in writing at least two days in advance. When bypassing flows, have at least one person available 24 hours per day to implement the emergency procedures in case of an emergency.

E. Describe the method used to protect storm drains, waterways, and drainages during construction on the plan. The description shall include where the storm drains are located (simple map of sewer pipe, storm drains, waterways, and any relief features) and information that would assist in containing the spill. The plan shall describe how storm

drains will be blocked in the event of a spill (what material, who will do it, how long will it take). Describe any other response-related plans (bypass pumping set ups, etc.).

F. Coordinate the plan to protect water quality and respond to spills of sewage, groundwater, or fuels. Describe all spill prevention measures (e.g. monitoring of upstream manholes, monitoring in the trench).

G. In general, good housekeeping is required so no contamination reaches surface waters or storm drains when it rains. Some specifics include, but are not limited to:

1. Prior to start of bypassing, all storm drain catch basins that are within the vicinity of the work that could possibly take in sewage in the event of a spill shall be isolated with sandbags and filter cloth or other approved means.

2. Oil pans should be under any engine that leaks oil.

3. Spill response as covered below.

H. The following spill procedures shall be incorporated into the plan in anticipation of the described failure mode, and the Contractor shall be prepared to act accordingly. If a spill is detected or a catastrophic pipe failure occurs, the immediate priority shall be to prevent any sewage from reaching surface waters and storm drainages. Immediately protect all drainage paths using sand bags (have sand bags on site).

1. When excavating for a new trench and moderate leaks are discovered in the existing pipe, make coupling/clamp repairs as soon as possible to minimize sewage flow into the trench. If the leak is too large to make fast coupling repair, start bypassing (see bypassing sequence below), then make repair.

(a) In case of catastrophic leak, immediately start the bypassing sequence:

(b) Plug upstream side of manhole upstream of a catastrophic leak.

(c) Insert bypass pump into manhole upstream of plugged manhole. The pump shall be sized to handle peak flow of existing sewer. Provide spare pump or set up standby pump availability with rental yard.

(d) Connect hose from pump to discharge point. (NOTE: Hose shall already be in place and connected to a downstream discharge point at all times when working near or with live sewers.)

(e) In event of any spill, immediately and in parallel with above activities, notify the Owner and request the Owner's wastewater collection staff to be dispatched. Give the best indication of the approximate size of the spill (<1,000 gallons is small; 1,000 gallons to 10,000 gallons is medium; and >10,000 gallons is large) to the Owner's staff so they can dispatch the appropriate response. Owner's staff will assist in the response and ensure that the spill is cleaned to the Owner's standards.

(f) While awaiting the Owner's wastewater collection staff response, pond the water in an area that can be easily and fully recovered for discharge to the Owner's treatment system. This ponding activity should not impact any environmentally sensitive areas.

(g) When Owner's collections staff and any other responding staff arrive onsite, a more permanent and planned response, repair, and cleanup will ensue. Cooperate with the Owner to the fullest extent possible in order to minimize the impacts and volume of the spill in the most efficient manner possible.

(h) No form of disinfection is allowed. All wash water must be contained and recovered as the sewage is.

(i) Clean up may require equipment. All costs of Owner time and material and special equipment for spill cleaning will be deducted from the Contractor's progress payment.

(j) In the event of a spill, be prepared to document the spill with a video camera and photographs. Plan on attending a debriefing immediately after the spill is contained and cleaned up.

I. Comply with the Regional Water Quality Control Board, San Luis Obispo County Health Department, and Owner Standards. Cooperate with Owner's staff and other regulators and environmental agencies.

3.04 DAMAGES

Without cost to the Owner, repair any damage that may result from the installation, operation, maintenance, and removal of the sewer bypass pumping system or short duration shutdown system. This includes but is not limited to damages resulting from inadequate or improper installation, operation and maintenance of the bypass or interruption system components, mechanical failures, or electrical failures.

If Owner staff is called on to assist, the Contractor shall pay for all costs incurred by the Owner in assisting the Contractor.

END OF SECTION

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SECTION 017410 CLEANING DURING CONSTRUCTION AND FINAL CLEANING

1.01 GENERAL

A. This section includes cleaning during construction and final cleaning on completion of the work.

B. At all times maintain areas covered by the contract and adjacent properties and public access roads free from accumulations of waste, debris, and rubbish caused by construction operations. Do not store materials in the roadway or on sidewalks.

C. Conduct cleaning and disposal operations to comply with local ordinances and antipollution laws. Do not burn or bury rubbish or waste materials on project site. Do not dispose of any wastes in storm or sanitary drains. Do not dispose of wastes into streams or waterways.

D. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

1.02 CLEANING DURING CONSTRUCTION

A. During execution of work, clean site, adjacent properties, and public access roads and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish. Sweep streets as needed.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. Provide containers for collection and disposal of waste materials, debris, and rubbish.

D. Cover or wet excavated material leaving and arriving at the site to prevent blowing dust. Clean the public access roads to the site of any material falling from the haul trucks.

1.03 SITE CLEANING PRIOR TO LANDSCAPING

Remove concrete, concrete wash, stucco splatter, gunite overspray, and all other wastes and debris prior to final grading and landscaping.

1.04 FINAL CLEANING

A. At the completion of work and immediately prior to final inspection, clean the entire project site as follows.

B. Clean, sweep, wash, and polish all work and equipment including finishes.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces.

D. Repair, patch, and touch up marred surfaces to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean landscaped areas.

F. Remove from the site temporary structures and materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work.

END OF SECTION

SECTION 018100 PRECOMMISSIONING AND COMMISSIONING

PART 1 - GENERAL

1.01 GENERAL

This section describes requirements for commissioning and starting up the lift station including operational testing, acceptance testing, and placing into service.

1.02 REQUIRED WORK PRIOR TO COMMISSIONING AND STARTUP

A. Prior to starting commissioning and startup, the following shall be completed:

1. Factory tests as required in the special provisions and standard provisions are submitted to the Engineer.

2. Pressure testing of forcemain piping per Section 400515.

3. Leakage and infiltration testing of gravity pipes per Section 330130.

4. All pumps, piping, lighting, instrumentation and controls necessary for lift station operation are installed and complete.

5. Field tests as required in the special provisions and standard provisions are successfully conducted in the presence of the Engineer.

1.03 OPERATIONAL TESTING

A. Perform operational tests of the pumping plant to demonstrate the following:

1. All pumps, piping, lighting, instrumentation and controls necessary for lift station operation operate as specified.

2. The submersible pumps operate as specified without excessive noise, cavitation, vibration, and without overheating of the bearings.

3. Automatic and manual controls function in accordance with the specified requirements.

4. Drive equipment operates without being overloaded.

B. Submit a plan to conduct operational tests at least ten (10) work days prior to testing. The plan shall include methods for:

1. Test schedule (i.e. starting date and number of days)

2. Removing all debris from the wet well before testing

3. Locating and installing bulkheads in the influent sewer, if used

4. Operational tests, including pump controller operation

5. Supplying recycled water

6. Recycled water disposal

C. Perform operational tests in the presence of the Engineer.

D. Control set levels may be adjusted for this test.

E. Perform operational tests with recycled water.

F. Furnish all recycled water and electrical energy necessary for testing. Water used for testing shall be disposed of in the downstream sewer by means of the existing forcemain, or as approved by the Engineer.

G. Repeat the operational tests until requirements have been met.

H. Operational tests shall be deemed complete when the Engineer issues a written letter to the Contractor stating that the operational tests are complete.

1.04 CLEANING

A. Prior to the Contractor beginning his field operations, City staff will clean the principal tributary pipelines.

B. The purpose of this cleaning is to minimize the presence of existing debris that could potentially interfere with the Contractor's bypass pumping.

C. During bypass pumping operations, accumulation of debris will possibly occur in the sanitary sewer pipelines that are tributary to the lift station. City staff will monitor the sewage level in the principal tributary pipelines to determine if any portions of the pipelines have become blocked. If a blockage is evident, City staff will clear the blockage from the pipeline. Prior to clearing the blockage, City staff will notify the Contractor so that he can adjust the bypass pumping system if necessary.

D. After operational tests are complete and prior to acceptance testing, the Contractor shall thoroughly clean and remove solids from the wet well. Contractor shall also clean the tributary pipelines to remove debris that may have accumulated. That debris can migrate, after the bypass plug is removed, in to the wet well and possibly clog the pumps. If the pumps cannot operate with those clogs being present, the acceptance testing cannot be completed. Therefore, the Contractor shall be responsible for removing debris that might interfere with the acceptance testing. The Contractor shall select the level of cleaning they believes is necessary for the successful completion of the acceptance testing. In the event clogging of the pumps occurs during the acceptance testing, the Contractor shall be responsible for removing, cleaning, and reinstalling the submersible pumps so that the

testing can be completed. The contractor shall be solely responsible for repairing any damage to the pumps that occurs during the acceptance testing.

1.05 ACCEPTANCE TESTING

A. Acceptance tests shall be conducted under actual service conditions with raw sewage and control set points per plan or as directed by the Engineer.

B. Acceptance testing may begin once operational tests are complete, bulkheads removed, and the upstream sewer is cleaned.

C. Perform acceptance tests of the pumping plant to demonstrate the following:

1. Submersible pumps shall operate without failure, interruption, or adjustment for fourteen (14) consecutive calendar days on automatic control.

2. Any interruption or adjustment, including cleaning of the pumps, shall restart the acceptance test.

D. Acceptance tests shall be deemed complete when the Engineer issues a written letter to the Contractor stating that the acceptance tests are complete.

E. The 5-day acceptance test as required per Section 405000 may be conducted during or after the acceptance test described above.

1.06 MAINTENANCE REQUIREMENTS

A. Section 7-1.15, "Relief from Maintenance and Responsibility," of the Standard Specifications does not apply to this project.

B. Until acceptance tests are complete, the Contractor shall:

1. Maintain total pumping capacity

2. Provide lift station maintenance, including performing adjustments and repairs for proper operation of pump and electrical equipment

3. Furnish electrical energy necessary for maintaining total pumping capacity and maintenance requirements.

C. Submit a plan for maintaining the total pumping capacity and maintenance of the lift station that includes lift station maintenance procedures and schedule.

D. Bypass equipment shall remain in place and operational until acceptance tests are complete.

E. Keep a logbook of lift station maintenance activities. Include maintenance dates, work performed, and the name of employee doing the work.

1.07 USE OF EQUIPMENT BEFORE ACCEPTANCE

A. Charges and fees for use of electrical power, telephone, and other utilities that result from operation of equipment prior to completion of acceptance testing shall be the responsibility of the Contractor and no additional payment shall be made therefor.

B. No payment shall be authorized for failed tests.

END OF SECTION

SECTION 019310 OPERATION AND MAINTENANCE MANUALS

1.01 GENERAL

Submit 2 hard copies and an electronic copy of all manufacturer's operation and maintenance manuals and data pertinent to equipment supplied for the project. Prepare and organize the material in three-ring binders with divider tabs and labels. Include a table of contents. Include a CD of all catalog data in pdf format and all drawings in both pdf and CADD formats. All pdf files shall be formatted to allow word search.

1.02 SUBMITTALS

A. Submittals shall include:

1. List of equipment furnished for project with name, address, and telephone number of each vendor.

2. List of serial numbers of equipment furnished.

3. A copy of shop drawings for mechanical, electrical, and instrument equipment in final form.

4. Manufacturer's operation and maintenance instructions and parts lists.

5. Tabulation of motor nameplate horsepower, nameplate current, field-measured current, overload relay setting, and catalog number for polyphase motors.

6. List of fuses, lamps, seals, and other expendable equipment and devices. Specify size, type, and ordering description. List name, address, e-mail address, website address, fax number, and telephone number of vendor.

B. Provide manuals for each piece of equipment including individual components and subsystems of complete assemblies. Line out nonapplicable text and illustrations. The section of the manual on operation shall describe the functions and limitations of each component and its relationship to the system of which it is a part. Where several models, options, or styles are described, the manual shall identify the items actually provided.

C. Each manual shall contain the following:

1. Manufacturer's identification, including order number, model, and serial number.

2. Prints or reviewed shop drawings and diagrams of all systems.

3. Certified equipment drawings or reviewed shop drawing data clearly marked for equipment furnished.

4. Complete operating and maintenance instructions for each and every item of equipment, setting forth in detail and step-by-step the procedure for starting,

stopping, operating, and maintaining the entire system as installed. Include a schedule of recommended maintenance intervals.

5. Complete parts list of replaceable parts, their part numbers, and the name and address of their nearest vendor.

6. Any special emergency operating instruction and a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.

7. Copy of manufacturer's equipment guarantees and warranties.

D. Brochures shall be loose leaf with durable plastic or fiberboard covers. Each sheet shall be reinforced to prevent tearing from continued use, and each brochure shall have the following information clearly printed on its cover:

1. Project name, name of Owner, and address.

2. Name and address of Owner's Representative.

3. Name and addresses of contractors and subcontractors and department to contact.

4. Telephone number of contractors, including night and emergency numbers.

5. Major equipment vendors' names and telephone numbers.

E. Submit complete manuals at least four weeks before the date of the instructions required by the subsections on "Manufacturer's Services" in the various specification sections.

F. Operation and maintenance manuals specified herein are in addition to any operation, maintenance, or installation instructions required by the Contractor to install, test, and start up equipment.

1.03 EQUIPMENT DATA SHEETS

Provide six sets of equipment data sheets, bound in three-ring binders, summarizing the equipment manufacturer's maintenance instructions and recommendations. A blank data sheet and a sample data sheet are attached.

Preventive Maintenance and Operating Requirement Sheets

Preventive Maintenance Program	Equipment Record Number	
EQUIPMENT DESCRIPTION	ELECTRICAL OR MECHANICAL DATA	
Name:	Size:	
Serial No.:	Model:	
Vendor:		
Vendor Address:	Type:	
	Mfr.:	
Vendor Rep:	Voltage:	Amps:
Phone:	Phase:	rpm:
Maintenance Work to be Done		Frequency*
OPERATING REQUIREMENTS AND REFERENCE		

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly;
S - Semiannually; A - Annually.

SAMPLE

Preventive Maintenance and Operating Requirement Sheets

Preventive Maintenance Program	Equipment Record Number	
EQUIPMENT DESCRIPTION	ELECTRICAL OR MECHANICAL DATA	
Name: Influent Pump No. 1 Tag No.: P01-1	Size: 15 hp	
Serial No.: 123456ABC Vendor: ABC Pump Co.	Model: 140T Frame Serial No. 987654ZY Class F Insulation W/Space Heater	
Vendor Address: 1111 Pump Circle Newport Beach, CA 92663	Type: Mfr.: DEF Motors, Inc.	
Vendor Rep: XYZ Equipment, Inc.	Voltage: 460	Amps: 20
Phone: 714/752-0505	Phase: 3	rpm: 1,800
Maintenance Work to be Done		Frequency*
1. Operate all valves and check such things as a) bearing temperature, b) changes in running sound, c) suction and discharge gauge readings, d) pump discharge rate, and e) general condition of the drive equipment.		D
2. Check packing.		D
3. Checking pumping unit for any dust, dirt, or debris.		W
(Continued on attached sheet)		
OPERATING REQUIREMENTS AND REFERENCE		
For manufacturer's instructions regarding installation, operation, maintenance, and trouble shooting of this equipment, see Volume ____, Section _____.		

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly;
S - Semiannually; A - Annually.

SAMPLE

Preventive Maintenance and Operating Requirement Sheets

Preventive Maintenance Program	Equipment Record Number	
EQUIPMENT DESCRIPTION	ELECTRICAL OR MECHANICAL DATA	
Name:	Size:	
Serial No.:	Model:	
Vendor:		
Vendor Address:	Type:	
	Mfr.:	
Vendor Rep:	Voltage:	Amps:
Phone:	Phase:	rpm:
Maintenance Work to be Done		Frequency*
4. Lubricate bearing frame and motor bearings (consult manufacturer's instructions for type of grease or oil).		Q
5. Disassemble and change or repair the following: a) impeller, b) shafts, c) shaft sleeve, d) rotary seals, and e) sleeve bearings.		A
OPERATING REQUIREMENTS AND REFERENCE		

*D - Daily; W - Weekly; B - Biweekly; M - Monthly; Q - Quarterly;
S - Semiannually; A - Annually.

END OF SECTION

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SECTION 020120 PROTECTING EXISTING UNDERGROUND UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and procedures for protecting existing underground utilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Trenching, Backfilling, and Compacting: 312316.

B. Subsurface Utility Locating (Potholing): 023219.

1.03 SUBMITTALS

The Contractor must submit a utility protection plan for all utilites that could be impacted by the project including, but not limited to existing water, sewer, electrical, gas, oil, and dry utilites that will remain in service during the construction.

PART 2 - MATERIALS

2.01 REPLACEMENT IN KIND

Except as indicated below or as specifically authorized by the Owner's Representative, reconstruct utilities with new material of the same size, type, and quality as that removed.

PART 3 - EXECUTION

3.01 GENERAL

A. Replace in kind street improvements, such as curbs and gutters, barricades, traffic islands, signalization, fences, signs, etc., that are cut, removed, damaged, or otherwise disturbed by the construction.

B. Where utilities are parallel to or cross the construction but do not conflict with the permanent work to be constructed, follow the procedures given below. Notify the utility owner 48 hours in advance of the crossing construction and coordinate the construction schedule with the utility owner's requirements. For utility crossings not shown in the drawings, refer to the Standard Specifications and the instructions of the Owner's Representative for guidance.

C. Determine the true location and depth of utilities and service connections which may be affected by or affect the work. Determine the type, material, and condition of these utilities. In order to provide sufficient lead-time to resolve unforeseen conflicts, order materials and take appropriate measures to ensure that there is no delay in work. Pothole all gravity lines crossing the work prior to starting other constructions. Provide the Engineer with depth information.

3.02 PROCEDURES

A. Protect in Place: Protect utilities in place, unless abandoned, and maintain the utility in service, unless otherwise specified in the drawings or in the specifications.

B. Cut and Plug Ends: Cut abandoned utility lines and plug the ends. Plug storm drains and sewers with an 8-inch deep concrete plug. Cap waterlines with a cast-iron cap or install a 3-foot-long concrete plug. Dispose of the cut pipe as unsuitable material. Failed or cracked sanitary sewer and storm drains designated to be abandoned shall be filled or removed.

C. Remove and Reconstruct: Where so indicated in the drawings or as required by the Owner's Representative, remove the utility and, after passage, reconstruct it with new materials. Provide temporary service for the disconnected utility.

3.03 COMPACTION

A. Utilities Protected in Place: Backfill and compact under and around the utility so that no voids are left.

B. Utilities Reconstructed: Prior to replacement of the utility, backfill the trench and compact to an elevation 1 foot above the top of the ends of the utility. Excavate a cross trench of the proper width for the utility and lay, backfill, and compact.

C. Alternative Construction--Sand-Cement Slurry: Sand-cement slurry consisting of one sack (94 pounds) of portland cement per cubic yard of sand and sufficient moisture for workability may be substituted for other backfill materials to aid in reducing compaction difficulties. Submit specific methods and procedures for the review of the Owner's Representative prior to construction. Pipes shall be wrapped or shaded with sand to form a bond breaker.

3.04 SPECIAL CONSTRUCTION

A. Reinforced Concrete Beam: Where indicated in the drawings or as determined by the Owner's Representative, support utilities by a reinforced concrete beam. The primary purpose of the beam is to prevent settlement of the utility line after construction. The Contractor is responsible for the protection of the utility during construction and shall incorporate the beam as part of the protection.

3.05 THRUST BLOCKS ON WATERLINES

A. The Contractor's attention is called to thrust blocks on existing waterlines throughout the project whose thrust is in the direction of the new excavation and, therefore, may be affected by the construction. These waterlines are owned and operated by the Owner. Protect thrust blocks in place or shore to resist the thrust by a means approved by the Owner's water division superintendent and reconstruct. If the thrust blocks are exposed or rendered to be ineffective in the opinion of the Owner's Representative, reconstruct them to bear against firm unexcavated or backfill material.

B. Provide firm support by backfilling that portion of the trench for a distance of 2 feet on each side of the thrust block to be reconstructed from the pipe bedding to the pavement subgrade, with either:

1. Sand-cement slurry (94 pounds of cement per cubic yard).

2. The native material compacted to a relative compaction of 95%.

C. Then excavate the backfill material for construction of the thrust block.

D. Test compaction of the backfill material before pouring any concrete thrust block. Use Class C concrete per Section 030500 for reconstruction.

3.06 ADJACENT PARALLEL UTILITIES

A. The Contractor's attention is called to the following utilities:

Size and Description	Station	
	From	To
12" Water Main	100+00	111+05
2" Gas Line	100+00	110+79

B. The position of these utilities between the above stations is just outside the new construction. Protect these utilities from any disturbances and repair the pipelines and associated vaults and appurtenances if they are damaged in any way.

END OF SECTION

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SECTION 023219 SUBSURFACE UTILITY LOCATING (POTHOLING)

PART 1 - GENERAL

A. DESCRIPTION

The CONTRACTOR shall conduct exploratory excavations by potholing to verify or to discover the actual location, depth and size of existing underground utilities and improvements.

B. SUBMITTALS

1. The CONTRACTOR'S proposed method of potholing and schedule for potholing shall be submitted for approval at least seven (7) calendar days prior to the commencement of field work. Approval of finalized pothole locations must be obtained prior to commencement of potholing field work.

2. The field records shall be submitted to the Owner's Representative within two (2) working days after the completion of potholing in each area.

3. A complete and final field log shall be submitted five (5) working days after the completion of all potholing activities.

PART 3 - EXECUTION

A. GENERAL

1. CALL BEFORE YOU DIG: Utility owners will need to be notified and given sufficient time to mark utility locations prior to potholing.

2. Contractor shall conform to individual utility owner's guidelines when potholing for these utilities.

3. Potholing operations shall be conducted in a manner that minimizes the damage potential to existing underground utilities in order to ensure that the existing facilities will remain in operation without interruptions.

4. The CONTRACTOR shall establish and record the coordinates, elevations and dimensions of all utilities and improvements verified or discovered. The field records shall be submitted to the Owners Representative within two (2) working days after the completion of potholing. The records shall also include dates of the potholing operations and any additional discovered information or pertinent data. Following is a summary of minimum required data for all potholes:

(1) Pothole Number

(2) Date of Pothole

(3) Coordinates

(4) Ground elevation at pothole

(5) Depth to top of utility

(6) Width or Diameter of Utility

(7) Utility Type

(8) Road and base thickness

(9) Miscellaneous notes and dimensions

B. EXCAVATION

1. METHODS: Backhoe excavation is not permitted. The following methods shall be utilized for potholing:

2. Hand Digging: Hand digging is the method of excavating a pothole by manual means with hand-held, non- mechanical equipment such as a shovel.

3. Vacuum Excavation: Vacuum excavation shall consist of air or water pressure to break up the soil and a vacuum device to collect the spoil. The Contractor shall determine if air or water vacuum excavation shall be used dependent upon specific site and environmental characteristics. Soil type such as heavy clay may require water vacuum excavation. Air vacuum excavators shall be utilized if mud from water vacuum excavators cannot be disposed of properly. Air vacuum excavators shall be used if damage to utilities, such as cutting through cables, will occur with the use of water vacuum excavators.

4. Air: Air vacuum excavators shall utilize a high velocity air stream to penetrate, expand, and break-up the soil. The loosened particles of soil and rock shall be removed from the excavation through the use of a vacuum.

5. Water: Water vacuum excavation systems shall excavate the pothole using high-pressure water to reduce and loosen the soil. The wet soil and mud slurry shall be removed to a spoil tank using a vacuum.

6. Size of Pothole: Maximum pothole size shall not exceed 18 inches in diameter or 18 inch x 18 inch square without prior authorization.

C. POTHOLE REPAIR

1. Upon completion of potholing in each area, potholes shall be backfilled, compacted and restored within 24-hours.

2. The contractor shall remove all loose material from the hole prior to backfilling. Repair materials shall be placed and compacted in the hole such that the completed patch provides a hard, stable surface which does not rut or otherwise distort under traffic loading, and provides a smooth transition to the surrounding pavement surface.

3. The finished surface of the repair shall be of like material and constructed to the same finished grade as the adjacent pavement. The finished surface shall be such that it does not allow water to pond. There shall be no discernable difference in surface level at the joint between the existing pavement and the completed repair.

4. Potholes shall be performed and repaired in conformance with the City of San Luis Obispo Standard Specifications.

END OF SECTION

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SECTION 024100 EQUIPMENT, PIPING, AND MATERIALS DEMOLITION

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes demolition and removal of existing mechanical and electrical equipment and piping.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Protecting Existing Underground Utilities: 020120.

B. Earthwork: 312300.

PART 2 - MATERIALS

Refer to other sections of these specifications for material to be used as replacements for removal or abandoned equipment.

PART 3 - EXECUTION

3.01 GENERAL

Perform removal, abandonment, and demolition work specified and indicated in the drawings. Prepare remaining surfaces to receive new scheduled and specified materials and finishes or finish to match adjacent surfaces if no additional work is scheduled or indicated.

3.02 REMOVAL AND REPLACEMENT

A. Remove equipment indicated in the drawings shall be properly disposed.

3.03 SHUTDOWNS OF EXISTING PIPING AND ELECTRICAL UTILITIES

Shut off or disconnect utilities affecting demolition work. Schedule shutdowns with the Owner; notify the Owner three working days in advance of any shutdown that is required to perform the work. The Owner will open/close valves on piping, slide and sluice gates in channels, and electrical disconnects required for the shutdowns.

3.04 TEMPORARY SUPPORT OF EXISTING EXPOSED PIPING

A. Provide temporary supports for existing piping that must be kept in service during demolition of adjacent piping or other existing work in the project. Do not block access

to the adjacent valves, equipment, or access door and stairways with the temporary supports.

3.05 ABANDON PIPING

A. Abandon piping per City of San Luis Obispo requirements and Section 030501.

3.06 REMOVAL OF EXISTING ASBESTOS CEMENT PIPE

A. Removal procedures shall be in accordance with 29 CFR 1926.1101, Class II, and California CCR Title 8, Division I, Chapter 4, Subchapter 4, Article 4, Section 1529.

B. Excavate the sections of pipe to be removed. Determine the airborne concentrations of asbestos to which employees may be exposed during removal operations per 29CFR 1926.1101, Appendices A and B. If the measured asbestos concentrations exceed the permissible exposure limit (PEL), provide temporary enclosures with ventilation systems, respiratory protection, wetting methods, or other procedures complying with 29 CFR 1926.1101.

C. Cover or seal the sections of pipe removed to prevent asbestos from becoming airborne during pipe removal and transportation operations.

3.07 REMOVAL OR RELOCATION OF ELECTRICAL MATERIALS AND EQUIPMENT

A. Unless otherwise noted, remove existing electrical materials and equipment from areas indicated for demolition or where equipment is to be relocated. Disconnect circuits at their source. Remove materials no longer used, such as studs, straps, and conduits. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface. Remove existing unused wires.

B. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface.

3.08 ELECTRICAL DISCHARGE LIGHTING BALLASTS

A. Electrical discharge lighting ballasts manufactured before 1974 that will be removed under this contract contain polychlorinated biphenyls (PCBs).

B. Electrical discharge lighting ballasts manufactured after 1973 may contain PCBs.

C. It is the Contractor's responsibility to identify the presence of PCBs and to dispose of them in compliance with all local, state, and federal laws, regulations, and ordinances.

3.09 FLUORESCENT LIGHT TUBES AND MERCURY VAPOR LAMPS--CALIFORNIA

Existing fluorescent light tubes and mercury vapor lamps to be disposed of may contain mercury. The Contractor may dispose as nonhazardous waste no more than 25 spent

fluorescent light tubes and/or mercury vapor lamps, regardless of size, at any one time in one day (e.g., 20 tubes and 5 lamps or 15 lamps and 10 tubes, etc., but not 25 tubes and 25 lamps). Disposal in excess of this rate shall be considered as disposal of a hazardous waste per California Code of Regulations, Title 22.

3.10 TRANSFORMERS AND OTHER ELECTRICAL APPARATUS

Transformers, switches, capacitors, resistors, and/or other liquid-filled electrical apparatus that will be removed under this contract may contain PCBs. It is the Contractor's responsibility to identify the presence of PCBs and to dispose of them in compliance with all local, state, and federal laws, regulations, and ordinances.

3.11 DEMOLITION

A. Existing buildings, structures, boxes, pipes, pavements, curbs, and other items are to be removed, altered, salvaged, and disposed of as specified herein or indicated in the drawings. Remove and dispose of all portions of these items that interfere with project construction.

B. Remove and dispose offsite facilities to be demolished in their entirety including belowground footings, foundations, and other associated appurtenances, as shown in the drawings or as specified herein. Backfill and compact all site areas disturbed by demolition work with earth backfill or gravel material in accordance with Section 312300.

C. Perform the work in a manner that will not damage parts of the structure not intended to be removed or to be salvaged for the Owner. If, in the opinion of the Owner's Representative, the method of demolition used may endanger or damage parts of the structure or affect the satisfactory operation of the facilities, promptly change the method when so notified by the Owner's Representative. No blasting will be permitted.

D. Equipment, material, and piping, except as specified to be salvaged for the Owner, or removed by others, within the limits of the demolition, excavations, and backfills, will become the property of the Contractor and shall be removed from the project site. The salvage value of this equipment, materials, and piping shall be reflected in the contract price of the demolition work.

E. Do not reuse material salvaged from demolition work on this project, except as specifically shown.

END OF SECTION

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SECTION 030500 GENERAL CONCRETE CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of formwork, reinforcing steel, joints, concrete, and finishing and curing for general concrete construction.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Precast Concrete Manholes: 034210.

B. Chemical-Resistant Coatings for Concrete: 099720.

C. Earthwork: 312300

D. Dewatering: 312319.

E. Shoring: 314100.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Prepare concrete and mortar mix designs and laboratory 7-day and 28-day compressive tests, or submit test reports of 7- and 28-day compressive tests of the mix where the same mix has been used on two previous projects. Submit mix design in writing for review by the Owner at least 15 days before placing of any concrete.

C. Submit manufacturer's catalog data and descriptive literature for form ties, spreaders, form coatings and curing compound, joint sealant, epoxy bonding compound, and color additive epoxy anchor adhesive.

D. Submit mill test certificates identifying chemical and physical analyses of each load of reinforcing steel delivered. If mill test reports are unavailable and the quantity of steel for a structure exceeds 5 tons, provide a laboratory test to prove conformance with the specified ASTM standard.

E. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting beams, walls, and footings indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, deck, floor, or roof slabs) including dowels and corner bars. Furnishing such lists shall not be construed that the lists will be

reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown in the drawings and as specified. Placing drawings shall be prepared by the Contractor and shall not incorporate photocopies of the contract drawings.

F. Submit one copies of a report from a testing laboratory verifying that aggregate material contains less than 1% asbestos by weight or volume and conforms to the specified gradations or characteristics.

PART 2 - MATERIALS

2.01 NONDOMESTIC CEMENT AND ADDITIVES

A. The use of nondomestic cement and additives in concrete may be permitted only after review of a written request to use such materials. The request to use nondomestic materials shall include a chemical analysis that indicates the material meets the project specifications. Certifications that state the nondomestic materials meet the project requirements will not be accepted.

B. Test reports for concrete materials shall be current to within three months of inclusion into the project and shall be identifiable to the materials supplied.

2.02 FORMWORK

A. Design forms according to ACI 347.

B. Class I Forms: Use steel forms, ply form, or smooth-surface plywood 3/4-inch minimum thickness for straight surfaces and 1/2-inch minimum thickness for curved surfaces.

C. Class II Forms: Use plywood in good condition, metal, or smooth-planed boards free from large or loose knots with tongue and groove or ship lap joints.

D. Class II forms may be used for exterior concrete surfaces that are 1 foot or more below finished grade. Use Class I forms for all other surfaces.

E. Coat forms with form release agent.

2.03 BOND BREAKER

Bond breaker shall be a nonstaining type which will provide a positive bond prevention, such as Williams Tilt-Up Compound, as manufactured by Williams Distributors, Inc., Seattle, Washington; Silcoseal 77, as manufactured by SCA Construction Supply Division, Superior Concrete Accessories, Franklin Park, Illinois; or equal.

2.04 FORM RELEASE AGENT

A. Form release agent shall effectively prevent absorption of moisture and prevent bond with the concrete. Agent shall be nonstaining and nontoxic after 30 days.

B. For steel forms, release agent shall prevent discoloration of the concrete due to rust.

2.05 REINFORCING STEEL

A. Reinforcement shall conform to ASTM A615 or A706, Grade 60.

B. Fabricate reinforcing in accordance with the current edition of the Manual of Standard Practice, published by the Concrete Reinforcing Steel Institute. Bend reinforcing steel cold.

C. Deliver reinforcing steel to the site bundled and with identifying tags.

2.06 WELDED WIRE REINFORCEMENT

Welded wire reinforcement shall conform to ASTM A185.

2.07 TIE WIRE

Tie wire shall be 16 gauge minimum, black, soft annealed.

2.08 BAR SUPPORTS

Bar supports in beams and slabs exposed to view after form stripping shall be galvanized and plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

2.09 BAR COUPLERS

Reinforcing steel bar splicing couplers shall be a mechanical type as manufactured by Dayton Barsplice Inc. or equal. Use couplers that do not reduce tensile or ultimate strength of bars.

2.10 JOINT SEALANT FOR CONCRETE STRUCTURES

A. Joint sealant shall be a multipart, gray, nonstaining, nonsagging, gun grade polyurethane sealant, which cures at ambient temperature to a firm, flexible, resilient, tear-resistant rubber. Sealant shall comply with ASTM C920, Type M, Grade P, Class 25 for horizontal joints and Grade NS, Class 25 for vertical joints and be recommended by the manufacturer for continuous immersion in water.

Characteristic or Parameter	Technical Requirements
Pot life	1 to 3 hours
Hardness	35 Shore A, ±5, ASTM D2240
Elongation	650%, ASTM D412
Tensile strength	200 psi, ASTM D412
Peel strength on concrete	No adhesion loss at 25 pounds
Temperature service range	40°F to 167°F
Immersion in water	Continuous

B. Sealant shall be Tremco Vulkem 227 or Sikaflex-2CNS (for Grade NS, Class 25), Sikaflex-2CSL of Sika Corporation or Vulkem 245 (for Type M, Grade P, Class 25), or equal. Troweling of sealants into joints will not be permitted.

2.11 BACKING ROD FOR EXPANSION JOINTS

Backing rod shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethafoam SB, as manufactured by Dow Chemical Company, Midland, Michigan; or equal. The rod shall be 1/4 inch larger in diameter than the joint width. Where possible, provide full-length sections for the joint; minimize splices. Apply backup rod and bond breaker tape in expansion joints.

2.12 BOND BREAKER TAPE

Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape that will adhere to the premolded joint material or concrete surface. The tape shall be the same width as the joint. The tape shall be compatible with the sealant.

2.13 PREFORMED CONTROL JOINT

Preformed control joint shall be a one-piece, flexible, PVC joint former, such as Kold-Seal Zip-Per Strip KSF-150-50-50, manufactured by Vinylex Corp., Knoxville, Tennessee, or a one-piece steel strip with preformed groove, such as Keyed Kold Retained Kap, manufactured by Burke Concrete Accessories, Inc., San Mateo, California, or equal. Provide the preformed control joint material in full-length unspliced pieces.

2.14 CEMENT

A. Use domestic portland cement that conforms to ASTM C150 provide a mixture of 85% Type II/V portland cement and 15% pozzolan fly ash.

B. Use only one brand of cement in any individual structure. Use no cement that has become damaged, partially set, lumpy, or caked. Reject the entire contents of the sack or container that contains such cement. Use no salvaged or reclaimed cement.

C. Maximum tricalcium aluminate shall not exceed 8%. The maximum percent alkalies shall not exceed 0.6%.

2.15 AGGREGATES

Aggregates shall be natural rock, sand, or crushed natural rock and shall comply with ASTM C33, and shall contain less than 1% asbestos by weight or volume. Aggregates shall be free from any substances that will react with the cement alkalies, as determined by Appendix X-1 of ASTM C33.

2.16 WATER AND ICE

Use water and ice that is clean and free from objectionable quantities of organic matter, alkali, salts, and other impurities that might reduce the strength, durability, or otherwise adversely affect the quality of the concrete. Water shall not contain more than 500 mg/L of chlorides or more than 500 mg/L of sulfate.

2.17 COLOR ADDITIVE FOR EXTERIOR ELECTRICAL DUCT ENCASEMENT

For exterior electrical duct concrete encasements, use a color additive for identification purposes: brick red "Colorfull" as manufactured by Owl Manufacturing Company, Arcadia, California; coral red "Chromix C-22" as manufactured by L. M. Scofield Company, Los Angeles, California; or equal. Add the color additive while the concrete is being mixed using the quantity per cubic yard of concrete recommended by the manufacturer for the class of concrete indicated.

2.18 CONCRETE ADMIXTURES

A. Class A concrete shall contain an air-entraining admixture conforming to ASTM C260. Admixtures shall be Master Builders MB-AE 90, Sika AER, or equal.

B. Class A concrete shall contain a water-reducing admixture conforming to ASTM C494, Type A. It shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the manufacturer's recommendations. Admixture shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete 161 or Plastiment, Sika Chemical Corporation, or equal.

C. Mineral Admixture: Class A concrete shall contain a mineral admixture, fly ash Class F, conforming to ASTM C618, not to exceed or replace more than 15% of the cement material required without the mineral admixture.

2.19 GROUT

A. Nonshrink grout shall conform to ASTM C1107 and to these specifications. Use a nongas-liberating type, cement base, premixed product requiring only the addition of water for the required consistency. Grout shall be UPCON High Flow, Master Flow 928, or equal. Components shall be inorganic.

B. Expansive Grout: Premixed, cementitious mixture with a minimum 28-day strength of 3,500 psi. Provide air-entraining admixture as recommended by the manufacturer.

C. Epoxy Grout:

1. Mix the two components of epoxy bonding compound in compliance with the manufacturer's instructions.

2. Use sand that is oven dry and meets the following gradation requirements for epoxy grout:

Sieve Size	No. 8	No. 50	No. 100
% Passing	100	30 ±15	5 ±5

2.20 GROUT BEDDING FOR HORIZONTAL JOINTS

The grout placed on horizontal construction joints shall be a mixture of cement, sand, and water in the same proportions and strength used in the overplaced concrete with coarse aggregate omitted.

2.21 REPAIR MORTAR

A. Mortar used for repair of concrete voids shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted or the mortar shall consist of not more than one part cement to two and one-half parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.

B. Materials for repair of major defects or cracks shall be in accordance with “Repair of Defects and Cracks” specified in Part 3.

2.22 BONDING COMPOUND

A. Epoxy bonding compound shall be Sikadur 32 Hi-Mod, Sika Chemical Corporation, Lyndhurst, New Jersey; Concresive by BASF; Euco Epoxy 452 by Euclid Chemical Company; or equal.

B. Nonepoxy bonding compound shall be Weldcrete by Larsen Products Corp., Link by Sta-Dry Manufacturing Corp., Euco Weld by Euclid Chemical Co., or equivalent. The compound shall be rewettable for up to two weeks.

2.23 CONCRETE MIX DESIGN

A. Conform to ASTM C94, except as modified by these specifications.

B. Air content as determined by ASTM C231 shall be 4% ±1%.

C. Maximum water-cement ratio for Class A concrete = 0.45 by weight.

D. Use classes of concrete as described in the following table:

Class	Type of Work	28-Day Compressive Strength (in psi)	Minimum Cement Content (in lbs per C.Y.)
A	Concrete for all structures and concrete not otherwise specified. Concrete fill at structure foundations, cradle, supports across pipe trenches, pipe supports, thrust blocks, and reinforced pipe encasement.	4,000	564
B	Pavement, curbs, and gutters	3,000	500
C	Floor grout and miscellaneous unreinforced concrete.	2,000	376

E. Measure slump in accordance with ASTM C143. Slump shall be as follows:

Slab on grade or heavy sections wider (in plan view) than 3 feet	3 inches maximum
Footings, walls, suspended slabs, beams, and columns	4 inches maximum
Pavement	2 inches maximum
Floor grout	4 inches maximum

Proportion and produce the concrete to have a maximum slump as shown. A tolerance of up to 1 inch above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit. Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

F. Aggregate size shall be 3/4 inch maximum for slabs and sections 8 inches thick and less. Aggregate size shall be 1 inch maximum for slabs and sections greater than 8 inches and less than 17 inches. Aggregate size shall be 1 1/2 inches maximum for all larger slabs and sections. Aggregate size for floor grout shall be maximum 3/8 inch.

G. Combined aggregate grading shall be as shown in the following table:

	Maximum Aggregate Size			
	1 1/2"	**1"**	**3/4"**	**3/8"**
Aggregate Grade per ASTM C33	467	57	67	8

H. Mix design for pumped concrete shall produce a plastic and workable mix. The percentage of sand in the mix shall be based on the void content of the coarse aggregate.

2.24 SLURRY CEMENT BACKFILL

A. Slurry cement backfill shall consist of a fluid, workable mixture of aggregate, cement, and water.

B. Aggregate shall be either:

1. Material selected from excavation, imported material, or a combination thereof, free from organic matter and other deleterious materials and meeting the following gradation:

Sieve Sieves	**Percentage Passing**
1 1/2 inches	100
1 inch	80 to 100
3/4 inch	60 to 100
3/8 inch	50 to 100
No. 4	40 to 80
No. 100	10 to 40

2. Commercial quality concrete sand.

C. Proportion the aggregate, cement, and water by either weight or volume. Include at least 188 pounds of cement per cubic yard produced. The water content shall be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed.

D. Thoroughly machine-mix the materials for the slurry cement backfill in pugmill, rotary drum, or other mixer. Continue the mixing until the cement and water are thoroughly dispersed throughout the material. Place slurry cement backfill within one hour after mixing.

2.25 CURING COMPOUND

A. Curing compound shall conform to ASTM C309, Type 1-D, Class A.

B. Curing compound shall be compatible with required finishes and coatings and shall meet the State of California Clean Air Quality Standards which limit the quantity of volatile organic compounds to 350 grams per liter.

2.26 MATS, PAPER, AND SHEETING FOR CURING

A. Burlap mats shall conform to AASHTO M182.

B. Sisal-kraft paper and polyethylene sheets shall conform to ASTM C171.

2.27 REINFORCING DOWEL ADHESIVE

Dowel anchor adhesive shall be HIT-RE 500-SD by Hilti; Sikadur 31, Hi-Mod Gel by Sika; or equal.

PART 3 - EXECUTION

3.01 FORM TOLERANCES

A. Failure of the forms to produce the specified concrete surface and surface tolerance shall be grounds for rejection of the concrete work. Rejected work shall be repaired or replaced at no additional cost to the Owner.

B. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

	Maximum Tolerance (inch)
Sleeves and inserts	+1/4 -1/4
Projected ends of anchors	+1/4 -0.0
Anchor bolt setting	+1/4 -1/4
Finished concrete, all locations	+1/4 -1/4 in 10 feet
	Max ±1-inch in total length

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and inserts:	Centerline of sleeve or insert.
Projected ends of anchors:	Plane perpendicular to the end of the anchor as located in the drawings.
Anchor bolt setting:	Centerline of anchor bolt.
Finish concrete:	The concrete surface as defined in the drawings.

Where equipment is to be installed, comply with manufacturer's tolerances if more restrictive than above.

3.02 FORM SURFACE PREPARATION

A. Clean form surfaces to be in contact with concrete of foreign material prior to installation.

B. Coat form surfaces in contact with concrete with a release agent prior to form installation.

3.03 FORM REUSE

Reuse only forms that provide a uniform surface texture on exposed concrete surfaces. Apply light sanding or other surface treatment between uses for uniform texture. Plug unused tie rod holes with corks, shave flush, and sand the concrete surface side. Do not patch forms other than filling tie rod holes, except in the case of Class II forms. Do not use metal patching discs on Class I forms.

3.04 REMOVAL OF FORMS

A. Forms and shoring for elevated structural slabs or beams shall remain in place until the concrete has reached a compressive strength equal to the specified 28-day compressive strength as determined by test cylinders. Do not remove supports and reshore. The following table indicates the minimum allowable time after the last cast concrete is placed before forms, shoring, or wall bracing may be removed:

Sides of footings and encasements	24 hours
Walls, vertical sides of beams, girders, columns, and similar members not supporting loads	48 hours
Slabs, beams, and girders	10 days (forms only)
Shoring for slabs, beams, and girders	Until concrete strength reaches specified 28-day strength
Wall bracing	Until top or roof slab concrete reaches specified 28-day strength

B. Do not remove forms from concrete that has been placed with outside air temperature below 50°F without first determining if the concrete has properly set without regard for time. Do not apply heavy loading on green concrete. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities in the surface shall be repaired and finished as specified.

3.05 FORMED OPENINGS

Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and water stops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.

3.06 EMBEDDED ITEMS

Set anchor bolts and other embedded items accurately and hold securely in position until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check nailing blocks, plugs, and strips necessary for the attachment of trim, finish, and similar work prior to concreting.

3.07 BEVELED EDGES (CHAMFER)

Form 3/4-inch beveled edges on exposed concrete edges and corners, beam soffit corners, and where indicated in the drawings. Reentrant corners in concrete members shall not have fillets, unless otherwise shown in the drawings. The top edges of slabs, walkways, beams, and walls may be beveled with an edging trowel in lieu of using chamfer strips.

A. Layout of construction joints shall be as shown in the drawings and according to the following guidelines:

   1. Provide horizontal construction joints at top of foundation members and slabs-on-grade and at the soffit of supported slabs and beams.

   2. Space the construction joints at a maximum horizontal distance of 25 feet and a maximum vertical distance of 16 feet.

   3. Space the corner vertical construction joints between 4 and 8 feet from the corner of walls or wall intersections.

   4. Space horizontal construction joints at least 8 inches below bottom of slabs.

B. Construction joints shall be keyed, unless otherwise detailed. Form keyways by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown in the drawings or specified, keyways shall be at least 1 1/2 inches in depth over at least 25% of the area of the section.

C. When it is necessary to make a joint because of an emergency, furnish and place reinforcing dowels across the joint normal to the face of joint created if not normal to specified reinforcement and at the centerline of the concrete section being terminated.

Carefully remove set concrete to a plane but rough surface near normal to adjacent formed or finish surfaces. Embed and extend dowels 48 bar diameters each side of the joint. Size and spacing of dowels shall match the largest reinforcing in the member but no closer than 6 inches on center. Furnishing and placing such reinforcing steel shall be at the Contractor's expense.

D. After a concrete placement pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material. Expose clean aggregate by sandblasting and thoroughly cleaning the surface of construction joints before placing the new concrete. Cover horizontal construction joints with grout bedding. Spread uniformly and work thoroughly into all irregularities of the surface. The consistency of the mortar shall be suitable for placing and working and shall be placed immediately prior to placing new concrete.

E. In case of emergency, place additional construction joints. (An interval of 45 minutes constitutes cause for an emergency construction joint.)

Immediately prime and fill with the expansion joint sealant and backup materials. The primer used shall be supplied by the same manufacturer supplying the joint sealant.

3.08 TIME BETWEEN POURS

At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise indicated in the drawings.

3.09 INSTALLATION OF JOINT SEALANTS

A. Immediately before installing the joint sealant, clean the joint cavity by sandblasting or power wire brushing. Install bond breaker tape per manufacturer's instructions.

B. After the joints have been prepared as described above, apply the joint sealant. Apply the primer, if required, and joint sealant only with the equipment and methods recommended by the joint sealant manufacturer. Application criteria for the sealant materials, such as temperature and moisture requirements and primer cure time, shall be in accordance with the recommendations of the sealant manufacturer.

C. Apply masking tape along the edges of the exposed surface of the exposed joints. Trowel the joints smooth with a tuck pointing tool wiped with a solvent recommended by the sealant manufacturer.

D. After the sealant has been applied, remove the masking tape and any sealant spillage.

3.10 PLACING REINFORCEMENT

A. Place reinforcing steel in accordance with the current edition of Recommended Practice for Placing Reinforcing Bars, published by the Concrete Reinforcing Steel Institute.

B. Place reinforcing in accordance with the following, unless otherwise indicated:

1. Reinforcement indicated in the drawings is continuous through the structure to the farthest extent possible. Terminate bars and hooks 2 inches clear from faces of concrete.

C. Reinforcing steel, before being positioned and just prior to placing concrete, shall be free from loose mill and rust scale and from any coatings that may destroy or reduce the bond. Clean reinforcing steel by sandblasting or wire brushing and remove mortar, oil, or dirt to remove materials that may reduce the bond.

D. Do not straighten or rebend reinforcing steel in the field. Do not use reinforcing with bends not shown in the drawings.

E. Position reinforcing steel in accordance with the drawings and secure by using annealed wire ties or clips at intersections and support by concrete or metal supports, spacers, or metal hangers. Do not place metal clips or supports in contact with the forms. Bend tie wires away from the forms to provide the specified concrete coverage. Bars, in addition to those shown in the drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at his own expense.

F. Place reinforcement a minimum of 2 inches clear of any metal pipe or fittings.

G. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.

H. Roll wire mesh used for reinforcement flat before placing concrete. Support and tie wire mesh to prevent movement during concrete placement.

I. Position dowels for masonry walls to occur at reinforced block cells.

3.11 SITE-MIXED CONCRETE

Conform to ACI 304.

3.12 READY-MIXED CONCRETE

Conform to ASTM C94.

3.13 PLACING CONCRETE

Conform to ACI 304.

3.14 PUMPING CONCRETE

Conform to ACI 304.2R-91.

3.15 WEATHER REQUIREMENTS

A. Conform to ACI 305 for placing during hot weather.

B. Conform to ACI 306 for placing during cold weather.

3.16 BONDING TO OLD CONCRETE

Coat the contact surfaces of structural sections with epoxy bonding compound when noted in the drawings. The method of preparation and application of the bonding compound shall conform to the manufacturer's printed instructions and recommendations for specific application for this project.

3.17 GROUTING MACHINERY FOUNDATIONS

Block out the original concrete or finish off a sufficient distance below the bottom of the machinery base to provide for the thickness of grout shown in the drawings. After the machinery has been set in position and placed at the proper elevation by steel wedges, fill the space between the bottom of the machinery base and the original pour of concrete with a pourable nonshrink grout. Grout and grouting procedure shall be in accordance with API 686, Chapter 4, paragraphs 3.6 and 3.7, and Chapter 5 and Section 432101.

3.18 BACKFILL AGAINST WALLS

A. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.

B. Do not backfill the walls of structures that are laterally restrained or supported by suspended slabs or slabs on grade until the slab is poured and the concrete has reached the specified compressive strength.

3.19 PLACING SLURRY CEMENT BACKFILL

Place slurry cement backfill in a uniform manner that will prevent voids in, or segregation of, the backfill. Remove foreign material that falls into the excavation or trench. Do not commence backfilling over or place any material over the slurry cement backfill until at least four hours after placing the slurry cement backfill, except that when concrete sand is used for the aggregate and the in-place material is free draining, backfilling may commence as soon as the surface water is gone.

3.20 CONCRETE FINISHES

A. Complete concrete surfaces in accordance with the following schedule:

Finish Designation	Area Applied
F-1	Beams, columns, and exterior walls not exposed to view.
	Beams, columns, and walls of structures or buildings exposed to view. Underside of formed floors or slabs.
F-4	Exterior and interior surfaces to be coated.
S-1	Slabs and floors to be covered with concrete or grout.
S-4	Slabs and floors of structures or buildings exposed to view.
	Slabs and floors at slopes greater than 10% and stairs.
E-1	Exposed edges. EXCEPTION: edges normally covered with earth.
E-2	Top of walls, beams, and similar unformed surfaces.

B. Finish F-1: Repair defective concrete, fill depressions deeper than 1/2 inch, and fill tie holes.

Finish F-4: Repair defective concrete, remove fins, fill depressions 1/16 inch or deeper, fill tie holes, remove mortar spatter, and remove bulges higher than 1/16 inch.

Finish S-1: Screed to grade without special finish.

Finish S-4: Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

Finish E-1: Provide chamfer or beveled edges.

Finish E-2: Strike smooth and float to an F-3 or F-4 finish.

3.21 CURING CONCRETE

A. Conform to ACI 308.

B. Water cure with burlap mats unless optional curing methods are permitted.

C. Do not use curing compound on surfaces that are to be coated in accordance with Section 099720.

D. It is the responsibility of the Contractor to select the appropriate curing method in response to climatical and/or site conditions occurring at the time of concrete placement. Take appropriate measures as described in ACI 305 and 306 for protecting and curing concrete during hot and cold weather.

3.22 REPAIR OF DEFECTS AND CRACKS

A. Do not repair defects until concrete has been evaluated by the Owner's Representative.

B. Surface Defects:

1. Repair surface defects that are smaller than 1 foot across in any direction and are less than 1/2 inch in depth.

2. Repair by removing the honeycombed and other defective concrete down to sound concrete, cut or grind edges perpendicular to the surface and at least 3/8 inch deep, abrasive clean and thoroughly dampen the surface, work into the surface an epoxy bonding agent, and fill the hole with one part cement to one part fine sand. Match the finish on the adjacent concrete, and cure as specified.

C. Severe Defects:

1. Repair severe defects that are larger than surface defects but do not appear to affect the structural integrity of the structure.

2. Repair by removing the honeycombed and other defective concrete down to sound concrete, make edges of the repair area perpendicular to the surface, as required above, sandblast the sound concrete surface, coat the exposed surfaces with epoxy bonding compound, place nonshrink grout, match the finish on the adjacent concrete, and cure as specified.

D. Repair minor cracks in concrete structures that are wider than 1/10 inch by cutting out a square edged and uniformly aligned joint 3/8 inch wide by 3/4 inch deep, preparing exposed surfaces of the joint, priming the joint, and applying polyurethane joint sealant.

E. If the cracks are major or affect the hydraulic capacity or function of the element, the Owner's Representative may require the concrete to be repaired by epoxy injection.

F. Major Defects and Cracks: If the defects affect the structural integrity of the structure or if patching does not satisfactorily restore quality and appearance to the surface, the Owner’s Representative may require the concrete to be removed and replaced, complete.

3.23 CONCRETE SURFACES TO BE COATED

See Section 099720.

3.24 CONCRETE TESTS

A. Concrete quality testing will be performed on the concrete by an independent testing laboratory as follows:

1. Frequency of Sampling: Cast four concrete test cylinders from each 50 cubic yards, or fraction thereof, of each class of concrete placed in any one day. Sampling and curing of cylinders shall conform to ASTM C31.

2. Strength Testing: Test cylinders in accordance with ASTM C39. Test one cylinder at 7 days for information; test two cylinders at 28 days for acceptance; and hold one cylinder for verification. Strength acceptance will be based on the average of the strengths of the two cylinders tested at 28 days. If one cylinder of a 28-day test manifests evidence of improper sampling, molding, or testing, other than low strength, discard it and use the fourth cylinder for the test result.

3. Determine concrete slump by ASTM C143 with each strength test sampling and as required to establish consistency.

4. Determine air content of the concrete using ASTM C231 to verify the percentage of air in the concrete immediately prior to depositing in forms.

5. The average value of concrete strength tests shall be equal to or greater than the specified 28-day strength. No test shall be less than 90% of the specified 28-day strength.

6. If the 28-day strength tests fail to meet the specified minimum compressive strength, the concrete will be assumed to be defective and one set of three cores from each area may be taken as selected by the Owner and in accordance with ASTM C42. If the average compressive strength of the set of three concrete cores fails to equal 90% of the specified minimum compressive strength or if any single core is less than 75% of the minimum compressive strength, the concrete will be considered defective. The Owner may require additional coring, nondestructive load testing, or repair of defective concrete. Costs of coring, testing of cores, load testing, and required repairing pertaining thereto shall be paid by the Contractor at no extra cost to the Owner.

B. To facilitate concrete sampling and testing, the Contractor shall:

1. Furnish labor to assist the Owner in obtaining and handling samples at the project site.

2. Advise the Owner in advance of concrete placing operations to allow for scheduling and completion of quality testing.

3. Provide and maintain facilities for safe storage and proper curing of concrete test specimens on the project site, as required by ASTM C31.

END OF SECTION

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SECTION 030501 ABANDON AND GROUT EXISTING SANITARY SEWER WITH FLOWABLE FILL

PART 1 - GENERAL

1.01 DESCRIPTION

Where the plans indicate to Abandon and Grout Existing Sanitary Sewer with Flowable Fill, the work to be performed under this section shall include the abandonment in place of existing sanitary sewer by completely filling with flowable fill, as indicated on the Plans and specified in the Special Provisions. Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range. In this specification, the words “flowable fill” and “one sack sand/cement mixture” and “abandonment grout” are used interchangeably.

The Contractor shall notify the Engineer a minimum of 48-hours prior to the abandonment of any sanitary sewer. The Contractor shall not begin any abandonment operations until the replacement sanitary sewer has been constructed, tested, and all service connections have been installed and approved by the Engineer.

1.02 REFERENCE STANDARDS:

1. These Special Provisions

2. ASTM C150 – Standard Specification for Portland Cement.

3. ASTM C494 – Standard Specification for Chemical Admixture for Concrete.

4. ASTM C618 – Standard Specification for Fly Ash and Raw or Calcinated Natural Pozzolan for use as Mineral Admixture in Portland Cement Concrete.

5. ASTM C940 – Standard test Method for Expansion and Bleeding of Freshly Mixed grout for Replaced Aggregate Concrete in the Laboratory.

6. ASTM C1017 – Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

7. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).

1.03 SUBMITTALS

A. Submit flowable fill mix design report to Engineer. Include the following:

1. Flowable fill type and production method: Describe if fill will be mixed to final proportions and consistency in batch plant or if constituents will be added in transit mixer at placement location.

2. Aggregate gradation of fill. Aggregate gradation of mix shall be used as pilot curve for quality control during production.

3. Fill mix constituents and proportions including materials by weight and volume, and air content. Give types and amounts of admixtures including air entrainment or air generating compounds.

4. Fill densities and viscosities, including wet density at point of placement.

5. Initial time of set.

6. Bleeding and shrinkage.

7. Compressive strength.

B. Submit technical information for equipment and operational procedures including projected injection rate, grout pressure, method for controlling grout pressure, bulkhead and vent design and number of stages for grout application.

PART 2 - MATERIALS

2.01 FLOWABLE FILL

A. Design Mix Criteria. Provide design of one or more mixes to meet design criteria and conditions for placement. Present information required by 5.21.04, to include the following:

1. Cement: ASTM C150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 50 pounds per cubic yard.

2. Fly ash: ASTM C618, Class C or F. Volume and weight per cubic yard of fill. Provide minimum fly ash content of 200 pounds per cubic yard.

3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.

4. Aggregate gradation: 100 percent passing 3/8-inch sieve and not more than 10 percent passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes: 3/8 inch, No. 4, 8, 16, 30, 50, 100 and 200. Do not deviate

from pilot gradation by more than plus or minus 10 percentage points for any sieve for production material.

5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, add at least 30 percent natural aggregate to provide workability.

6. Admixtures: use admixtures meeting ASTM C494 and ASTM C1017 as needed to improve pumpability, to control time of set and to reduce bleeding.

7. Fluidifier: Use fluidifier meeting ASTM C937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.

8. Performance additive: Use flowable fill performance additive, if needed, to control fill properties.

B. Flowable Fill Requirements:

1. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report.

2. Placement characteristics: self-leveling.

3. Shrinkage characteristics: non-shrink.

4. Water bleeding for fill to be placed by grouting method in pipes: not to exceed 2 percent according to ASTM C940.

5. Minimum wet density: 90 pounds per cubic foot.

C. Grout Plugs:

1. Cement-based dry-pack grout conforming to ASTM C1107, Grade B or C.

PART 3 - PREPARATION

A. Notify inspector at least 24-hours in advance of grouting with flowable fill.

B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portions of the work, new or existing.

C. Cut and cap portions of the piping system to remain, as shown on the Drawings.

D. Clean sewer lines and video to identify connections and locate obstructions. Locate previously unidentified connections which have not been redirected or reconnected as

part of the work and report them to the Engineer. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions or open joints, to ensure no voids remain unfilled.

E. Perform demolition work prior to starting fill placement. Clean placement areas for pipes and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of the fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume. Dispose of waste material in accordance with applicable codes and regulations.

F. Remove free water prior to fill placement.

PART 4 - EXECUTION

A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.

B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

SECTION 034210 PRECAST CIRCULAR CONCRETE MANHOLES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes design, materials, testing, and installation of precast circular concrete manholes.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500

B. Painting and Coating: 099000.

C. Chemical-Resistant Coatings for Concrete: 099720.

D. Trenching, Backfilling, and Compacting: 312316.

E. Gravel and Crushed Rock Base for Structures: 312323

F. Leakage and Infiltration Testing: 330130.

G. HDPE Pipe, 20 Inches and Smaller: 402097.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions and Section 013300.

B. Submit manufacturer's catalog data on precast concrete manholes, frames, pipe connections, joint sealing compound, external sealing bands for joints, and covers. Show dimensions and materials of construction by ASTM reference and grade. Show lettering on manhole covers.

PART 2 - MATERIALS

2.01 PRECAST CIRCULAR CONCRETE MANHOLES

A. Precast circular concrete manholes shall comply with ASTM C478, except that the wall thickness shall be 6 inches minimum. Minimum manhole diameter shall be 48 inches. Design manholes for the depths shown in the drawings, assuming a soil density of 130 pounds per cubic foot.

B. Minimum allowable steel shall be hoops of No. 4 wire cast into each unit.

C. Precast top sections shall be concentric cone, except where shown otherwise in the drawings.

D. Design joints using a butyl rubber sealant per ASTM C990.

2.02 CEMENT

Cement for precast manhole risers and precast bases shall conform to ASTM C150, Type II/V.

2.03 PRECAST MANHOLE BASE

Manhole base shall be precast reinforced Class A concrete with extended base and conform to the requirements for manhole risers

2.04 MANHOLE FRAMES AND COVERS

A. Manhole frames and covers shall be made of cast iron conforming to ASTM A48, Class 30. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Frames and covers shall be designed for H20-44 traffic loads. The cover shall have a sealed blind pickhole and seat firmly into the frame without rocking.

B. Grind or otherwise finish each cover so that it will fit in its frame without rocking. Frames and covers shall be matchmarked in sets before shipping to the site.

C. Sewer manhole covers shall have the word "SANITARY SEWER" and the letters as indicated in the drawings cast thereon. Do not apply any other lettering.

D. Before leaving the foundry, clean castings and subject them to a hammer inspection.

2.05 SEALING COMPOUND AND MORTAR

Butyl rubber sealing compound shall comply with ASTM C990. Mortar shall comply with ASTM C387, Type S, or use grout complying with Section 030500.

2.06 PIPE CONNECTIONS FOR SEWER MANHOLES

Provide resilient watertight connectors between the manhole and piping in accordance with ASTM C923. Connections shall consist of a chemically resistant neoprene EPDM flexible boot, locking ring, and pipe clamp(s). The locking ring shall be stainless steel and shall lock the boot into the preformed opening in the manhole. The pipe clamp shall be stainless steel. Pipe connections shall be Kor-N-Seal (Dukor Corporation), Z-Lok-XP (A-Lok Products, Inc.), or equal.

2.07 CRUSHED ROCK FOR MANHOLE BASE

Crushed rock shall comply with Section 312323

PART 3 - EXECUTION

3.01 MANHOLE BASE

A. Place crushed rock or gravel base beneath structures where shown in the drawings, 18 inches thick unless otherwise indicated. Excavate below the required grade for the bottom of the structure and refill with crushed rock or gravel as specified above. The rock base shall extend a minimum of 12 inches beyond the structure base.

B. Prior to placement of the crushed gravel, the excavation should be dewatered and the bottom compacted to the degree practicable to facilitate the placement of geotextiles and subsequent crushed gravel. The crushed gravel should be completely encapsulated in a two-layer (woven and non-woven) geotextile system. The system should consist of a layer of woven geotextile stabilization fabric conforming to the Caltrans Section 88-1.020-Class B1 and a layer of heavy-duty filter fabric conforming to Caltrans Section 88-1.02I-Class 8.

C. Set each precast concrete manhole base plumb on a 6 inch bed of compacted aggregate base.

3.02 INSTALLING MANHOLES

A. Set each precast concrete manhole unit plumb on a bed of sealant or mortar to make a watertight joint at least 1/2 inch thick with the concrete base or with the preceding unit. Point the inside joint and wipe off the excess sealant or mortar. Secure the manhole frame to the grade ring with grout and cement mortar fillet. Backfill, compact, and replace pavement.

B. Assemble units so that the cover conforms to the elevation determined by the manhole location as follows:

1. In Paved Areas: Top of cover shall be flush with the paving surface.

2. In Shoulder Areas: Top of cover shall be flush with existing surface where it is in traveled way of shoulder and 0.1 foot above existing surface where outside limits of traveled way but not in the existing roadside ditch.

3. In Roadside Ditch or Unpaved Open Areas: Top of cover shall be 18 inches above the ground surface.

3.03 SEALING AND GROUTING OF MANHOLE SECTIONS

Clean ends of precast sections of foreign materials. Place two wraps of butyl rubber sealing compound around the groove of the lower section. Set next section in place. Fill remaining interior and exterior joint cavity completely with mortar of the proper consistency. If the manhole is tested using the vacuum method (see Section 330130), do not place the grout in the joint cavity containing the butyl rubber sealing compound until after testing is completed. Trowel interior and exterior surfaces smooth on tongue-and-

groove joints. Wipe off any excess grout from the interior and exterior of the joints. Prevent mortar from drying out by applying curing compound or comparable method. Chip out and replace cracked or defective mortar. Completed manhole shall be rigid and watertight. Grout should be properly cured prior to applying interior and exterior coatings.

3.04 LEAKAGE TESTING OF SEWER MANHOLES

Test manholes per Section 330130.

3.05 COATING INTERIOR OF MANHOLES

Coat interior of manholes per Section 099720.

3.06 COATING EXTERIOR OF MANHOLES

Coat exterior of wet wells with 78% solids amine-cured coal-tar epoxy, Amercoat 78HB, or equal. Reappoint coating over all joints and penetration seals after rings are set and piping is installed to ensure a completely coated exterior surface.

3.07 BACKFILL AROUND MANHOLES

Backfill and compact around the manholes using imported sand, crushed rock, or sand cement slurry per Section 312316 and the pipe specification.

END OF SECTION

SECTION 042223 CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of hollow block concrete unit masonry.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Miscellaneous Structural Steel and Aluminum: 051210.

C. Exterior Wall Stucco: 092000.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data of each type including special shapes required to show range of colors, texture, finishes, and dimensions. If colored, state source of color for coordination with mortar mix.

C. Submit manufacturer's certificate and test results to show that masonry units comply with the cited ASTM specification.

D. Provide statement from concrete products supplier results of ASTM tests and gradations when requested by Owner's Representative.

E. Furnish grout mix design including admixture with laboratory 7- and 28-day compressive tests prior to placing plant-mixed grout on the project.

F. Submit which method of grouting is to be used for masonry work: low-lift or high-lift.

G. Submit report from a testing laboratory verifying that aggregate material is asbestos-free and conforms to the specified gradations or characteristics.

H. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall indicate all openings (mechanical, electrical, equipment, and architectural) including additional reinforcing at openings and corner bar arrangements at intersecting walls indicated in the typical detail and structural drawings. Placing drawings shall be coordinated with the sequence of masonry construction. Each bending list and placing drawing submitted shall be complete for each major element of a structure. Furnishing such lists shall not be construed that the lists will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details

shown in the drawings and as specified. Placing drawings shall include elevation views showing the location of each bar. Placing drawings shall be prepared by the Contractor and shall not incorporate photocopies of the contract drawings.

I. Submit test results of mortar and grout tests conducted by an independent testing agency.

1.04 QUALITY CONTROL

Construct in accordance with the CBC, Section 2104 except as specified herein.

PART 2 - MATERIALS

2.01 CONCRETE MASONRY UNITS

A. Provide ASTM C90, hollow load-bearing concrete masonry units, normal weight, average compressive strength over net area: 1,900 psi. Nominal face dimensions: 8 inches by 8 inches by 16 inches, unless 4-inch-high units are noted. Color shall be cement gray, unless a specific color is noted otherwise.

B. Units shall be precision face by ORCO Block Co., Stanton, California; Angelus Block Co., Orange, CA; or equal.

C. Units shall be modular and shall include all special shapes and sizes to complete the work as shown. Units shall be sound and free from cracks, chipped edges, or other defects that would interfere with their proper setting or impair the strength or durability of the construction. Where used as the finished surface of exposed masonry walls, units shall be free from surface defects that would be noticeable and objectionable at a distance of 10 feet from the finished wall. Provide special units for bond beams, sills, columns, and half blocks to hold cutting to a minimum.

2.02 MORTAR AND GROUT

A. Mortar: Provide mortar mix that conforms to the requirements of ASTM C270.

B. Grout: Provide grout that conforms to the requirements of ASTM C476 for fine or coarse grout.

C. Cement: Portland Type I or II, ASTM C150. For mortar, use same cement coloring agent as in colored block manufacture.

D. Sand: Fine granular aggregate; a natural sand passing the No. 4 sieve with 10% to 35% passing the No. 50 and 2% to 15% passing the No. 100; or a manufactured sand, ASTM C144.

E. Coarse Aggregate for Grout: 95% passing the 3/8-inch sieve and no more than 5% passing the No. 8 sieve, ASTM C404. Aggregate shall be asbestos-free.

F. Lime: Hydrated lime, ASTM C207, Type S; lime putty, ASTM C1489; slaked quicklime, ASTM C5.

G. Admixture for Grout: Reduce early water loss and produce an expansive action sufficient to offset initial shrinkage. Products: Sika Grout Aid.

2.03 REINFORCEMENT

Deformed bars, ASTM A615 or A706, Grade 60. Use annealed tie wires, 16 gauge.

2.04 MORTAR AND GROUT MIX PROPORTIONS AND STRENGTHS

Use the following proportions for field mixes and obtain the following strengths of cement mortar with plant mixes:

MORTAR AND GROUT MIX PROPORTIONS AND STRENGTHS					
Type Mix	**Minimum 28-Day Compressive Strength (lbs/sq. in.)**	**Cement**	**Coarse Aggregate**	**Lime Putty or Hydrated Lime**	**Sand (Measure in a Damp, Loose Condition)**
Mortar, Type M	1,900	1	0	1/4 maximum	Not less than two and one-quarter and not more than three times the sum of the volumes of the cement and lime used.
Fine grout	2,000	1	0	0 minimum to 1/10 maximum	Not less than two and one-quarter and not more than three times the sum of the volumes of the cement and lime used.
Coarse grout	2,000	1	Not less than one and not more than two times the sum of the volumes of cement and lime used.	0 minimum to 1/10 maximum	Not less than two and one-quarter and not more than three times the sum of the volumes of cement and lime used.
Grout admixture		In accordance with admixture manufacturer's recommendations.			

2.05 CONTROL JOINT

Control joint shall be PVC conforming to ASTM D2287 Type PVC 654-4 or rubber conforming to ASTM D2000 2AA-805. Shore durometer hardness shall be 80 to 85. Control joint shall be as manufactured by Ty-Wall Accessories (supplier is Dayton Superior), Duro-O-Wal Inc., or equal.

2.06 EPOXY

Epoxy used for grouting misplaced dowels shall be Sikadur 32 by Sika Corporation, HIT RE 500 by Hilti, or equal.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Store masonry units above ground on level platforms that allow air circulation under stacked units. Cover and protect against wetting prior to use.

B. Deliver units on pallets or flatbed barrows. Do not permit free discharge from conveyor or mortar trays.

3.02 MIXING AND HANDLING MORTAR

Mechanically mix mortar for at least five minutes with the amount of water required to produce the desired workability. Retemper on mortar boards by adding water within a basin formed in the mortar and rework the mortar into the water. Do not dash or pour water over the mortar. Do not retemper harsh, nonplastic mortar. Remove from the work mortar that is unused after one hour of the initial mixing.

3.03 MIXING AND HANDLING GROUT

For block spaces 2 inches or less or if the clear distance between the reinforcing and masonry surface is less than 1/2 inch, use fine grout. For block spaces greater than 2 inches, use coarse grout. Add grout admixture in accordance with the manufacturer's recommendations. Mechanically mix grout for at least five minutes. Completely empty the mixer drum before placing in the succeeding batch of materials. Discard grout that is unused after one hour from initial mixing.

3.04 QUALITY CONTROL OF MORTAR AND GROUT

Conform to CBC Section 2105.

A. Mortar Testing: Obtain test mortar from batch in accordance with ASTM C780. Prepare three sets of three specimens for testing at 7 days and 28 days and hold one set for future testing.

B. Grout Testing: Perform grout testing in accordance with ASTM C1019. Obtain one sample for each day’s work. Prepare three sets of three specimens from each sample for testing at 7 days and 28 days and hold one set for future testing.

C. Mortar or grout that does not meet or exceed the specified strength shall be considered defective. Removal and reconstruction or strengthening of defective masonry shall be done at Contractor’s expense, and no additional payment will be made therefor.

3.05 PLACEMENT OF REINFORCEMENT

A. Use foundation dowels of the same size and spacing as vertical wall reinforcing. When a foundation dowel does not line up with the vertical core to be reinforced, epoxy-grout the misplaced dowel into a core in direct vertical alignment in a cell adjacent to the

vertical wall reinforcing. Diameter and depth of hole shall be in accordance with the manufacturer's recommendations.

B. Where walls are to be low-lift grouted, install vertical reinforcement such that bars are continuous or provide minimum laps of 48 bar diameters. Assure that the cells to be grouted are free from debris and that the vertical reinforcing bars contact the concrete footing or slab.

C. Where high-lift, full-height grouting is employed, clean out opened core and inspect for clearance of reinforcing and mortar debris. Place full-length vertical reinforcing. No splices are permitted in vertical reinforcing, unless indicated in the drawings.

D. Place horizontal reinforcing in special bond beam or other channel units. Lap splices by 50 diameters and securely tie.

3.06 LAYING MASONRY UNITS

A. Do not lay block on concrete footings until concrete has reached a compressive strength of 1,500 psi when tested in accordance with Section 030500.

B. Lay dry block units starting on a full mortar bed over a clean foundation. If the air temperature is below 40°F, heaters are required for curing. If the air temperature is above 95°F, provide shade over the mortar construction.

C. Laying: Lay masonry true to dimensions, plumb, square, and in running bond. All courses shall be level with joints of uniform width.

D. Adjust masonry unit to final position while mortar is soft and plastic. If units are displaced after mortar has stiffened, remove, clean joints and units of mortar, and re-lay with fresh mortar. When joining fresh masonry to set or partially set masonry construction, clean exposed surfaces of set masonry and remove loose mortar prior to laying new masonry.

E. Lay with full mortar coverage on horizontal and vertical faces. Cover webs in all courses of piers, columns and pilasters, and where adjacent cells or cavities are not to be filled with grout.

F. Maximum height of masonry laid prior to low-lift grouting shall be 4 feet. Where high-lift grouting is used, masonry may be laid full height of walls.

G. If height of masonry prior to any grouting exceeds 4 feet, provide cleanouts at the bottom of each cell for removing mortar droppings.

H. Set anchor bolts to line and grade with proper projection prior to grouting.

I. Securely hold vertical reinforcement in high-lift grouting at top and bottom and at 192 bar diameters.

J. Accessories: As masonry work progresses, install angles, metal items, flashings, anchors, wall plugs, and other accessories. Spaces around built-in work shall be complete and solidly filled in with masonry.

3.07 WALL TIES

Install ties when brick facing is specified. Space ties at 24 inches on center maximum horizontally and 16 inches on center maximum vertically with staggered lines.

3.08 PROTECTION OF WORK

Protect sills, ledges, and offsets from mortar drippings and other damage during construction. Protect face materials against staining by removing misplaced mortar or grout immediately and by brushing the masonry surface at the end of each day's work.

3.09 JOINTS

A. Finish of Horizontal and Vertical Face Joints: Construct uniform 3/8-inch joints. Make vertical joints tight. Strike joints flush for surfaces to be plastered, stuccoed, or covered with other surface-applied finish except paint.

B. Tool joints in surfaces to be painted or to remain exposed with a round jointer as soon as they are thumbprint hard. Joints to receive caulking shall be raked out 3/4 inch and left ready for caulking. Strike flush unexposed joints.

C. Running or Stack Bond: Use running bond with vertical joints located at center of masonry units in alternate course below except where stack bond is noted. Bond intersecting masonry walls.

D. Fill horizontal joints with mortar between top of masonry partitions and underside of concrete slabs or beams.

E. Fill collar joints by shoving from the back side or grouting to assure complete filling with mortar.

F. Install control joints where indicated in the drawings. Unless other spacing is indicated, provide 3/8-inch-wide control joints in concrete masonry walls, spaced a maximum of 30 feet. Form control joints with square end masonry units having sash groove and filled with synthetic rubber filler. Omit mortar from joint. Joint sealant for control joints is specified in Section 030500.

3.10 POINTING AND CLEANING, WALL COMPLETION

A. At final completion of unit masonry work, fill any remaining holes in joints and tool. Do not fill weep holes. Cut out and repoint defective joints. Dry brush masonry surface after mortar has set, at end of each day's work, and after final pointing. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

B. Do not saturate a masonry wall with water for curing, but where the atmosphere is dry, dampen the surfaces with a very light fog spray during a curing period for the mortar of three days.

C. Brace the wall against wind and seismic forces during construction.

3.11 GROUT PLACEMENT

A. Before grouting, allow masonry joints to cure at least 18 hours for low-lift grouting and 72 hours for high-lift grouting.

B. After inspection and cleaning out of walls for grouting, place forms over any cleanout and inspection holes and fill cells requiring grout to not over 4 feet in height for low-lift grout placement. Limit high-lift grout pours to lifts of 4 feet maximum. Minimum time period between grout lifts shall be one hour.

C. Fill all cells. Fill cells solid with grout from footings to top of wall. Consolidate by puddling or vibrating.

D. Fill spaces around doorframes and other built-in items.

E. Immediately wash spilled grout from surfaces of masonry units.

END OF SECTION

SECTION 050520 BOLTS, WASHERS, ANCHORS, AND EYEBOLTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials and installation of anchor bolts, connecting bolts, washers, drilled anchors, epoxy anchors, screw anchors, eyebolts, and stainless steel fasteners.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Miscellaneous Structural Steel and Aluminum: 051210.

C. Ladders, Stairs, and Stair Nosings: 055100.

D. General Piping Requirements: 400500.

1.03 DESIGN CRITERIA

Structural Connections: AISC Specification for Structural Steel Buildings, latest edition, except connection details are shown in the contract drawings.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data and ICC reports for bolts, washers, and concrete anchors. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

2.01 ANCHOR BOLTS

Steel anchor bolts shall conform to ASTM A307, Grade A, B, or C.

2.02 CONNECTION BOLTS

A. Steel connection bolts shall conform to ASTM A307. Connection type shall be N per the AISC handbook.

B. Provide self-locking nuts or lockwashers and plain nuts where shown in drawings.

C. Provide galvanized bolts where shown in drawings. Galvanizing of bolts, nuts, and washers shall be in accordance with ASTM F2329.

2.03 STAINLESS STEEL BOLTS

Stainless steel bolts shall be ASTM F593, Type 316. Nuts shall be ASTM F594, Type 316. Provide washer for each nut and bolthead. Washers shall be of the same material as the nuts.

2.04 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

Lubricant shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.

2.05 PLAIN UNHARDENED STEEL AND STAINLESS STEEL WASHERS

Washers shall comply with ASTM F844. Stainless steel washers shall be Type 316. Provide clipped washers where space limitations necessitate.

2.06 DRILLED ANCHORS

A. Where indicated in the drawings, drilled anchors shall be Type 316 stainless steel heavy-duty wedge anchors suitable for dynamic loading. Anchors shall be HSL-3 heavy-duty wedge anchor by Hilti, Power-Bolt by Rawlplug Company, or equal. For metric anchors, use the size that is closest to, but no smaller than, the required English size.

2.07 EPOXY ANCHORS

A. Epoxy anchors in concrete shall be Type 316 stainless steel threaded rod adhesive anchors. Adhesive shall be Rawl Power-Fast, Hilti HIT RE 500-SD, Simpson SET-XP, or equal. Epoxy anchor assemblies shall be ICC approved.

B. Epoxy anchors in grouted concrete masonry walls shall be ASTM F593 Type 316 stainless steel threaded rods. Epoxy adhesive shall be Hilti HIT HY 150 MAX, Simpson Epoxy-Tie, or equal.

2.08 EMBEDDED EYEBOLTS

Eyebolts shall be of the welded-eye or forged Type 316 stainless steel.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 GALVANIZING

Zinc coating for bolts, anchor bolts, and threaded parts shall be in accordance with ASTM F2329.

3.03 INSTALLING CONNECTION BOLTS

A. Use steel bolts to connect structural steel members. Use stainless steel bolts to connect structural aluminum members.

B. Install washers per AISC Specification for ASD.

C. Bolt holes in structural members shall be 1/16 inch in diameter larger than bolt size. Measure cast-in-place bolt locations in the field before drilling companion holes in structural steel beam or assembly.

D. Slotted holes, if required in the drawings, shall conform to AISC Specifications, Chapter J, Section J3, Table J3.1.

E. Drive bolts accurately into the holes without damaging the thread. Protect boltheads from damage during driving. Boltheads and nuts or washers shall rest squarely against the metal. Where bolts are to be used on beveled surfaces having slopes greater than 1 in 20 with a plane normal to the bolt axis, provide beveled washers to give full bearing to the head or nut. Where self-locking nuts are not furnished, bolt threads shall be upset to prevent the nuts from backing off.

F. Bolts shall be of the length that will extend entirely through but not more than 1/4 inch beyond the nuts. Draw boltheads and nuts tight against the work. Tap boltheads with a hammer while the nut is being tightened.

3.04 INSTALLING ANCHOR BOLTS

A. Preset bolts and anchors by the use of templates. For mechanical equipment (pumps, compressors, and blowers), do not use concrete anchors set in holes drilled in the concrete after the concrete is placed.

B. For static items (storage tanks and heat exchangers), use preset anchor bolts or drilled anchors with ICC report data.

C. After anchor bolts have been embedded, protect projecting threads by applying grease and having the nuts installed until the time of installation of the equipment or metalwork.

D. Minimum depth of embedment of drilled mechanical anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.

E. Minimum depth of embedment of epoxy anchors shall be as recommended by the manufacturer, but no less than that shown in the drawings.

F. Prepare holes for drilled and epoxy anchors in accordance with the anchor manufacturer's recommendations prior to installation.

3.05 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

SECTION 051210 MISCELLANEOUS STRUCTURAL STEEL AND ALUMINUM

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of structural steel, structural aluminum, stainless steel plate and members, steel tubing, aluminum tubing, and aluminum sheet.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Bolts, Washers, Anchors, and Eyebolts: 050520.

C. Ladders, Stairs, and Stair Nosings: 055100.

D. Handrails and Safety Chains: 055200.

E. Grating, Cover Plates, and Access Hatches: 055300.

F. Painting and Coating: 099000.

1.03 DESIGN CRITERIA

Structural Connections and Framing: AISC Specification for Structural Steel Buildings, latest edition, except connection details are shown in the contract drawings.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit placing or erection drawings that indicate locations of fabricated items. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

2.01 STRUCTURAL STEEL

Material for all-purpose bolted or welded construction shall conform to the following:

A. ASTM A992: W shapes (rolled wide flange shapes).

B. ASTM A36 or A572, Grade 50: S, M, HP, and channels.

C. ASTM A36: Angles and plates.

2.02 BOLTS AND WASHERS

See Section 050520.

2.03 HOLLOW STRUCTURAL STEEL (HSS) AND STAINLESS STEEL TUBING

A. Steel: Conform to ASTM A500, Grade B or A501.

B. Stainless Steel: Conform to ASTM A554, Grade MT-316.

2.04 STAINLESS STEEL PLATE AND MEMBERS

Except where otherwise specified, stainless steel plate shall be Type 316, ASTM A240. Stainless steel pipe shall conform to ASTM A312, Grade TP316. Wrought stainless steel fittings shall conform to ASTM A403, Class WP316.

2.05 ALUMINUM TUBING

Aluminum seamless pipe and tubing shall conform to ASTM B241, Alloy 6061-T6. Wall thickness shall be Schedule 80, per ANSI H35.2, unless otherwise shown in the drawings.

2.06 STRUCTURAL ALUMINUM

Aluminum structural members shall conform to ASTM B308, Alloy 6061-T6. Aluminum bars and rods shall conform to ASTM B221, Alloy 6061-T6.

2.07 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Welding electrodes for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS A5.4. Use electrodes as follows:

Stainless Steel Material	**Welding Electrode Material**
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 FABRICATION AND ERECTION

A. Fabricate miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated in the drawings, there shall be no bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded.

B. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

C. Set embedded metalwork accurately in position when concrete is placed and support rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 030500.

3.03 GALVANIZING FOR STEEL PLATES, PIPE, AND TUBING

Zinc coating shall be in accordance with ASTM A123.

3.04 WELDING

A. Perform welding on steel by the SMAW process. Welding shall conform to the AWS D1.1-2008, except as modified in AISC Section J2.

B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS D1.2-2003.

C. Perform welding on stainless steel by the TIG process. All welds shall be full penetration and smooth unless otherwise indicated in the drawings. Provide inert gas on the inside of pipe during welding to reduce oxidation.

D. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.

E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely

fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.05 BOLTING

See Section 050520.

3.06 CONTROL OF FLAME CUTTING

Do not use a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a gas-cutting torch only on minor members when the member is not under stress.

3.07 REPAIR OF GALVANIZED SURFACES

Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner. Repair galvanized surfaces per Section 099000, System No. 55.

3.08 CORROSION PROTECTION OF ALUMINUM SURFACES

A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry, per Section 099000, System No. 54 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, except stainless steel, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

3.09 PAINTING AND COATING OF STRUCTURAL STEEL

Coat nongalvanized structural steel surfaces per Section 099000, System No. 13. Apply prime coat in the shop prior to shipping to the site. Apply intermediate and finish coats after erection, except surfaces that will be inaccessible for coating after erection or assembly shall be finish coated prior to erection or assembly. Color of finish coat shall be selected by Owner. Faying surfaces of connections that are not specified to be slip critical may be primed and need not be further painted.

END OF SECTION

SECTION 055100 LADDERS, STAIRS, AND STAIR NOSINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of ladders, prefabricated alternating tread stairs, stair nosings, and stair treads.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Bolts, Washers, Anchors, and Eyebolts: 050520.

C. Painting and Coating: 099000.

1.03 DESIGN CRITERIA

Handrails, Walkways, Ladders, and Personnel Platforms: OSHA, and CBC.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit drawings of stairs, ladders, and stair nosings. Show dimensions and reference materials of construction by ASTM designation and grade.

PART 2 - MATERIALS

2.01 VERTICAL LADDERS

Fabricate ladders as shown in the drawings. Ladders shall be Type 316 stainless steel as indicated in the drawings. Minimum diameter of rungs shall be 3/4 inch. The distance between rungs, cleats, and steps shall not exceed 12 inches and shall be uniform throughout the length of the ladder. The minimum clear length of rungs or cleats shall be 16 inches. Coat rungs with coarse grain nonskid epoxy coating No. 6901T44 as supplied by McMaster-Carr Supply Company, Los Angeles, California, or equal. Color of coating shall be gray. Apply nonskid coating per manufacturer's recommendations.

2.02 SAFETY CLIMB FOR VERTICAL LADDERS

A. Equip the interior ladders that are higher than 12 feet with a ladder-centered notched safety climbing tube of ASTM A276, Type 304 stainless steel.

B. Provide a removable extension kit for each ladder that is equipped with a Saf-T-Climb.

C. Provide a Ladder Up Safety Post by Bilco or equal for ladders at access hatches.

D. Provide post, storage brackets, and box mounted on the handrail for the removable extension kit, which extends above the roof hatch. Provide three sets of safety belts and sleeves. Provide ladder-up safety posts for ladders without safety climbs. Posts shall be of the same material as the ladder.

2.03 STAIR TREADS

Stair treads shall be of aluminum design with 1-1/4-inch by 3/16-inch bars spaced 1-3/16 inches on center. Treads shall have cast abrasive nosings. Treads shall be as manufactured by Grating Pacific, IKG Industries, or equal.

2.04 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Welding electrodes for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS 5.4. Use Electrodes E308 for Type 304 stainless steel and E316 for Type 316 stainless steel.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 INSTALLING LADDERS

Mount ladders to provide clearance in back of ladder so that the distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches.

3.03 INSTALLING ANCHOR BOLTS

See Section 050520.

3.04 REPAIR OF GALVANIZED SURFACES

Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner. Repair galvanized surfaces per Section 099000, System No. 55.

3.05 CORROSION PROTECTION FOR ALUMINUM SURFACES

A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 099000, System No. 54 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

END OF SECTION

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SECTION 055200 HANDRAILS AND SAFETY CHAINS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of aluminum handrail and safety chains.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Painting and Coating: 099000.

1.03 DESIGN CRITERIA

Handrails, Walkways, Ladders, Personnel Platforms: OSHA and CBC.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit drawings of handrail and safety chains. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.

C. Submit placing or erection drawings that indicate locations of handrail and safety chains. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

2.01 ALUMINUM HANDRAILS

Construct aluminum handrails of clear anodized aluminum pipe conforming to ASTM B429, Alloy 6063-T6. Handrail shall be CV Pipe Rail by Craneveyor, Wesrail as manufactured by Moultrie Manufacturing Co., or equal.

2.02 STAINLESS STEEL HANDRAIL SAFETY CHAINS

Handrail safety chains shall be Type 316 stainless steel. Chains shall be proof coil style, 3/16 inch in diameter, with at least 12 links per foot and with snaphooks at each end. Snaphooks shall be Type 316 stainless steel.

2.03 WELDING ELECTRODES

Welding electrode for aluminum shall be ER4043 filler metal.

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store material above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 FABRICATION AND ERECTION

A. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

B. Set embedded metalwork accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 030500.

3.03 WELDING

A. Perform welding on steel by the SMAW process. Welding shall conform to the AWS D1.1, except as modified in AISC Section J2.

B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to the AWS D1.2-2003.

C. Perform welding on stainless steel by the gas tungsten arc (TIG) process. Welds shall be full penetration and smooth. Provide inert gas on the inside of pipe during welding to reduce oxidation.

D. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.

E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.04 INSTALLING HANDRAILS

Provide handrail components to complete the installation for the various types of handrail.

3.05 INSTALLING SAFETY CHAINS

Provide two chains 4 inches longer than the access opening for each opening. Mount the top chain 3 feet 6 inches above the floor, and mount the lower chain 2 feet above the floor.

3.06 REPAIR OF GALVANIZED SURFACES

Repair damaged galvanized surfaces by coating per Section 099000, System No. 55.

3.07 CORROSION PROTECTION FOR ALUMINUM SURFACES

A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 099000, System No. 54 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

3.08 CORROSION PROTECTION OF STEEL HANDRAIL POSTS EMBEDDED IN CONCRETE

Coat steel handrail posts to be embedded in concrete per Section 099000, System No. 7. Apply coating from the bottom of the post to 1 inch above concrete embedment.

END OF SECTION

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SECTION 055300 GRATING, COVER PLATES, AND ACCESS HATCHES

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, fabrication, and installation of steel and aluminum grating, cover and floor plates, and access hatches.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Painting and Coating: 099000.

1.03 DESIGN CRITERIA

A. Grating, Floor Plates, and Miscellaneous Cover Plates: Design live load of 150 psf, maximum deflection of 1/240 of span.

B. Access Hatches: 300 psf loading.

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit drawings of grating, cover plates, and access hatches. Show dimensions and reference materials of construction by ASTM designation and grade. Show design criteria.

C. Submit placing or erection drawings that indicate locations of fabricated items. Reproductions of contract documents will not be accepted for this purpose.

PART 2 - MATERIALS

2.01 DESIGN OF GRATING, FLOOR PLATES, AND MISCELLANEOUS COVER PLATES

A. Grating, floor plates, and miscellaneous cover plates shall be as detailed in the drawings or, if not detailed, shall be designed per subsection on “Design Criteria” in Part 1. No single piece of grating, floor plate, or miscellaneous cover plate shall weigh more than 80 pounds. Length of individual pieces shall not exceed one and one-half times the width, unless limited by the installation.

B. Field measure grating and cover plates for proper cutouts and size.

C. Grating shall be completely banded. For pipe and conduits (including electrical conduit) larger than 1 inch in diameter penetrating grating, cut and band grating.

2.02 STAINLESS STEEL PLATE AND MEMBERS

Except where otherwise specified, stainless steel plate and members shall be Type 316L, ASTM A240 or A666.

2.03 ALUMINUM SHEET

Aluminum sheet shall conform to ASTM B209, Alloy 3003, H 14 temper.

2.04 ALUMINUM ACCESS HATCHES

A. Access hatches shall be U.S.F. Fabrications, Inc., Type THS aluminum or Bilco Type J-AL H-20 of the size and configuration shown in the drawings. Aluminum doors shall be anodized. Latch and lifting mechanism assemblies, hold-open arms and guides, and brackets, hinges, pins, and fasteners shall be Type 316 stainless steel.

B. Locking and Latching Devices:

1. Hinged hasp on exterior door surface.

2.05 PROTECTIVE GRATE FOR ACCESS HATCHES

Provide hinged grating panel to cover each access hatch opening where indicated in the drawings. The grating panel shall fit beneath the access hatch cover. Provide Type 316 stainless steel hold-open arm with aluminum latch, Type 316 stainless steel hardware including mounting hardware and supports and aluminum grating with OSHA Safety Orange fusion-bonded coating. Provide spring-loaded lifting handle. Products: Halliday Products “Retro-Grate” or equal.

2.06 GRATING

Grating shall be welded stainless steel as indicated in the drawings. Main bars shall be of the thickness and of the depth indicated in the drawings.

2.07 CHECKERED COVER PLATES

Checkered cover plates shall be aluminum. Minimum thickness shall be ¼-inch. Provide U-bolt lifting handles located at opposite ends on each removable section. Handles shall be recessed to reduce tripping hazards. Steel plates, including angle edgings, support angles, and lifting handles, shall be stainless steel. Aluminum plates shall comply with ASTM A786, Pattern 4, with material conforming to ASTM B209, Alloy 6061-T6.

2.08 FRAMES AND SUPPORTS FOR GRATING AND CHECKERED PLATES

Fabricated frames and supports for grating and checkered cover plates shall be stainless steel. Corners of embedded angle frames shall be mitered and welded with the welds ground smooth.

2.09 WELDING ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

B. Welding electrode for aluminum shall be ER4043 filler metal.

C. Welding electrodes for stainless steel shall conform to AWS A5.4. Use electrodes as follows:

Stainless Steel Material	Welding Electrode Material
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

PART 3 - EXECUTION

3.01 STORAGE OF MATERIALS

Store structural material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease, and other foreign matter and protect from corrosion.

3.02 INSTALLATION AND ERECTION

A. Clean the surfaces of metalwork to be in contact with concrete of rust, dirt, grease, and other foreign substances before placing concrete.

B. Set grating seats and frames and checkered plate frames and supports accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete. Unless otherwise specified, where metalwork is to be installed in recesses in formed concrete, said recesses shall be made, metalwork installed, and recesses filled with dry-pack mortar in conformance with Section 030500.

C. Set seat angles for grating so that the grating will be flush with the floor. Maintain the grating and floor plates flush with the floor. Seat angles and anchors shall be stainless steel.

3.03 FASTENING

Fasten grating panels to supporting members with two saddle clips at each end of each panel bolted to studs that are welded to supporting members. Bolt studs shall be 1/4 inch in diameter and of the same material as the supporting members. Saddle clips shall be the same material as the grating.

3.04 GALVANIZING

Zinc coating for plates, bolts, anchor bolts, and threaded parts shall be in accordance with ASTM A153 and F2329.

3.05 WELDING

A. Perform welding on steel by the SMAW process. Welding shall conform to AWS D1.1-2006, except as modified in AISC Section J2.

B. Perform welding on aluminum by the gas metal arc (MIG) or gas tungsten arc (TIG) process. Welding shall conform to AWS D1.2-2003.

C. Perform welding on stainless steel by the gas tungsten arc (TIG) process. Welds shall be full penetration and smooth. Provide inert gas on the inside of pipe during welding to reduce oxidation.

D. Provide a minimum of two passes for metal in excess of 5/16-inch thickness.

E. Produce weld uniform in width and size throughout its length with each layer of weldment smooth; free of slag, cracks, pinholes, and undercuttings; and completely fused to the adjacent weld beads and base metal. Avoid irregular surface, nonuniform bead pattern, and high crown. Form fillet welds of the indicated size of uniform height and fully penetrating. Accomplish repair, chipping, and grinding of welds in manner that will not gouge, groove, or reduce the base metal thickness.

3.06 REPAIR OF GALVANIZED SURFACES

Repair or replace metal with damaged galvanized surfaces at no additional cost to the Owner. Repair galvanized surfaces per Section 099000, System No. 55.

3.07 CORROSION PROTECTION OF ALUMINUM SURFACES

A. Coat aluminum surfaces to be embedded or which will be in contact with concrete or masonry per Section 099000, System No. 54 before installation. Allow the coating to dry before the aluminum is placed in contact with the concrete.

B. Where aluminum surfaces come in contact with dissimilar metals, keep the dissimilar metallic surfaces from direct contact by use of neoprene gaskets or washers.

END OF SECTION

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SECTION 092000 EXTERIOR WALL STUCCO

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials and installation of lath and plaster (stucco) for exterior surfaces. Stucco is to be used on the exterior of all walls.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Concrete Unit Masonry: 042223.

C. Painting and Coating: 099000.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's literature on screeds and accessories.

C. Submit color pallet. Color shall be selected by Owner from the full range of colors available from the manufacturer.

1.04 FIELD SAMPLES AND QUALITY ASSURANCE

A. Before plastering, install mockups of at least 25 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution. Install mockups for each type of finish indicated.

B. The finish stucco coat on the masonry wall shall match the color and texture, as well as practical, as the masonry wall stucco finish located across Motel 6 driveway.

1.05 CODES AND STANDARDS

Lathing materials and their application and plaster materials and their application shall be in accordance with the requirements of ASTM C926 and the CBC latest edition, Vol. II, Chapter 25.

PART 2 - MATERIALS

2.01 CEMENT

Portland cement, ASTM C150, Type II or plastic (stucco) cement, ASTM C1328, Type S. The maximum alkali content shall not exceed 0.6% by weight.

2.02 BONDING AGENT

For bonding of cement plaster to concrete, use Larsen Products Corporation's "WeldCrete" or equal.

2.03 PLASTER FINISH COAT

California Stucco Products Co., "Exterior California Stucco," U.S. Gypsum's "Oriental Exterior Stucco," or equal, in color and texture finish as noted in these specifications.

2.04 LIME

Special finishing hydrated lime conforming to ASTM C206, Type S for cement plaster. Lime required for structural purposes shall be quicklime conforming to ASTM C5. Lime putty, if used, shall comply with ASTM C1489.

2.05 WATER

Fresh, clean and potable, and free from such amounts of mineral and organic substances as would adversely affect the hardening of cement mortar.

2.06 AGGREGATE

A. Aggregate for plaster (stucco) shall be clean, asbestos free, conforming with ASTM C897 and graded from coarse to fine as follows:

Sieve	Maximum Percent Retained	Minimum Percent Retained
No. 4	0	--
No. 8	10	0
No. 16	40	10
No. 30	65	30
No. 50	90	70
No. 100	100	95

B. The aggregate for finish coats shall meet the above requirements except 100% shall pass the No. 8 sieve.

2.07 FIBER

Alkaline-resistant glass fibers, 1 1/2 to 2 inches in length and free of contaminants. Quantities shall be in amounts recommended by the fiber manufacturer but no more than 2 pounds per cubic foot of cementitious material.

2.08 WATERPROOFING ADMIXTURE

Use "Berylex" as manufactured by Berylex Western of Oakland, California; A. C. Horn's "Hydratite"; Sonneborn's "Hydrocide Powder"; or equal. Add waterproofing admixture to cement plaster scratch and brown coats in amounts recommended by the manufacturer.

2.09 EXTERIOR LATH AND ACCESSORIES

Furnish and install corner beads, corner reinforcement, casing beads and stops, base screeds, expansion joints, and manufacturer's standard soffit vents of not less than 26-gauge zinc-coated steel. Manufacturers: U.S. Gypsum, Milcor, Penmetal, or equal.

2.10 INTEGRAL COLOR

Color admixture for finish coat shall be as manufactured by La Habra Products, Inc., or equal.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE OF MATERIALS

Deliver manufactured materials in their original packages and containers, bearing name of manufacturer and brand. Store plaster, cement, and lime off the ground, under watertight cover, and away from damp surfaces. Remove damaged or deteriorated materials from the site.

3.02 APPLICATION OF ACCESSORIES

Install plaster grounds, casing beads or stops, base screeds, corner reinforcement, special stops, and other metal accessories. Apply and shim out to required thickness. Set plumb, level, and straight and free of kinks and bends. Install casing beads or stops at the edges of plaster continuously. Provide expansion joints or control joints. Do not install in conspicuous location.

3.03 PROTECTION OF ADJACENT SURFACES

Protect adjacent surfaces of the building from spattering or other staining caused by plastering. Clean any surfaces so spattered or stained.

3.04 WORKMANSHIP

A. Do not hand mix stucco materials and components.

B. Intersections of planes shall be sharp and accurate. Plane surfaces shall finish plumb, straight, and true to an 8-foot straightedge. Finished surfaces shall be uniform as to texture and color throughout the area and shall be free from imperfections.

C. Where plaster stops at angles or where wall panels are employed for architectural treatment, panels framed by these accessories or other construction shall be finished in one operation. Do not stop vertically or horizontally in the middle or intermediate area of a panel.

D. Repair imperfections that occur after curing and drying.

3.05 APPLICATION OF CEMENT PLASTER OVER UNIT MASONRY

A. Cut joints flush.

B. Dampen surface before beginning work.

C. Apply exterior cement plaster (stucco) to concrete masonry units in a two-coat system to a minimum thickness of 5/8 inch.

D. The first and second coats shall meet the requirements of application of concrete plaster over exterior lath except that lime putty shall not exceed one to one and one-half parts.

E. Apply the first coat with sufficient material and pressure to provide tight contact and complete coverage of solid base to a minimum thickness of 3/8 inch.

F. The finish coat shall be of uniform texture and color to a minimum thickness of 1/4 inch.

3.06 INTEGRAL COLOR

Proportion and mix color admixture uniformly in finish coat.

3.07 CURING OF PLASTER

A. Cure cement plaster for a minimum period of four days after completion. Moistening shall begin as soon as the plaster has hardened sufficiently. Apply water in a fine fog spray. Do not soak walls.

B. Apply only as much water as will be readily absorbed. Protect plaster from uneven and excessive evaporation during hot, dry weather and from strong blasts of wind. Provide for curing on Saturdays, Sundays, and holidays, if necessary.

C. Provide temporary heat where required for proper curing of plaster and to protect work against damage from too rapid drying or from any other cause. Provide temporary closures as may be necessary to close openings.

3.08 CUTTING AND PATCHING

Remove and replace plaster containing cracks, pits, checks, or discolorations with plaster conforming to the requirements of this section. Patch defective work in a manner acceptable to the Owner's Representative. Patching shall match existing work in texture and color. Leave finish work with angles and lines clean and sharp and surfaces clean and smooth.

3.09 PROTECTION

Protect plaster work and maintain protection until acceptance of the project by the Owner.

END OF SECTION

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SECTION 099000 PAINTING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and application of painting and coating systems for the following surfaces:

A. Submerged metal.

B. Exposed metal.

C. Buried metal.

D. Metal in contact with concrete.

It does not include coating steel water tanks and reservoirs.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Chemical-Resistant Coatings for Concrete: 099720.

C. Fusion-Bonded Epoxy Linings and Coatings: 099761.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer’s data sheets showing the following information:

1. Percent solids by volume.

2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.

3. Recommended surface preparation.

4. Recommended thinners.

5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

6. Application instructions including recommended equipment and temperature limitations.

7. Curing requirements and instructions.

C. Submit color swatches.

D. Submit certificate and supplier's data sheets identifying the type and gradation of abrasives used for surface preparation. The certificate or data sheets shall specifically identify that the abrasives comply with federal and state of California regulations for materials to be used for abrasive blasting for surface preparation for paints and coatings.

E. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX

No.	**Title**	**Generic Coating**
Submerged Metal Coating Systems		
1.	Submerged Metal, Raw Water (Nonpotable) or Raw Sewage	Epoxy
7.	Submerged Metal, Potable or Nonpotable Water	Epoxy
Exposed Metal Coating Systems		
10.	Exposed Metal, Corrosive Environment	High-build epoxy (two-coat system) with polyurethane topcoat
13.	Exposed Metal, Corrosive Environment	Epoxy with urethane topcoat
Buried Metal Coating Systems		
21.	Buried Metal	Epoxy
24.	Buried Metal	Corrosion-resisting grease
Coating Systems for Nonferrous Metals		
54.	Aluminum Insulation from Concrete and Carbon Steel	Epoxy
55.	Repair of Galvanized Surfaces	Cold galvanizing compound

These systems are specified in detail in the following paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and

coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

2.02 SUBMERGED METAL COATING SYSTEMS

A. System No. 1--Submerged Metal—Raw Water (Nonpotable) or Raw Sewage:

Type: Epoxy having a minimum volume solids of 80%.

Service Conditions: For use with metal pipes or structures (such as scum troughs, sluice gates, or piping) alternately submerged in raw sewage or raw water (nonpotable) and exposed to a moist saturated hydrogen sulfide atmosphere, as in raw sewage wet wells. Minimum temperature resistance of the coating shall be 140°F for moist heat conditions.

Surface Preparation: SSPC SP-10.

Prime Coat: Devoe Bar-Rust 233H, 8 mils; Tnemec 104-1211, 8 mils; or equal.

Finish Coat: Devoe Bar-Rust 233H, 8 mils; Tnemec 104-ABO5, 8 mils; or equal.

B. System No. 7--Submerged Metal, Potable or Nonpotable Water:

Type: Epoxy.

Service Conditions: For use with structures, valves, piping, or equipment immersed in potable or nonpotable water.

Surface Preparation: SSPC SP-10.

Coating System: Apply the manufacturer’s recommended number of coats to attain the specified minimum dry-film coating thickness. Products: Devoe Bar-Rust 233H, Tnemec 100, Scotchkote 323 or equal, 24 mils total. Color of topcoat: white. Each coat shall be different color than the one preceding it.

2.03 EXPOSED METAL COATING SYSTEMS

A. System No. 10--Exposed Metal, Corrosive Environment:

Type: High-build epoxy intermediate coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.

Service Conditions: For use with metal structures or pipes subjected to water condensation; chemical fumes, such as hydrogen sulfide; salt spray; and chemical contact.

Surface Preparation: SSPC SP-10.

Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec 90E-92, Devoe Catha-Coat 304 or 304V, International Interzinc 22HS, PPG Dimetcote 9HS, Carboline Carbozinc 11, Sherwin-Williams Zinc-Clad II Plus, PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97-672, or equal.

Intermediate Coat: Tnemec 104, Devoe Devran 224HS or 231, International Interseal 670HS, PPG Amercoat 385, Carboline Carboguard 890, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or equal; 5 mils.

Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 1075, Devoe Devthane 379, International Interline 990HS, PPG Amercoat 450HS, Carboline 134 HG, Sherwin-Williams Hi-Solids Polyurethane B65-300, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or equal.

B. System No. 13--Exposed Metal, Corrosive Environment:

Type: High-build epoxy prime coat with a pigmented high-build aliphatic or acrylic polyurethane finish coat.

Service Conditions: For use with metal structures or pipes subjected to water condensation; chemical fumes, such as hydrogen sulfide; salt spray; and chemical contact.

Surface Preparation: SSPC SP-10.

Prime Coat: Two-component high-build epoxy. Apply to a thickness of 8 mils. Products: PPG Amerlock 400, Devoe 235, Tnemec 104, International Interseal 670HS, Carboline 890 or 890LT, Sherwin-Williams Macropoxy 646 B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or equal.

Finish Coat: Two-component pigmented high-build polyurethane. Apply one or more coats to a total thickness of 5 mils. Products: PPG “Amershield,” Devoe Devthane 359, Tnemec Series 1075, International Interthane 990HS, Carboline 133HB or 134HG, Sherwin-Williams Hi-Solids Polyurethane B65-300 series, PPG PITTHANE® Ultra Gloss Urethane Enamel 95-812 series, or equal.

2.04 BURIED METAL COATING SYSTEMS

A. System No. 21--Buried Metal:

Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).

Service Conditions: Buried metal, such as valves, flanges, bolts, nuts, structural steel, and fittings.

Surface Preparation: SSPC SP-10.

Coating System: Apply three or more coats of PPG Amerlock 400 or 400VOC, Tnemec 104HS or 80, Devoe Bar-Rust 233H, Carboline 890LT, Sherwin-Williams Tank Clad HS B62-80 series, or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

B. System No. 24--Buried Metal:

Type: Corrosion-resisting grease.

Service Conditions: Buried metal, such as bolts, bolt threads, tie rods, and nuts.

Surface Preparation: SSPC SP-3 or SP-6.

Coating: NO-OX-ID GG-2 as manufactured by Sanchem, Inc. Apply to a minimum thickness of 1/4 inch.

2.05 COATING SYSTEMS FOR NONFERROUS METALS

A. System No. 54--Aluminum Insulation from Concrete and Carbon Steel:

Type: High solids epoxy or phenolic epoxy having a minimum volume solids of 80% (ASTM D2697).

Service Conditions: Coat areas of aluminum grating, stairs, structural members or aluminum fabrications, in contact with concrete or carbon steel with this system.

Surface Preparation: Solvent or steam cleaning per SSPC SP-1; do not use alkali cleaning. Then dust blast.

Coating System: Apply three or more coats of PPG Amerlock 400 or 400VOC, Tnemec Series 135, Devoe Bar-Rust 233H, Sherwin-Williams Macropoxy B58-600, PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 series, or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

B. System No. 55--Repair of Galvanized Steel Surfaces:

Type: Cold galvanizing compound consisting of paint containing oils, solvents, and zinc dust and complying with MIL-P-21035. Minimum metallic zinc content in the cured coating shall be 90%.

Service Conditions: Repair of damaged galvanized coatings on steel surfaces.

Surface Preparation: Clean damaged surfaces per SSPC SP-1 and SP-11.

Coating System: Apply Z.R.C. Galvanizing Compound, RAMCO Specialty Products "Zinckit," NuWave "Galv-Match-Plus," Devcon "Cold Galvanizing," Clearco "Cold Galvanizing Spray," or equal to a minimum dry-film thickness of 3 mils. Apply per ASTM A780, Annex A2.

2.06 ABRASIVES FOR SURFACE PREPARATION

A. Abrasives used for preparation of ferrous (excluding stainless steel) surfaces shall be one of the following:

1. 16 to 30 or 16 to 40 mesh silica sand or mineral grit.

2. 20 to 40 mesh garnet.

3. Crushed iron slag, 100% retained on No. 80 mesh.

4. SAE Grade G-40 or G-50 iron or steel grit.

B. Abrasives used for preparation of stainless steel surfaces shall be 20 to 40 mesh silicon carbide or aluminum oxide.

C. Abrasives used for preparation of copper and aluminum surfaces shall be one of the following:

1. Crushed slag, 80 to 100 mesh.

2. Very fine silica sand, 80 to 100 mesh.

D. Abrasives used for preparation of concrete and masonry surfaces shall be 16 to 30 or 16 to 40 mesh silica sand.

E. In the above gradations, 100% of the material shall pass through the first stated sieve size and 100% shall be retained on the second stated sieve size.

PART 3 - EXECUTION

3.01 WEATHER CONDITIONS

A. Do not paint in the rain, wind, snow, mist, and fog or when steel or metal surface temperatures are less than 5°F above the dew point.

B. Do not apply paint when the relative humidity is above 85%.

C. Do not paint when temperature of metal to be painted is above 120°F.

D. Do not apply alkyd, inorganic zinc, silicone aluminum, or silicone acrylic paints if air or surface temperature is below 40°F or expected to be below 40°F within 24 hours.

E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

3.02 SURFACE PREPARATION PROCEDURES

A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a film or greasy residue on the cleaned surfaces before abrasive blasting.

B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter.

D. Do not abrasive blast PVC, CPVC, or FRP piping or equipment. Do not abrasive blast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.

E. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within two hours of blasting or before any rust bloom forms.

F. Surface preparation shall conform with the SSPC specifications as follows:

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
Power Tool Cleaning to Bare Metal	SP-11
Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating	SP-12
Surface Preparation of Concrete	SP-13

G. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these specifications or in paint manufacturer’s specifications, they shall be understood to refer to the applicable SSPC (Society for Protective Coatings), surface preparation specifications listed above.

H. Dust blasting is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any contamination or oxide and to provide a surface profile for the coating.

I. Brush-off blasting of concrete and masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.

J. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the Owner’s Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner’s Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner’s Representative.

K. Do not apply any part of a coating system before the Owner’s Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner’s Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this specification.

3.03 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.

B. After abrasive blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast cleaned surface not coated within said eight-hour period.

C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13 and the following.

B. Do not apply coating until concrete has cured at least 30 days. Finish concrete surfaces per Section 030500. Do not use curing compound on surfaces that are to be coated.

C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.

D. Detergent clean the concrete or masonry surface with trisodium phosphate per ASTM D4258. Then sandblast surfaces (brush-off blast). Floor slabs may be acid etched per ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts, per ASTM D4258 or D4261. The grain of the concrete surface to touch shall not be rougher than that of No. 10 mesh sand.

E. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable, not rising.

3.05 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

A. After application of primer to surfaces, allow coating to cure for a minimum of two hours before handling to minimize damage.

B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.

C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

3.06 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.

B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of trisodium phosphate, detergent, and water. Before applying intermediate or finish coats to inorganic zinc primers, remove any soluble zinc salts that have formed by means of scrubbing with a stiff bristle brush. Rinse scrubbed surfaces with clean water.

C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that remaining primers are not damaged by the blast cleaning operation. Remaining primers shall be firmly bonded to the steel surfaces with blast cleaned edges feathered.

D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that remaining primers are not damaged by the blast cleaning operation. Areas smaller than 1 square inch may be prepared per SSPC SP-11. Remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

E. Use repair procedures on damaged primer that protects adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles, and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.

F. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.

G. Surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

3.07 PAINTING SYSTEMS

A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.

B. Deliver paints to the jobsite in the original, unopened containers.

3.08 PAINT STORAGE AND MIXING

A. Store and mix materials only in areas designated for that purpose by the Owner’s Representative. The area shall be well-ventilated, with precautionary measures taken to

prevent fire hazards. Post “No Smoking” signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.

B. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

3.09 PROCEDURES FOR THE APPLICATION OF COATINGS

A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.

B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.

C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner prior to mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.

D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility of working area prior to coating applications. Remove dust from coated surfaces by dusting, sweeping, and vacuuming prior to applying succeeding coats.

E. Apply coating systems to the specified minimum dry-film thicknesses as determined per SSPC PA-2.

F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Reclean surfaces by blast cleaning that have surface colored or become moist prior to coating application.

G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces prior to the application of the primer and finish coat. Apply the brush coat prior to and in conjunction with the spray coat application. Apply the spray coat over the brush coat.

H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

I. Each coat shall cover the surface of the preceding coat completely, and there shall be a visually perceptible difference in applied shade or tint of colors.

J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.

K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

3.10 SURFACES NOT TO BE COATED

Do not paint the following surfaces unless otherwise noted in the drawings or in other specification sections. Protect during the painting of adjacent areas:

A. Concrete walkways.

B. Mortar-coated pipe and fittings.

C. Stainless steel.

D. Metal letters.

E. Glass.

F. Roofings.

G. Fencing.

H. Copper tubing, red brass piping, and PVC piping except where such piping occurs in rooms where the walls are painted, or required for color coding.

I. Electrical fixtures except for factory coatings.

J. Nameplates.

K. Grease fittings.

L. Brass and copper, submerged.

M. Buried pipe, unless specifically required in the piping specifications.

N. Fiberglass items, unless specifically required in the FRP specifications.

O. Aluminum handrail, stairs, and grating.

3.11 PROTECTION OF SURFACES NOT TO BE PAINTED

Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors to prevent paint and other materials from entering the motors.

3.12 SURFACES TO BE COATED

The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as “corrosive environment,” “buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:

A. Coat mechanical equipment, such as pumps, blowers, clarifier mechanisms, as described in the various mechanical equipment specifications.

B. Coat aboveground and exposed piping or piping in vaults and structures as described in the various piping specifications.

C. Coat aluminum surfaces in contact with concrete per System No. 54.

D. Coat buried flanges, nuts and bolts, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes as specified in the particular specifications for the above items.

E. Coat aboveground structural steel or structural steel located in vaults and structures as described in Section 051210.

3.13 DRY-FILM THICKNESS TESTING

A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge per ASTM D7091. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past six months. Provide detector as manufactured by Tinker and Rasor or K-D Bird Dog.

C. Measure coating thickness specified for concrete or masonry surfaces in accordance with ASTM D4138. Test the finish coat of concrete and masonry surfaces in accordance with

NACE SP0188-2006 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.

D. Check each coat for the correct dry-film thickness. Do not measure within eight hours after application of the coating.

E. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80%, nor more than 120%, of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.

F. Perform tests in the presence of the Owner's Representative.

3.14 REPAIR OF IMPROPERLY COATED SURFACES

If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish coat in accordance with the specifications. Work shall be free of runs, bridges, shiners, laps, or other imperfections.

3.15 CLEANING

A. During the progress of the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.

B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.

C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

END OF SECTION

SECTION 099720 CHEMICAL-RESISTANT COATINGS FOR CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of a chemical-resistant coating for concrete subject to corrosive environments.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Painting and Coating: 099000.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's data sheets showing the following information:

1. Percent solids by volume of coating compound.

2. Number of coats required to give the specified dry thickness.

3. Minimum recommended dry thickness per coat for prime, intermediate, and finish coats.

4. Recommended surface preparation.

5. Recommended surface tensile strength of the concrete surface.

6. Application instructions including recommended equipment and temperature limitation.

7. Curing requirements and instructions.

C. Submit color swatches.

D. Submit certificate and supplier’s data sheets identifying the type and gradation of abrasives used for surface preparation. The certificate or data sheets shall specifically identify that the abrasives comply with federal and state of California regulations for materials to be used for abrasive blasting for surface preparation for paints and coatings.

E. Submit material safety data sheets for each coating.

PART 2 - MATERIALS

2.01 POLYURETHANE

A. Coating system shall be a two-component, minimum 100% solids, polyurethane or polyurethane elastomer, with primer.

B. Characteristics shall be as follows:

1. Tensile Strength on Concrete: 2,500 psi (minimum) per ASTM D412.

2. Flexibility: No effect bending 0.50 mm plate with 30-mil coating over 1/8-inch mandrel per ASTM D1737 or no effect bending 180 degrees over 1-inch mandrel with 15-mil coating per ASTM D522.

3. Elongation: 50% (minimum) recoverable, per ASTM D412.

4. Surface Hardness: 57 minimum, Shore "D" per ASTM D2240.

5. Abrasion Resistance: Weight loss of 80 mg (maximum) on Taber abraser, CS-17 wheel, 1,000 grams, 1,000 cycles per ASTM D4060.

C. Products: Utilithane 1600 as manufactured by Prime Coatings Inc..; Sancon 100 as manufactured by Sancon Engineering Inc.; or equal.

D. Apply prime coat and finish coats to give a total dry coating thickness of at least 125 mils on walls and floor slabs.

2.02 ABRASIVES FOR SURFACE PREPARATION OF CONCRETE

Abrasives used for preparation of concrete surfaces shall be medium grade “Black Beauty” abrasive as manufactured by Reed Minerals, or equal. Silica sand will not be accepted.

PART 3 - EXECUTION

3.01 COATING SYSTEM

A. Materials including primer, intermediate, and finish coats shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the coating manufacturer.

B. Deliver coatings to the jobsite in the original, unopened containers.

3.02 PROTECTION OF SURFACES NOT TO BE COATED

Remove, mask, or otherwise protect surfaces not intended to be coated. Provide drop cloths to prevent coating materials from falling on or marring adjacent surfaces. Protect

working parts of mechanical and electrical equipment from damage during surface preparation and coating process. Mask openings in motors to prevent coating and other materials from entering the motors.

3.03 WEATHER CONDITIONS

A. Do not coat in the rain, wind, snow, mist, and fog or when surface temperatures are less than 5°F above the dew point.

B. Do not apply coatings when the relative humidity is above 85% or the temperature is above 90°F.

C. Do not coat when temperature of concrete to be painted is above 120°F.

D. Do not apply coatings if air or surface temperature drops below or is expected to drop below the manufacturer's recommended minimum temperature in a 24 hour period.

3.04 SURFACE PREPARATION

A. Surface preparation of concrete surfaces shall be in accordance with SSPC SP-13 and the following.

B. Do not apply coating until concrete has cured at least 30 days. Finish concrete surfaces per Section 030500. Do not use lubricants or release agents on tools. Do not use curing compound on surfaces that are to be coated.

1. Concrete surfaces on which coating is to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces. The grain of the concrete surface to touch shall not be rougher than that of No. 10 mesh sand.

2. Repair existing deteriorated concrete as directed by Owner's Representative and per Section 030500, Finish F-4. Fill spalled areas with grout to provide a surface level with the surrounding area.

3. All existing concrete surfaces to be lined shall be waterblasted to remove all deteriorated concrete, oil, grease, or existing coating to produce sound and clean concrete. Wasterblasting equipment shall be capable of 10,000 psi. Cleaning shall be accomplished with a minimum of 5,000 psi using no detergents, solvents, or chemicals of any kind.

4. All debris produced from waterblasting operation shall be removed from the structure prior to coating. No debris shall be allowed to enter the sewer system.

5. Repair existing deteriorated concrete as directed by Owner's Representative. Fill spalled areas with grout to provide a surface level with the surrounding area.

6. Any surfaces subject to immersion shall be abrasive blasted. Abrasive blast surfaces (brush-off blast) per ASTM D4259 and Section E. After sandblasting, wash surfaces with water to remove dust and salts, per ASTM D4258 or D4261. Concrete surfaces shall be air-dried prior to lining application.

7. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable, not rising.

3.05 ABRASIVE BLAST CLEANING

A. Use dry abrasive blast cleaning material. When field blast cleaning with hand-held nozzles, do not recycle or reuse blast particles.

B. After blast cleaning and prior to application of coating, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within the period of an eight-hour working day. Do not apply coating over damp or moist surfaces. Reclean prior to application of primer or touch-up coating any blast-cleaned surface not coated within said eight-hour period.

C. Keep the area of the work in a clean condition, and do not permit blasting particles to accumulate and constitute a nuisance or hazard.

D. During sandblast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating such that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

3.06 COATING APPLICATION

A. Lining application shall be performed only by workmen trained and experienced with the specified material. Provide proof of such experience with the bid documents. Proof shall include a list of similar projects using the specified material.

B. Apply the lining through plural component equipment specifically designed and approved by the manufacturer of the lining material. The equipment shall be in good working order to ensure correct proportioning and mixing of the components.

C. Apply the lining to specified thickness in one continuous coat. The lining shall be free of seams, holes, bubbles, or defects. All areas in question shall be removed, reworked, and patched.

D. For manholes, the lining shall be installed on the entire manhole concrete interior, including shelves, except for the formed channel surface. For wet wells, the lining shall be installed on the entire wet well concrete interior, including the floor.

E. Application of the lining shall not take place during weather described in Section 3.03. Protect the work from the above mentioned conditions.

3.07 WET GUAGE TESTING

A. During lining application, take wet gauge thickness readings as required to insure correct lining thickness.

B. Provide copies of the wet gauge thickness reading results to the Owner’s Representative.

3.08 HOLIDAY (CONTINUITY) TESTING OF APPLIED COATING

The Owner's Representative will inspect each coat of primer and finish coating in accordance with ASTM D4787 to determine integrity. Each coating application will be checked and deficiencies marked. After observing specified recoat time, apply additional coating materials over areas having any holidays or pinholes. After correction of deficiencies, the Owner's Representative will reinspect those areas to determine the acceptability of the additional coating at the Contractors expense. Each coating application must be 100% to the satisfaction of the Owner's Representative prior to succeeding coating applications.

END OF SECTION

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SECTION 099752 COLD-APPLIED WAX TAPE COATING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and application of a three-part, cold-applied wax tape coating system for buried piping per NACE RP0375-2006, Section 4 except as modified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Polyethylene Sheet Encasement (AWWA C105): 099754.

B. Manual, Check, and Process Valves: 400520.

C. Flexible Pipe Couplings: 400722.

D. Polyethylene Pipe for Natural Gas Service: 401449.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data sheets and application instructions.

PART 2 - MATERIALS

2.01 PRIMER

A. Primer shall be a blend of petrolatums, plasticizers, and corrosion inhibitors having a paste-like consistency. The primer shall comply with NACE RP0375-2006 and shall have the following properties:

1. Pour Point: 100°F to 110°F.

2. Flash Point: 350°F.

3. Coverage: 1 gallon per 100 square feet.

B. Primer shall be Trenton Wax Tape Primer, Denso Paste Primer, or equal.

2.02 WAX TAPE

A. Wax tape shall consist of a synthetic-fiber felt, saturated with a blend of microcrystalline wax, petrolatums, plasticizers, and corrosion inhibitors, forming a tape coating that is

easily formable over irregular surfaces. The tape shall comply with NACE RP0375-2006 and shall have the following properties:

1. Saturant Pour Point: 115°F to 120°F.

2. Thickness: 50 to 70 mils.

3. Tape Width: 6 inches.

B. Wax tapes used for pipe soil-to-air transitions shall be UV light stable so as not to degrade in the presence of sunlight.

C. Wax tape shall be Trenton No. 1 Wax Tape, Denso "Densyl Tape," or equal.

2.03 PLASTIC WRAPPER

A. Wrapper shall be a polyvinylidene chloride plastic with three 50-gauge plies wound together as a single sheet. The wrapper shall have the following properties:

1. Color: Clear.

2. Thickness: 1.5 mils.

3. Tape Width: 6 inches.

B. Plastic wrapper shall be Trenton Poly-Ply, Denso Tape PVC Self-Adhesive, or equal.

2.04 POLYETHYLENE SHEET COATING

See Section 099754.

PART 3 - EXECUTION

3.01 WAX TAPE COATING APPLICATION

A. Surfaces shall be clean and free of dirt, grease, water, and other foreign material prior to the application of the primer and wax tape.

B. Apply primer by hand or brush to fitting surfaces. Work the primer into crevices and completely cover exposed metal surfaces.

C. Apply the wax tape immediately after the primer application. Work the tape into the crevices around fittings. Apply the wax tape by pressing and molding the tape into conformity with the surface so that it does not bridge over irregular surfaces configurations. Begin wrapping approximately 3 inches behind the area to be wrapped. If starting at a straight edge, wrap the tape spirally around the pipe while touching the end edge before starting the angle to begin the spiral. If the previous roll is headed in a

downward direction, tuck the next roll under the previous roll. Stretch each roll tight as wrapping continues to avoid air bubbles.

D. Wrap the wax tape spirally around the pipe and across the fitting. Use a minimum overlap of 50% of the tape width. Apply tape to flanges, mechanical and restrained joint bolts, nuts and glands, and grooved-end couplings to 6 inches beyond each side of the item.

E. Work the tape into the crevices and contours of irregularly shaped surfaces and smooth out so that there is a continuous protective layer with no voids or spaces under the tape.

F. After application, seal the overlap seams of the tape by hand by tapering and pressing the seam, attempting to create a continuous surface. There shall be no air pockets underneath the tape. The tape shall have direct intimate contact with the pipe surface.

G. On vertical sections of the piping, such as at pipe-to-soil transitions, wrap the pipe starting from the bottom and proceeding upward so that downward flowing water and backfill do not catch in a seam.

H. Overwrap the completed wax tape installation with the plastic wrapping material. Wrap spirally around the pipe and across the fitting. Use a minimum overlap of 55% of the tape width and apply two layers or applications of overwrap. Secure plastic wrapper to pipe with adhesive tape.

3.02 APPLICATION OF POLYETHYLENE SHEET COATING TO BURIED PIPING

Wrap completed wax tape coating system with polyethylene film per Section 099754 and secure around the adjacent pipe circumference with adhesive tape.

3.03 HANDLING AND INSTALLING WAX-TAPE COATED PIPE

A. Handle pipe in a manner to minimize damage to the coating. Equipment used for the handling of coated pipe shall be designed and constructed to avoid damaging the protective coating system. Inspect supported areas of the pipe prior to installation. Repair damaged areas before installation.

B. The pipeline trench shall be free of rocks, foreign matter, and projections that could damage the coating system.

END OF SECTION

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SECTION 099754 POLYETHYLENE SHEET ENCASEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of a polyethylene sheet encasement for buried pipe, fittings, and valves.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Cold-Applied Wax Tape Coating: 099752

B. Trenching, Backfilling, and Compacting: 312316.

C. General Piping Requirements: 400500.

D. Flexible Pipe Couplings: 400722.

E. Ductile-Iron Pipe: 402040.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog literature and product data sheets describing the physical, chemical, and electrical properties of the encasement material.

PART 2 - MATERIALS

2.01 POLYETHYLENE WRAP

A. The encasement shall consist of low-density polyethylene wrap of at least 8-mil thickness conforming to AWWA C105.

B. Polyethylene encasement for ductile-iron pipe shall be supplied as a flat tube meeting the dimensions of Table 1 in AWWA C105 and shall be supplied by the ductile-iron pipe manufacturer.

2.02 PLASTIC ADHESIVE TAPE

A. Tape shall consist of polyolefin backing and adhesive which bonds to common pipeline coatings including polyethylene.

B. Minimum Width: 2 inches.

C. Products: Canusa Wrapid Tape; Tapecoat 35; Polyken 934; AA Thread Seal Tape, Inc.; or equal.

PART 3 - EXECUTION

3.01 APPLICATION OF MOLDABLE MASTIC FILLER TO IRREGULAR ADJACENT SURFACES

When the adjacent joints are bell-and-spigot or mechanical joints and any associated welding specifications do not require an external full fillet weld, apply a moldable mastic filler (per Section 400500) at the step-down area prior to the application of the sheet encasement and tape.

3.02 APPLYING SHEET COATING TO BURIED PIPING AND FITTINGS

A. Apply wrapping per AWWA C105 as modified herein.

B. Apply a double wrapping.

C. Install the polyethylene to completely encase the pipe and fittings to provide a watertight corrosion barrier. Continuously secure overlaps and ends of sheet and tube with polyethylene tape. Make circumferential seams with two complete wraps, with no exposed edges. Tape longitudinal seams and longitudinal overlaps, extending tape beyond and beneath circumferential seams.

D. Wrap bell-spigot interfaces, restrained joint components, and other irregular surfaces with wax tape or moldable sealant prior to placing polyethylene encasement.

E. Minimize voids beneath polyethylene. Place circumferential or spiral wraps of polyethylene tape at 2-foot intervals along the barrel of the pipe to minimize the space between the pipe and the polyethylene.

F. Overlap adjoining polyethylene tube coatings a minimum of 1 foot and wrap prior to placing concrete anchors, collars, supports, or thrust blocks. Hand wrap the polyethylene sheet, apply two complete wraps with no exposed edges to provide a watertight corrosion barrier, and secure in place with 2-inch-wide plastic adhesive tape.

3.03 APPLYING SHEET COATING TO BURIED VALVES

A. Wrap flanges and other irregular surfaces with wax tape or moldable sealant. Press tightly into place leaving no voids underneath and a smooth surface under coating for polyethylene sheet.

B. Wrap with a flat sheet of polyethylene. Place the sheet under the valve and the flanges or joints with the connecting pipe and fold in half. Extend the sheet to the valve stem and secure the sheet in place with 2-inch-wide plastic adhesive tape. Apply a second layer and secure with tape. Make two complete wraps, with no exposed edges, to provide a

watertight corrosion barrier. Secure the sheets with tape around the valve stem below the operating nut and around the barrel of the connecting pipe to prevent the entrance of water and soil. Place concrete anchor and support blocks after the wrap has been installed.

3.04 APPLYING SHEET COATING TO BURIED FLEXIBLE PIPE COUPLINGS

A. Wrap irregular surfaces with wax tape or moldable sealant. Press tightly into place leaving no voids underneath and a smooth surface under coating for polyethylene sheet.

B. Apply two layers or wraps around the coupling. Overlap the adjoining pipe or fitting a minimum of 1 foot and secure in place with tape. Provide sufficient slack in polyethylene to allow backfill to be placed around fitting without tearing polyethylene. Apply tape around the entire circumference of the overlapped section on the adjoining pipe or fitting in two complete wraps, with no exposed edges, to provide a watertight corrosion barrier.

3.05 REPAIR OF POLYETHYLENE MATERIAL

Repair polyethylene material that is damaged during installation. Use polyethylene sheet, place over damaged or torn area, and secure in place with 2-inch-wide plastic adhesive tape.

3.06 APPLYING SHEET COATING TO EXISTING BURIED PIPING

When connecting polyethylene-encased pipe or fittings to existing pipe, expose existing pipe, thoroughly clean the surface, and securely tape the end of the polyethylene to the existing as specified above. When the existing pipe is polyethylene encased, wrap new polyethylene encasement over the existing, with overlap of at least 2 feet. Tape securely as specified above.

3.07 BACKFILL FOR POLYETHYLENE-WRAPPED PIPE, VALVES, AND FITTINGS

Place sand backfill within 1 foot of the pipe, valves, and fittings wrapped with polyethylene encasement per Section 312316.

3.08 INSTALLATION AND REPAIR OF POLYETHYLENE AT SERVICE TAPS

A. Wrap two or three layers of polyethylene adhesive tape completely around the pipe to cover the area where the tapping machine and chain will be mounted.

B. Mount the tapping machine on the pipe area covered by the polyethylene tape. Then make the tap and install the corporation stop directly through the tape and polyethylene.

C. After making the direct service connection, inspect the entire circumferential area for damage and make repairs.

D. To minimize the possibility of dissimilar metal corrosion at service connections, wrap the corporation stop a minimum clear distance of 3 feet of copper service pipes with polyethylene or dielectric tape.

END OF SECTION

SECTION 099761 FUSION-BONDED EPOXY LININGS AND COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, application, and testing of one-part, fusion-bonded, heat-cured, thermosetting, 100% solids epoxy linings and coatings on cast-iron and ductile-iron equipment, such as valves, flexible pipe couplings, and pipe.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. Flexible Pipe Couplings: 400722.

C. Ductile Iron Pipe: 402040.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog literature and product data sheets, describing the physical and chemical properties of the epoxy coating. Describe application and curing procedure.

C. Submit coating application test records for measuring coating thickness and holiday detection for each item or pipe section and fitting. Describe repair procedures used.

PART 2 - MATERIALS

2.01 PIPING AND EQUIPMENT SURFACES

A. The Contractor shall require the equipment suppliers to provide equipment that is free of salts, oil, and grease to the coating applicator.

B. The Contractor shall require pipe suppliers to provide bare pipe that is free of salts, oil, and grease to the coating applicator.

2.02 SHOP-APPLIED EPOXY LINING AND COATING

Lining and coating shall be a 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin: Scotchkote 134 or 206N, or equal. Epoxy lining and coating shall meet or exceed the following requirements:

Hardness (minimum)	Barcol 17 (ASTM D2583) Rockwell 50 ("M" scale)
Abrasion resistance (maximum value)	1,000 cycles: 0.05 gram removed
	5,000 cycles: 0.115 gram removed
	ASTM D1044, Tabor CS 17 wheel, 1,000-gram weight
Adhesion (minimum)	3,000 psi (Elcometer)
Tensile strength	7,300 psi (ASTM D2370)
Penetration	0 mil (ASTM G17)
Adhesion overlap shear, 1/8-inch steel panel, 0.010 glue line	4,300 psi, ASTM D1002
Impact (minimum value)	100 inch-pounds (Gardner 5/8-inch diameter tup)

2.03 FIELD-APPLIED EPOXY COATING FOR PATCHING

Use a minimum 80% solids liquid epoxy resin, such as Scotchkote 306 or 323.

2.04 PAINTING AND COATING OF GROOVED-END AND FLEXIBLE PIPE COUPLINGS

Line and coat couplings the same as the pipe. Color shall match the color of the pipe fusion epoxy coating.

PART 3 - EXECUTION

3.01 SHOP APPLICATION OF FUSION-BONDED EPOXY LINING AND COATING--GENERAL

A. Grind surface irregularities, welds, and weld spatter smooth before applying the epoxy. The allowable grind area shall not exceed 0.25 square foot per location, and the maximum total grind area shall not exceed 1 square foot per item or piece of equipment. Do not use any item, pipe, or piece of equipment in which these requirements cannot be met.

B. Remove surface imperfections, such as slivers, scales, burrs, weld spatter, and gouges. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.

C. Uniformly preheat the pipe, item, or piece of equipment prior to blast cleaning to remove moisture from the surface. The preheat shall be sufficient to ensure that the surface temperature is at least 5°F above the dew point temperature during blast cleaning and inspection.

D. Sandblast surfaces per SSPC SP-5. Protect beveled pipe ends from the abrasive blast cleaning.

E. Apply lining and coating by the electrostatic spray or fluidized bed process. Minimum thickness of lining or coating shall be 15 mils. Heat and cure per the epoxy manufacturer's recommendations. The heat source shall not leave a residue or contaminant on the metal surface. Do not allow oxidation of surfaces to occur prior to coating. Do not permit surfaces to flash rust before coating.

3.02 SHOP APPLICATION OF FUSION-BONDED EPOXY LINING AND COATING TO PIPE--ADDITIONAL REQUIREMENTS

A. Apply lining and coating per AWWA C213 except as modified herein.

B. Grind 0.020 inch (minimum) off the weld caps on the pipe weld seams before beginning the surface preparation and heating of the pipe.

3.03 SHOP APPLICATION OF FUSION-BONDED EPOXY LINING AND COATING TO JOINT AREAS OF DUCTILE-IRON AND CAST-IRON FITTINGS--ADDITIONAL REQUIREMENTS

Limit the protective coating thickness in the joints of ductile-iron and cast-iron fittings to maintain a leak-proof joint. However, the coating thickness in the joint area shall not be less than 4 mils.

3.04 QUALITY OF LINING AND COATING APPLICATIONS

The cured lining or coating shall be smooth and glossy, with no graininess or roughness. The lining or coating shall have no blisters, cracks, bubbles, underfilm voids, mechanical damage, discontinuities, or holidays.

3.05 FACTORY TESTING OF COATING--GENERAL

A. Test linings and coatings with a low-voltage wet sponge holiday detector. Test pipe linings and coatings per AWWA C213, Section 5.3.3. If the number of holidays or pinholes is fewer than one per 20 square feet of coating surface, repair the holidays and pinholes by applying the coating manufacturer's recommended patching compound to each holiday or pinhole and retest. If the number of pinholes and holidays exceeds one per 20 square feet of coating surface, remove the entire lining or coating and recoat the item or pipe.

B. Measure the coating thickness at three locations on each item or piece of equipment or pipe section using a coating thickness gauge calibrated at least once per eight-hour shift. Record each measured thickness value. Where individual measured thickness values are less than the specified minimum thickness, measure the coating thickness at three additional points around the defective area. The average of these measurements shall exceed the specified minimum thickness value, and no individual thickness value shall be more than 2 mils below or 3 mils above the specified minimum value. If a section of

the pipe, item, or piece of equipment does not meet these criteria, remove the entire lining or coating and recoat the entire item or piece of equipment.

3.06 FACTORY INSPECTION OF LINING AND COATING OF PIPE--ADDITIONAL REQUIREMENTS

Check for coating defects on the weld seam centerlines. There shall be no porous blisters, craters, or pimples lying along the peak of the weld crown.

3.07 SHIPPING, STORAGE, AND HANDLING

A. When loading piping, fittings, couplings, or other coated items for shipment to the project site, use spacers and other protective devices to separate pipes or other coated items to prevent damaging the coated surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the coated surfaces after separation. Use padded chains or ribbon binders to secure the loaded pipe or other coated items and minimize damage.

B. Do not load or unload pipe, fittings, couplings, or other coated items by inserting forklift tines or lifting chains inside the pipe or item. Use nonmetallic slings, padded chains, or padded forklift tines to lift pipe or other coated items.

C. Cover piping or other coated items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Provide stulls, braces, and supports for piping during shipping and storage such that out-of-roundness or deflection does not exceed 0.5% of the pipe diameter.

E. Handle piping and other coated items with care during the unloading, installation, and erection operations to minimize damage. Do not place or store pipe or other coated items on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place pipe or other coated items above the ground upon platforms, skids, or other supports.

F. Store piping or other coated items at the site on pallets to prevent direct contact with ground or floor. Cover pipe or coated items during storage with protective coverings or tarpaulins to prevent deposition of rainwater, salt air, dirt, dust, and other contaminants.

G. Do not allow piping or other coated items to contact metal, concrete, or other surfaces during storage, handling, or installation and erection at the site that could damage or scratch the coating.

3.08 FIELD REPAIRS

Patch scratches and damaged areas incurred while installing fusion-bonded epoxy coated items with a two-component, 80% solids (minimum), liquid epoxy resin. Wire brush or sandblast the damaged areas per SSPC SP-10. Lightly abrade or sandblast the coating or lining on the sides of the damaged area before applying the liquid epoxy coating. Apply

an epoxy coating to defective linings and coatings to areas smaller than 20 square inches. Patched areas shall overlap the parent or base coating a minimum of 0.5 inch. If a defective area exceeds 20 square inches, remove the entire lining and coating and recoat the entire item or piece of equipment. Apply the liquid epoxy coating to a minimum dry-film thickness of 15 mils.

END OF SECTION

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ASECTION 260500 GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of the electrical system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. One-Year Guarantee: General Provisions.

B. Permits and Licenses: General Provisions.

C. Submittals: 013300.

D. Construction Facilities and Temporary Controls: 015100.

E. Operation and Maintenance Manuals: 019310.

F. Short Circuit and Arc Flash Study 260573.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions. Submittal in electronic PDF format will be accepted provided text is searchable.

B. In submitted catalog cuts, cross out items shown that are not pertinent to this project. Where catalog cuts list manufacturer's standard options, cross out those options not intended to be provided and clearly highlight those options that are to be provided.

C. Submit electrical service changes work procedure.

1.04 REGULATORY AGENCIES AND STANDARDS

A. See General Provisions.

B. Electrical work shall comply with the NEC as amended by the CEC and local city code where applicable.

1.05 QUALITY CONTROL

Materials, appliances, equipment, and devices shall conform to the applicable UL standards. The label of, or listing by, UL is required for all electrical equipment.

1.06 UTILITY COMPANY REQUIREMENTS AND FEES

A. The Owner will make application for electric service. The Owner will pay utility company fees, cable charges, and added facilities charges.

B. The Contractor shall make any service and installation agreements that the utility companies may require.

C. Install electric service entrance equipment in accordance with the serving utility's requirements. Coordinate with the serving utility to ensure timely connection by the utility. Obtain utility company approval of service entrance and metering equipment shop drawings prior to starting fabrication.

1.07 ELECTRICAL SERVICE CHANGES

A. These specifications and drawings delineate the remodeling of an existing structure and/or the addition to an existing structure. While the existing structure is occupied, keep the present services intact until the new construction, facilities, or equipment is installed.

B. Prior to making revisions to the existing service, make certain that every item is thoroughly prepared. Do the actual work at an off-peak time, or overtime, as arranged with the Owner or as hereinafter specified. Once the work is started, vigorously prosecute it to completion to keep downtime to a minimum. Be prepared to temporarily serve the existing service or discontinue the necessary revisions in the event of an emergency or other condition which makes it impossible to finish the scheduled work on time.

C. Prepare a work procedure for work-interrupting service to the Owner's equipment. Include a step-by-step procedure that will be followed in the performance of this work and the time involved in each step. Submit this procedure to the Owner's Representative for review two weeks in advance of the performance of the work.

1.08 POWER FOR CONSTRUCTION

Provide for or purchase power for construction in accordance with Section 015100.

1.09 OPERATION AND MAINTENANCE MANUALS

Submit operation and maintenance manuals in accordance with Section 019310.

1.10 LOCATIONS

1. Wet Locations: Locations exposed to the weather, whether under a roof or not, unless otherwise designated in the drawings.

2. Hazardous and Corrosive Locations: Wet well and vaults.

PART 2 - MATERIALS

2.01 GENERAL

A. Similar materials and equipment shall be the product of a single manufacturer.

B. Provide only products which are new, undamaged, and in the original cartons or containers.

C. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current design.

D. Materials and equipment shall be suitable for storage, installation, and operation at an ambient temperature of 0°C to 40°C except where more stringent conditions are stated in individual equipment specifications.

E. Electrical equipment and panels shall be factory finished with manufacturer's standard primer and enamel topcoats, unless stated otherwise in the individual equipment specifications. Provide 1 pint of the equipment manufacturer's touchup paint per 500 square feet of painted surface for repair of damaged enamel topcoats.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The drawings indicate connections for typical equipment only. If the equipment furnished is different from what is shown, provide the modifications necessary for a safe and properly operating installation in accordance with the equipment manufacturer's recommendations.

B. The drawings diagrammatically indicate the desired location and arrangement of outlets, conduit runs, equipment, and other items. Field determine exact location based on physical size and arrangement of equipment, finished elevations, and obstructions.

C. Work or equipment not indicated or specified which is necessary for the complete and proper operation of the electrical systems shall be accomplished without additional cost to the Owner.

D. Review demolition methods with Owner's Representative prior to cutting or removing existing architectural and/or structural items or equipment. Repair damage to match existing.

E. Accomplish work required to pierce any waterproofing after the part piercing the waterproofing has been set in place. Seal and make watertight the openings made for this purpose.

F. Seal weathertight equipment or components exposed to the weather.

G. Protect equipment outlets and conduit openings with factory-made plugs or caps whenever work is not in progress at that point.

3.02 REMOVAL OR RELOCATION OF MATERIALS AND EQUIPMENT

A. Unless otherwise noted, remove existing electrical materials and equipment from areas indicated for demolition or where equipment is relocated. Remove materials no longer used, such as studs, straps, and conduits. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface. Remove existing unused wires.

B. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface.

3.03 NAMEPLATES

A. Mark each individual panelboard, motor controller, disconnect switch, timer, relay, and contactor to identify each item with its respective service or function.

B. Provide nameplates with engraved lettering not less than 1/4 inch high. Use black-on-white laminated plastic, attached with rivets or sheet metal screws. Do not use embossed plastic adhesive tape.

3.04 WARNING SIGNS

A. Install markings, identifications, warning, caution, or instruction signs where required by NEC, NFPA 70E, and NFPA 79 paragraph 4.5.1, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect.

B. The design of safety signs and labels shall conform to ANSI Z535.4. Existing and new panelboards, instrument control panels, and motor control center, shall be field marked to warn qualified persons of potential electric arc hazards. The marking shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment, in conformance with NEC Article 110.16.

C. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

END OF SECTION

SECTION 260519 WIRES AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials and installation of wires and cables rated 600 volts and below.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: 260500.

B. Grounding and Bonding: 260526.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit material list for each conductor type. Indicate insulation material, conductor material, voltage rating, manufacturer, and other data pertinent to the specific cable, such as shielding, number of pairs, and applicable standards.

PART 2 - MATERIALS

2.01 LOW-VOLTAGE WIRE

A. Conductor material shall be copper.

B. Low-voltage building wire for use at 600 volts or less shall be 600-volt insulated, Type XHHW or THWN-2, and rated for continuous operation at 75°C.

C. Use No. 12 AWG minimum conductor size for power and lighting circuits.

D. Use No. 14 AWG minimum conductor size for control circuits.

E. Conductors for lighting and receptacle circuits that are No. 10 AWG and smaller shall be solid. All other conductors shall be stranded.

2.02 TWISTED-SHIELDED CABLE

A. Single-pair cables shall be two No. 18 AWG and single triads shall be three No. 18 AWG stranded tinned-copper conductors individually insulated with fully color-coded PVC rated at 600 volts; insulated conductors twisted together and shielded with a spiral-wound metal foil tape overlapped for 100% shielding. Outer jacket shall be PVC.

2.03 GROUNDING CONDUCTORS--BARE COPPER

Refer to Section 260526 for bare copper grounding conductors.

2.04 CONDUCTOR TAGS

Provide self-extinguishing heat-shrink individual or sleeved, nonmetallic, snap-on type. Grafoplast, Phoenix Contact, Thomas & Betts sleeve markers, or equal.

Alternatively, provide adhesive-type markers. Brady, Thomas & Betts, or equal.

2.05 PLASTIC ADHESIVES

Plastic adhesives for color coding shall be 7-mil minimum thick, flame-retardant, weather-resistant tape, resisting abrasion, UL rays, moisture, alkalies, solvents, and acids. Adhesives shall meet the requirements of UL 510 and CSA C22.2.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wiring and cable in conduit and terminate unless otherwise noted.

B. To reduce pulling tension in long runs, coat cables with pulling compound recommended by the cable manufacturer before being pulled into conduits.

C. Remove debris and moisture from the conduits, boxes, and cabinets prior to cable installation.

D. Group conductors No. 1/0 and smaller in cabinets, pull boxes, and motor control centers tie with plastic ties; and fan out to terminals. Lace conductors No. 2/0 and larger with marline.

3.02 IDENTIFICATION

A. Color Coding of Low-Voltage Building Wire: Provide color coding throughout the entire network of feeders and circuits as follows:

Phase	**240/120 Volts**
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green

B. Phase conductors No. 10 AWG and smaller and neutral/ground conductors No. 6 and smaller shall have factory color coding with solid color insulation. Do not use onsite coloring of ends of conductors or apply colored plastic adhesives in lieu of factory color coding. Larger conductors may have onsite application of colored plastic adhesives at ends of conductors and at each splice.

C. Control wires shall have colored insulation. Separate color codes for each wire shall be provided in each conduit that has up to seven wires. Conduits with more than seven wires shall have at least seven types of colored insulation.

D. Tagging of Conductors: Tag control wires and instrument cables in panels, pull boxes, wireways, and at control device. Tag control wires and instrument cables with same wire numbers as on the shop drawing submittals. Tag power wires in pull boxes and wireways where there is more than one circuit. Tag power conductors with motor control center or panelboard number and circuit numbers.

3.03 WIRE SPLICES

A. Solid Conductors: Use 3M "Scotchlok," Ideal "Super Nut," Buchanan B-Cap, or equal. Seal splices in underground handholes and pull boxes and in light poles with individual sealing packs of Scotchcast Brand 400 Resin or equal.

B. Stranded Conductors No. 8 and Larger: Use T & B "Locktite" connectors, Burndy Versitaps and heavy-duty connectors, O.Z. solderless connectors, or equal.

C. Stranded Conductors No. 10 and Smaller: Use crimp connectors with tools by same manufacturer and/or UL listed for connectors of all stranded conductors.

D. Control wires shall be terminated at terminal blocks or devices, without splicing.

E. Retighten bolt-type connectors 24 to 48 hours after initial installation and before taping. Tape connections made with noninsulated-type connectors with rubber-type tape, one and one-half times the thickness of the conductor insulation, then cover with Scotch 33 tape.

3.04 WIRE TERMINATIONS

A. Terminate wires and cables at each end.

B. Provide ring tongue, nylon- or vinyl-insulated copper crimp terminals for termination on screw-type terminals, except for light switches and receptacles. Utilize installation tools recommended by the crimp manufacturer.

C. Terminal lugs shall be electro-tin plated copper compression type or spring compression type with a corrosion protection coating. Provide color-coded system on terminal and die sets to provide the correct number and location of crimps. Permanent die index number shall be embossed on completed crimp for inspection purposes.

D. Tighten screws to the value recommended by the manufacturer.

3.05 FIELD TESTING

A. Perform insulation resistance test on all circuits and feeders with No. 10 size conductors and larger. Utilize a 1,000-volt d-c megohmmeter for 600-volt insulated conductors.

B. Test each complete circuit prior to energizing. Insulation resistance between conductors and between each conductor and ground shall not be less than 25 megohms. Repair or replace wires or cables in circuits that do not pass this test and repeat the test.

C. Evaluate ohmic values by comparison with conductors of same length and type.

D. Inspect shielded cables for proper shield grounding, proper terminations, and proper circuit identifications.

E. Inspect control cables for proper termination and proper circuit identification.

END OF SECTION

SECTION 260526 GROUNDING AND BONDING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of electrical grounding.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: 260500.

B. Wires and Cables Less Than 600 Volts: 260519.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit material list for all grounding materials and equipment. Indicate size, material, and manufacturer.

C. Submit test results. Indicate overall resistance to ground and resistance of each electrode.

1.04 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance:

1. Separately Derived Sources (as defined by NEC 250) Grounding Electrode: 10 ohms.

2. Grounds Not Covered Above: 25 ohms.

PART 2 - MATERIALS

2.01 GROUND RODS

Ground rods shall be copper-clad steel, 3/4 inch in diameter, minimum 10 feet long, with hardened steel points.

2.02 CONNECTIONS

A. Ground Clamps: Clamps for connection of ground wire to ground rod shall be bronze.

B. Exothermic Connections: Provide Cadweld or equal.

2.03 CONDUCTORS

A. Equipment Ground: Conductors shall be low-voltage building-wire type as specified in Section 260519.

B. Bare Copper Conductors: Annealed bare copper, conforming to ASTM B3 and B8.

PART 3 - EXECUTION

3.01 GROUND ELECTRODE

A. Install a bare copper ground loop 3 inches above bottom of concrete footing for new concrete pads as shown in the drawings. Bring the end of the loop to the ground bus within the motor control center. Exothermic weld underground connections.

B. Bond magnetic flow sensor and adjoining pipes per manufacturer's recommended method, based on pipe type and cathodic protection of pipes where applicable.

3.02 EQUIPMENT GROUNDING

A. Connect the ground bus of lighting panel to the ground bus within the motor control center with a grounding conductor.

B. Ground raceways and noncurrent-carrying parts of electrical equipment in accordance with NEC Article 250. Use the metallic conduit system for equipment and enclosure grounding.

C. Additionally, all circuits shall carry one ground conductor for equipment grounding. Ground conductor shall be in excess of grounding through the metallic conduit system.

END OF SECTION

SECTION 260534 CONDUITS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes material, installation, and testing for conduit, boxes, fittings, terminal boxes, and cabinets.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: 260500.

B. Grounding and Bonding: 260526.

C. Trenching, Backfilling, and Compacting: 312316.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit product data for the following:

1. Conduit and fittings for each type specified.

2. Boxes and cabinets.

1.04 QUALITY CONTROL

A. NEMA Compliance: Comply with NEMA standards pertaining to conduits and components.

B. UL Compliance and Labeling: Comply with requirements of UL standards pertaining to electrical conduits and components. Provide conduits and components listed and labeled by UL.

PART 2 - MATERIALS

2.01 RIGID STEEL CONDUIT AND FITTINGS

A. Rigid Steel Conduit and Fittings: Conform to ASME C80.1, NEMA RN2, and UL 6, hot-dipped galvanized after threading. The zinc coating shall be flexible and not crack during bending.

B. Fittings:

1. Locknuts: Steel or malleable iron.

2. Bushings: Threaded type, steel or malleable iron, with 105°C rated plastic insulated throat. Plastic bushings with a temperature rating of 105°C may be used for conduits 1 inch and smaller.

3. Box Connectors for Damp and Wet Locations: Provide a watertight threaded hub on enclosure consisting of sealing fitting with tapered conduit thread, neoprene O-ring, and 105°C rated insulating throat with grounding and bonding lug.

4. Couplings: Threaded, hot-dipped galvanized after fabrication.

C. Long-Radius Elbows (90 Degrees):

Conduit Size (inches)	**Minimum Radius (inches)**
3/4 through 1 1/4	12
2 and 2 1/2	15
3 and 3 1/2	18
4	30

2.02 PVC-COATED RIGID STEEL CONDUIT AND FITTINGS

A. Conduit:

1. All conduits, prior to coating, shall conform to ASME C80.1 and UL 6. Conduits shall be hot-dipped galvanized inside and out with hot galvanized threads.

2. The zinc surface shall be treated prior to coating to enhance the bond between metal and plastic.

3. Both interior and exterior of the conduit shall be coated with an epoxy acrylic primer of approximately 0.5-mil thickness.

4. The exterior coating shall be applied by dipping in liquid plastisol or other equal method that will produce a finished product conforming to NEMA 5-19-1986.

5. The thickness of the PVC coating shall be a minimum of 40 mils the full length of the conduit except the threads.

6. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic.

7. Apply a chemically cured urethane coating of a thickness of 2 mils to the interior of conduit.

8. The conduit shall be bendable without damage to the PVC or urethane coatings.

9. Threads shall have an added protection of a 2-mil clear urethane coating.

B. Fittings:

1. Coat fittings similar to the conduits.

2. Provide a loose coupling with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling, and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 2 inches whichever is smaller. The wall thickness of the sleeve shall be the same as the plastic coating on the pipe.

3. The PVC coating on the coupling shall be ribbed to enhance installation.

4. Hubs shall have PVC sleeves equal to those on the couplings.

5. Screws on Form 8 fittings shall be of stainless steel with encapsulated plastic heads.

6. Size U bolts and RA clamps to fit conduit, and encapsulate the nuts in plastic.

7. Fittings shall otherwise be same as specified for rigid steel.

8. Elbows or bends exceeding 45 degrees shall be PVC coated and shall be of the same dimensions as specified for rigid steel long-radius elbows.

9. Conduit bodies, where applicable, shall be Form 8 with a tongue-in-groove (V-seal) gasket to effectively seal out corrosive elements.

C. Conduits and fittings shall conform to NEMA RN-1 and shall be manufactured by Robroy, Perma-coat, KorKap, or equal.

2.03 RIGID NONMETALLIC CONDUIT (PVC) AND FITTINGS

A. Conduit and Elbows: PVC Schedule 80 conduit.

B. Couplings, Adapters, End Bells, Expansion Couplings, Elbows, and Turns of 30 Degrees: Factory-made in accordance with NEMA TC-2 and TC-3.

C. Joint Cement: As recommended by manufacturer as suitable for the climate, furnished with instructions to achieve watertight joints.

D. Manufacturers: Carlon, Condux, or equal.

2.04 LIQUID-TIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: Steel, UL 360 listed, PVC jacketed.

B. Fittings:

1. Conform to ASME C33.84, UL listed for use with the conduit.

2. In sizes 1 1/4 inches and less, UL listed for grounding.

3. Made of steel or malleable iron, zinc plated, 105°C insulated throat, grounding and bonding lug.

2.05 CONDUIT BODIES

A. Provide types, shapes, and sizes to suit individual applications. Provide matching gasketed covers, secured with at least two captive corrosion-resistant screws.

B. Bodies connecting to rigid conduit shall be of the same material and material coating as the conduit, with metal threaded hubs. Provide with threaded covers or gasketed covers secured with at least two corrosion-resistant captive screws.

C. Bodies connecting to nonmetallic conduit shall be nonmetallic conduit bodies conforming to UL 514B.

2.06 OUTLET BOXES

A. Exposed Boxes:

1. Cast iron or aluminum, with threaded hubs.

2. Conduit bodies may be used instead of boxes except where boxes contain devices.

2.07 JUNCTION AND PULL BOXES

A. Provide factory-made standard sizes, and shop fabricate when nonstandard size boxes are shown or are required. Comply with UL and NEMA standards.

B. NEMA Type 4X: Type 316 stainless steel or fiberglass, with gasketed covers and Type 316 stainless steel bolts or screws.

C. Provide terminal junction boxes with terminal strips or terminal blocks with a separate connection point for each conductor entering or leaving the box. Provide 25% spare terminal points.

D. Junction boxes shall be manufactured by Hoffman, Wiegmann, or equal.

2.08 IN-GRADE PULL BOX

A. Pull Boxes shall be of precast concrete type, closed bottom with sump and hot-dipped galvanized steel traffic-rated covers, designed to AASHTO HS20-44 loading.

B. Cover Holddowns: Stainless steel, penta-head, flush with cover, bolts.

C. Sump: Cast in bottom of pull boxes with cover and discharge pipe.

2.09 HAZARDOUS LOCATIONS

A. Conform to NEC Articles 501 and 502 for areas identified as "Hazardous Areas."

B. Use EYS-type sealing fittings suitable for Class I, Division 1 areas. Use sealing fiber and compound approved for Class I, Division 1 areas.

PART 3 - EXECUTION

3.01 CONDUIT USAGE SCHEDULE

Install the following types of conduits and fittings in locations listed, unless otherwise noted in the drawings. Definitions and requirements of NEC apply unless specifically modified below. Refer to Section 260500 for definitions of locations.

A. Exterior Exposed:

1. Material: PVC-coated rigid steel conduit.

2. Minimum Size: 3/4 inch.

B. Interior, Exposed: PVC-coated rigid steel conduit

1. Material:

2. Minimum Size: 3/4 inch.

C. Embedded in Concrete:

1. Material: PVC-coated rigid steel conduit.

2. Minimum Size: 3/4 inch.

D. In Earth, Below Concrete Slabs or Underground:

1. Material: Rigid nonmetallic conduit (PVC).

2. Minimum Size: 3/4 inch.

3. Conduit Stub-Ups: Provide PVC-coated rigid steel conduit long-radius elbows for stub-ups which connect to underground rigid PVC conduit. Extensions from elbows above grade shall be PVC-coated rigid steel for a minimum of 6 inches above grade. Stub-ups into free-standing electrical gear, such as motor control centers may be Schedule 80 rigid PVC conduit, in which case terminate the conduits with appropriate end bells.

E. Final Connections to Vibrating Equipment, or Instruments:

1. Material: Liquid-tight flexible conduit.

2. Minimum Size: 1/2 inch.

3. Length of liquid-tight flexible conduit shall be 5 feet or less, unless field conditions require longer lengths.

F. Hazardous (NEC-Classified) Locations:

1. Material: PVC-coated rigid steel conduit.

2. Minimum Allowable Size: ¾ inch.

3.02 JUNCTION AND PULL BOXES--USAGE SCHEDULE

Install the following type of boxes in locations listed, unless otherwise noted in the drawings. Refer to Section 260500 for definitions of locations:

A. Exterior: NEMA 4X.

B. Hazardous Area: NEMA 7.

3.03 CONDUIT FILL

For runs that are not sized in drawings, compute the maximum conduit fill using NEC requirements for Type THW conductors (larger if applicable), although the actual wiring may be with types of conductors having smaller cross-sections.

3.04 CONDUIT INSTALLATION, GENERAL

A. Make right-angle bends in conduit runs with long-radius elbows or conduits bent to radii not less than those specified for long-radius elbows.

B. Make bends and offsets so that the inside diameter of conduit is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

C. Cap all conduits immediately after installation to prevent entrance of foreign matter.

D. Do not use diagonal runs except when specifically noted in the drawings.

E. Route exposed conduit to preserve headroom, access space, and work space.

F. Treat threaded joints of rigid steel conduit with T&B "Kopr-Shield" before installing fittings where conduit is in slabs and other damp or corrosive areas.

G. For PVC-coated rigid conduits, use manufacturer's recommended installation tools and recommendations. The manufacturer shall certify the installer before installation can proceed.

H. Conduit Terminations:

1. Terminate conduits with locknuts and bushings except where threaded hubs are specified.

2. Install conduits squarely to the box and provide one locknut outside the box and one locknut and bushing inside the box.

3. Install locknuts with dished side against the box.

4. When terminating in threaded hubs, screw the conduit or fitting tight into the hub so that the end bears against the fire protection shoulder.

5. When chase nipples are used, install conduits and coupling square to the box and tighten the chase nipple leaving no exposed threads.

I. Install exposed, parallel, or banked conduits together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel.

J. Conduit runs are shown schematically. Supports, pull boxes, junction boxes, and other ancillary equipment are not usually shown in drawings. If not shown, provide as required by NEC except that there shall not be more than the equivalent of three quarter bends (270 degrees) total between underground pull points. Provide additional boxes to permit pulling of wires without damage to the conductors or insulation.

K. Locations of conduit stub-ups shown in the drawings are schematic. Coordinate these locations with conduit entries of actual equipment served.

3.05 REQUIREMENTS FOR RIGID NONMETALLIC (PVC) CONDUIT

A. Comply with the installation provisions of NEMA TC-2, except as modified below.

B. Make cuts with a fine tooth handsaw. For sizes 2 inches and larger, use a miter box or similar saw guide to assure a square cut.

C. Use factory-made couplings for joining conduit.

D. Cementing and joining operation shall not exceed 20 seconds. Do not disturb joint for 5 minutes, longer (up to 10 minutes) at lower temperatures. Make joints watertight. Joining procedure shall conform to the procedures of ASTM D2855.

3.06 EYS-TYPE CONDUIT FITTINGS

A. Install EYS-type conduit fittings at every conduit leaving Class I, Div 1 area. Seal with fiber and sealing compound as specified in Part 2 of this Section.

3.07 GROUNDING

A. Provide grounding in accordance with Section 260526.

B. Use grounding bushings for all conduits carrying a grounding conductor.

3.08 CONDUITS EMBEDDED IN CONCRETE AND BELOW SLABS

A. Install conduits and sleeves passing through slabs, walls, columns, or beams so as not to impair the strength of construction. Secure conduit to prevent sagging or shifting during concrete pour.

B. Conduits larger than 1 1/2 inches in diameter may be embedded in structural concrete only after submittal and review of location and reinforcement details.

C. Conduits and sleeves may be installed without specific permission, provided:

1. They are 1 1/2 inches or less in diameter, are spaced not less than three diameters on centers, and conform to paragraph 2 or 3 below.

2. Conduits, including fittings, which are embedded within a column, do not displace more than 4% of the cross-sectional area on which structural strength is calculated.

3. Conduits and sleeves, embedded within a wall, slab, or beam, are not larger in the outside dimension than one-third the overall thickness of wall, slab, or beam in which they are embedded.

4. There is a minimum of 1 1/2 inches between the conduit and reinforcement for slab and wall penetrations.

D. Install conduits in slabs other than slabs-on-grade as close to the middle of the slabs as practical without disturbing the reinforcement. Outside diameter of the conduit shall not exceed one-third times the slab thickness. Do not space parallel runs of conduit closer than three diameters on centers, except at cabinet and outlet box locations.

E. Conduits shown in or under slab-on-grade construction shall be installed below the floor slab and under curing or damp-proofing membranes. An exception may be made for conduit with an outside diameter not larger than 25% of the slab thickness, in which case, standards applying to slabs other than slab-on-grade may be used.

3.09 CONDUITS UNDERGROUND

A. Where conduit is installed underground in locations other than under concrete slab, provide 24-inch minimum cover. Provide 3-inch minimum sand above and below

conduits as specified in Section 312316. Maintain a 12-inch minimum separation between conduit and other systems. Pitch conduit to drain away from buildings.

B. Provide sand-cement slurry extending 3 inches on top and sides of conduits. Slurry shall be as specified in Section 312316 with a red color additive as specified in Section 030500.

C. Provide 6-inch-wide warning tape 12 inches above top of slurry.

3.10 CONDUIT SUPPORTS

A. Support conduit at intervals and at locations as required by the NEC. Do not use perforated strap or plumber's tape for conduit supports.

B. Conduit on Concrete or Masonry: Use one-hole malleable iron clamps with pipe spacers (clamp backs) or preformed galvanized steel channels. Anchor with metallic expansion anchors and screws or from preset inserts. Use preset inserts in prestressed concrete. On plaster or stucco, use one-hole malleable iron straps with toggle bolts.

3.11 CONDUIT PENETRATIONS

A. Unless otherwise indicated, dry-pack around conduits which penetrate concrete walls, floors, or ceilings.

B. Conduits passing vertically through concrete slabs and through structural beams shall be sleeved, except where sealing and expansion/deflection fittings are required. Pack sleeves through floors and fire-rated walls with fire-rated packing. Nonrated penetrations may be packed with nonshrink grout.

C. Where underground conduits penetrate a structure through a concrete roof or a membrane waterproofed wall or floor, provide a malleable iron, watertight, entrance sealing device. When there is no raceway concrete encasement, provide the device with sealing assembly at each end with pressure bushings that may be tightened at any time. For concrete-encased raceway penetrations, provide with pressure bushing on the accessible side.

D. Maintain the integrity of damp-proofing and waterproofing membranes that are penetrated by conduits and boxes.

E. Buried conduit shall penetrate surface at right angle.

3.12 DAMAGED CONDUIT

A. Repair or replace conduit damaged during or after installation.

B. Replace crushed or clogged conduit or any conduit whose inner surface is damaged or not smooth.

C. Repair cuts, nicks, or abrasions in the zinc coating of galvanized conduit with galvanizing repair stick, Enterprise Galvanizing "Galvabra" or equal.

D. Repair cuts, nicks, or abrasions in the PVC coating of PVC-coated conduit with the manufacturer's recommended PVC material and build up surface thickness to match the factory coating thickness and color.

3.13 IN-GRADE PULL BOX

Pull box shall be used to install conduit seals required for transitioning from a Class I, Div 1 location to a non-classified area.

3.14 EMPTY CONDUIT

A. Provide 200-pound strength pull cord in all empty conduits.

B. Provide a waterproof label on each end of the pull cords to indicate the destination of the other end.

3.15 OUTLETS FOR GENERAL WIRING

A. Install outlets and boxes securely and support them substantially.

3.16 HAZARDOUS LOCATIONS

A. Provide a conduit sealing fitting for each conduit leaving the hazardous location in an in grade pullbox as noted in the drawings.

3.17 ADJUSTING AND CLEANING

Upon completion of installation of conduits and boxes, inspect interiors of conduits and boxes; clear blockages; and remove burrs, dirt, and construction debris.

END OF SECTION

SECTION 260548 SEISMIC RESTRAINT FOR ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the requirements for furnishing and installing seismic restraint devices for electrical equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

When it applies, this section is referenced in other sections of the specifications.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit seismic anchoring calculations with equipment submittals. Calculations shall be performed by a licensed civil or structural engineer registered in the state of California.

C. Submit equipment anchoring methods. Include anchoring locations, anchor types, and minimum anchor embedment depths. Anchors shall have ICC-approved anchorage values.

1.04 PROJECT-SPECIFIC CRITERIA

A. Importance Factor, Ip: 1.5.

B. Occupancy Category: III.

C. Seismic Design Category: D.

D. Site Class: E.

E. S_{DS}: 0.90g.

F. S_{D1}: 0.873g.

G. Ap and Rp per ASCE Table 13.6-1.

PART 2 - MATERIALS

2.01 SEISMIC DESIGN OF EQUIPMENT

Equipment fabricated or assembled at manufacturers' premises shall be designed and constructed in such a manner that all portions, elements, subassemblies, and/or parts of

said equipment and the equipment as a whole, including their attachments, shall have the capability of withstanding seismic forces specified under “Seismic Anchoring and Restraints” below.

2.02 SEISMIC ANCHORING AND RESTRAINTS

A. Equipment Anchors: Electrical equipment shall be securely anchored. Anchoring shall have the capability of withstanding seismic forces per Section 16 of the California Building Code (CBC) and ASCE 7-05, Chapter 13.

PART 3 - EXECUTION

3.01 EQUIPMENT

Install equipment anchors in accordance with the final shop drawing and manufacturer's recommendations. Properly torque all bolts to the required values.

END OF SECTION

SECTION 260573 SHORT-CIRCUIT AND ARC-FLASH STUDY

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the requirements for furnishing a short-circuit and arc-flash hazard analysis.

1.02 SUBMITTALS

Submit the study in accordance with Section 260500.

PART 2 - MATERIALS

2.01 ARC FLASH LABEL

A. Arc flash labels shall identify the following as a minimum (distances indicated shall be in inches):

1. Flash Hazard Boundary: Threshold at which burn level exceeds 1.2 cal/cm^2.

2. Calculated incident energy at indicated working distance (18 inches).

3. Hazard risk category and personal protective equipment (PPE) description.

4. Equipment rated voltage.

5. Required electrical glove class.

6. Shock Hazard Boundaries: Limited approach, restricted approach, and prohibited approach (based on equipment rated voltage).

7. Location (name of board).

8. Name of organization that performed the analysis, contact information, and date analysis was performed.

B. Labels shall carry either a “DANGER” or “WARNING” header, depending on whether an accident will or can result in injury or death, as stated in ANSI Z534.4.f. Header shall also include the following: “QUALIFIED WORKERS ONLY – PPE REQUIRED.”

C. Labels shall carry a footer that reads “Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements.”

D. Labels shall be approximately 6 inches long by 4 inches wide, die-cut and shall come on industrial-quality adhesive-backed vinyl.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform study using commercially available computer software, such as Power Tools for Windows by SKM Systems Analysis, Inc.; ETAP by Operation Technology, Inc.; or equal.

B. Perform study under the supervision of and signed by a registered professional electrical engineer.

C. The study shall include scope, results, comments, and suggestions. Evaluation procedures shall follow applicable ANSI, NEMA, IEEE, and UL standards.

D. Obtain referenced or required characteristics and data from pertinent equipment manufacturers and from serving utility company, as applicable. Obtain lengths and sizes of conductors from the drawings. Collect any field data of existing equipment needed for the study.

E. Do not perform study based on assumptions for lack of data.

3.02 SHORT-CIRCUIT STUDY

A. Short-circuit study shall provide calculations for the maximum short-circuit currents produced by balanced 3-phase and unbalanced faults at each bus shown in the single line diagrams. Short-circuit study shall be performed for system connected to utility.

B. Motor contributions to short circuit shall be included.

C. Evaluation shall include status (pass/fail), calculated short circuit current, short circuit rating of device, ratio of calculated short-circuit current to short-circuit rating of device in percent.

3.03 ARC-FLASH HAZARD ANALYSIS AND EQUIPMENT LABELING

A. Perform an arc-flash hazard analysis in compliance with the latest edition of NEC 110.16 and NFPA 70E 110.8(B)(1) for the electrical equipment in accordance with Annex D of NFPA 70E and IEEE 1584 to identify:

B. The arc-flash protection boundaries, defined in Article 130.3(A) as "an approach limit at a distance from exposed live parts within which a person could receive a second-degree burn if an electrical arc flash were to occur."

C. The shock hazard boundaries.

D. The PPE and protective clothing necessary, based on the incident energy present at the working distance for the task to be performed, as described in Article 130.3(B) and Article 130.7.

E. New motor control center shall be provided with electric shock and arc flash labels. Labels shall be provided for each section of motor control center. Arc flash study shall not exclude equipment exempted by NFPA 70(E) and IEEE 1585, which allow exclusion of equipment that operates at 240 volts maximum and is fed from a transformer smaller than 125 kVA.

3.04 REEVALUATION OF ANALYSIS

Owner will have the right to request reevaluation of any part of the coordination and arc flash analysis to improve coordination or to reduce arc flash risk category or to eliminate cable protection inadequacy. Owner reserves the right to contact the individual who performed the study or to witness the actual reevaluation at the premises of the organization performing the study and shall be allowed to make suggestions. All of these services shall be provided at no extra cost.

END OF SECTION

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SECTION 260590 MISCELLANEOUS ELECTRICAL DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of miscellaneous electrical devices and equipment, such as disconnect switches, float switches, and receptacles.

1.02 RELATED WORK SPECIFIED ELSEWHERE

General Electrical Requirements: 260500.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit ratings and characteristics including voltage ratings, continuous current ratings, conduit entry restrictions, and enclosure type and dimensions.

PART 2 - MATERIALS

2.01 FLOAT SWITCHES

A. Each float switch shall contain a single-pole mercury-free switch that shall actuate when the longitudinal axis of the float is horizontal and deactuate when the liquid level falls 1 inch below the actuation elevation. Float construction shall consist of a polypropylene housing with a firmly bonded electrical cable protruding. One end of the cable shall be permanently connected to the enclosed mercury switch, and the entire assembly shall be encapsulated to form a completely watertight and impact-resistant unit.

B. Switch rating shall be 10 amperes at 120 volts, 60 hertz, noninductive. Switch contacts shall be normally open or normally closed as detailed in the schematic drawings. Float cable shall be PVC Type STO, No. 18 conductors (41 strand) rated 600 volts.

C. Floats shall include an internal stabilizing weight so that the float may be suspended from above.

D. Float switches shall be ECO-Float Model GSI by Anchor Scientific or equal.

2.02 RECEPTACLES

General purpose receptacles shall be ground fault interrupter (GFI) type. Receptacles shall be rated 20 amperes and comply with UL 943, Class A. Provide Leviton 6398-HGI, 3M GFI-2701, or equal. Provide individually gasketed weatherproof cover plates. Plates shall be gray polycarbonate lift-cover type.

PART 3 - EXECUTION

3.01 FIELD TESTING

A. Float Switches: Operate float switches three times, minimum, and verify that controls operate per the drawings or other sections of these specifications. Verify float actuates at the required level.

B. General purpose receptacles shall be tested with the circuits energized. Devices shall be tested with a portable GFI receptacle tester capable of circulating 7.5 mA of current, when plugged in, between the "hot" line and "ground" to produce tripping of the receptacle. Resetting and tripping shall be checked at least twice at each GFI receptacle.

END OF SECTION

SECTION 262410 PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, testing, and installation of panelboards.

1.02 RELATED WORK SPECIFIED ELSEWHERE

General Electrical Requirements: 260500.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Show ratings and characteristics including voltage ratings, busing arrangement, continuous current ratings, fault current withstand ratings, neutral bus rating, enclosure type, ratings and arrangement of overcurrent protective devices, and mounting provisions.

C. Submit outline and dimensional drawings and conduit entry restrictions.

PART 2 - MATERIALS

2.01 GENERAL

A. Panelboards shall comply with NEMA PB 1 (panelboards) and UL 67 (electric panelboards) requirements.

B. Provide dead-front, safety-type panelboards with ratings as scheduled. Panelboards shall be circuit-breaker type and shall be fully rated for short-circuit capacity indicated in the drawings. Panelboards shall be UL listed and labeled and manufactured by Tesco, General Electric, Cutler-Hammer, Square D, Siemens, or equal.

2.02 PANELBOARD ENCLOSURES

NEMA 1 enclosures shall be fabricated from galvanized sheet steel cabinet-type enclosures, code-gauge, minimum 16-gauge thickness. Stainless steel enclosures shall be fabricated from 316 stainless steel. Provide enclosure with multiple knockouts and wiring gutters. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys. All panelboard enclosures shall be keyed alike. Panelboards shall have concealed door hinges. Provide baked gray enamel finish over a rust inhibitor. Design enclosure for recessed or surface mounting as indicated. Provide enclosures fabricated by same manufacturer as panelboards and which mate properly with panelboards to be enclosed.

2.03 BREAKERS

A. Breakers shall be molded-case type and shall comply with NEMA AB3 requirements. Provide quick-make and quick-break toggle mechanism, inverse-time trip characteristics, and trip-free operation on overload or short circuit. Automatic tripping shall be indicated by a handle position between the manual OFF and ON position. Provide trip ratings as indicated in the panelboard schedules.

B. Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multiple circuit breakers shall be of the common-trip type having a single operating handle.

2.04 BREAKER CONNECTIONS

Circuit breaker current-carrying connections to the bus shall be bolted type.

2.05 BUS BARS

Bus bars shall be copper. Provide a copper ground bus bar installed on the panelboard frame, bonded to the box, and containing a number of terminal screws equal to or greater than the maximum number of branch circuits. For panelboards with neutrals, provide full-size neutral bus bar, unless otherwise noted in the drawings, and suitable lugs to support maximum number of circuits.

2.06 SPACE

Where "space" is noted in the panelboard schedules in the drawings, provide connectors and mounting brackets for the future insertion of a 20-ampere, single-pole overcurrent device.

2.07 DIRECTORIES

Equip with interior circuit-directory frame and card with clear plastic covering. Provide typed circuit directories. Do not provide handwritten directories.

2.08 NAMEPLATES

Provide nameplates as specified in Section 260500. Designate the identifying nomenclature, voltage, and phase of the panel as shown in the drawings.

PART 3 - EXECUTION

3.01 ACCESSIBILITY

Install panelboards so that the top of the highest circuit breaker is not more than 6 feet 6 inches above the floor or working platform.

3.02 TESTS

Operate each circuit breaker and verify that all phases of each load are disconnected.

END OF SECTION

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SECTION 262419 MOTOR CONTROL CENTER

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, testing, and installation of a low-voltage motor control center.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: 260500.

B. Seismic Restraint for Electrical Equipment: 260548.

C. Protective Device Coordination Study and Arc-Flash Study: 260573.

D. Panelboards: 262410.

E. Automatic Transfer Switch: 263623.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit manufacturer's descriptive and technical literature.

C. Submit manufacturer's descriptive data including ratings, single-line diagrams, three-line diagrams, control schematic wiring diagrams, dimensional data, weights, conduit entry restrictions, and overload relay ratings.

D. Submit control schematic diagrams in a “ladder diagram” format that satisfy the following minimum requirements:

1. Show unique rung numbers on left side of each rung. Provide unique wire numbers for all wires between terminals.

2. Show terminal numbers for all devices, relays, timers, contacts, etc.

3. Where the internal wiring diagrams of subassemblies are furnished on separate sheets, show as a rectangle in the schematic diagram with external points identified and cross-referenced to the separate sheets of the control circuit. Show coils and contacts internal to the subassemblies in the rectangle connected to their terminal points.

4. Use a cross-referencing system in conjunction with each relay coil so that associated contacts may be readily located on the diagram. Where a relay contact

appears on a sheet separate from the one on which the coil is shown, describe the purpose of the contact on the same sheet. Show spare contacts.

5. Show symbols of external field devices on the schematic (ladder) diagram with utilities turned off (electric power, air, gas, oil, water, lubrication, etc.) and with the equipment at its normal starting position. If the equipment is shown in a specific position, identify the position.

6. Show contacts of multiple contact devices, e.g., selector switches, on the line of the schematic diagram where they are connected in a circuit. Indicate a mechanical connection between the multiple contacts by a dotted line or arrow. This does not apply to control relays, starters, or contactors. Use additional charts or diagrams to indicate the position of multiple contact devices.

7. Show the purpose or function of switches adjacent to the symbols. Show the purpose or function of controls such as relays, starters, contactors, solenoids, subassemblies, and timers on the diagram on the right side of the respective rung.

8. The motor control center (MCC) manufacturer shall review the control schematic diagrams provided in the drawings, shall identify any adjustments that might be required to achieve the intended control features, and shall suggest such changes for Owner's Representative's review. If further adjustments are required, make such adjustments in the field, with the consent of the Owner's Representative.

E. Submit manufacturer's test report of the factory tests. Describe each circuit, logic function, device, or item tested. Describe results of tests and retests. Describe corrective action taken on defective circuits, logic functions, and devices.

1.04 OPERATION AND MAINTENANCE MANUALS

Submit operation and maintenance manuals in accordance with Section 260500.

1.05 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

A. One labor day for the MCC to check the installation and advise during start-up, testing, and adjustment.

B. One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

1.06 RATINGS

Motor horsepower ratings and enclosures shown are minimum expected. This does not limit the equipment size. When motors furnished differ from the minimum ratings indicated, make the necessary adjustments to wiring, conduit, disconnect devices, motor

starters, branch circuit protection, and other affected material or equipment to accommodate the motors actually installed, at no additional cost to the Owner.

PART 2 - MATERIALS

2.01 GENERAL

A. MCCs shall be dead front, dead rear, floor standing, 72” high and front accessible NEMA 1 gasketed construction in a NEMA 3R nonwalk-in enclosure with locking provisions. Provide 10-inch minimum front access space between the exterior door and the front of the MCC. The NEMA 3R enclosure shall be provided with a duplex convenience outlet, LED lighting operated from a lighting switch and thermostatically controlled space heaters and ventilation fans. The voltage and ampere rating and physical dimensions shall be as indicated in the drawings. Wiring shall be NEMA Class II, Type B (with wiring schematics showing field devices and connections). Tag control wiring within 2 inches of termination at each device and terminal board. Schematics shall also show terminal numbers and interior and field wire numbers. Obtain instrument wire numbers from instrument system supplier.

B. Provide channel iron sills and removable lifting angles.

C. Provide a separate vertical wiring compartment for each MCC section. Provide cable supports and a hinged door separate from the unit starters.

D. Provide vertical bus insulated barriers.

E. Connect field control wires via terminal blocks. Provide hinged pull-apart terminal blocks for control wiring where foreign voltage may be present, in compliance with NEC 430.74.

F. Provide individual compartments separated by steel barriers and with separate hinged doors for each starter, circuit breaker, or other unit. Locate equipment to enable termination of field wiring from front without equipment removal.

G. Mechanically interlock starter and circuit breaker doors so doors cannot be opened with unit energized. Provide defeater mechanism to allow intentional access while starter or circuit breaker is energized. Make provisions for padlocking external disconnect handles in the off position.

H. MCC shall have short-circuit current rating equal to or greater than kAIC rating shown in the drawings.

I. Bus bars shall be copper or tin-plated copper. Provide full horizontal bus rating for entire length of the MCC. Do not taper the bus.

J. Provide a continuous, front accessible 200-ampere-minimum ground bus extended the full length of the MCC.

K. Do not mount components or terminals on the sides of cubicles. Only mounting on back panels or front panels is acceptable.

L. Compartments allocated for controllers and other devices and number of sections shall not be less than those shown in the drawings. If sizes are required to be larger and/or number of sections is required to be more, they shall be provided at no extra cost to the Owner.

M. Provide rodent barriers at all sections.

N. Mount devices without obstruction, to be readily accessible.

O. Feeder circuit breakers shall be molded-case thermal-magnetic or electronic type. Provide quick-make and quick-break toggle mechanism, inverse-time trip characteristics, and trip-free operation on overload or short circuit. Automatic tripping shall be indicated by a handle position between the manual off and on positions. Provide trip ratings and number of poles as indicated in the drawings.

P. Combination starters shall be as described in "Combination Magnetic Motor Starters" in this section.

Q. Each compartment shall have nameplates as specified in Section 260500.

R. MCCs shall comply with applicable NEMA, UL, and ANSI standards for industrial control. Provide UL label on each MCC section.

S. Exterior finish shall be ANSI 49 gray.

T. Compartment covers shall be bonded to the frame of the MCC.

U. No instruments or meters operating at voltages higher than 120VAC shall be mounted on compartment covers. Instruments that operate at voltages higher than 120VAC shall have only their monitors operating at 120VAC or less mounted on covers.

V. The complete assembly, including anchors, shall be capable of withstanding seismic forces per Section 260548.

W. MCCs shall be General Electric 8000 line, Cutler-Hammer Freedom or Advantage 2100, Allen-Bradley Centerline, Siemens Tiastar, or equal.

2.02 COMBINATION MAGNETIC MOTOR STARTERS

A. Comply with NEMA ICS, Class A, and with NEC Article 430.

B. Combination motor starters shall be circuit-breaker type equipped with adjustable magnetic-trip circuit breakers (motor circuit protectors) as noted in the drawings. The short-circuit rating shall be at least 65,000 amperes symmetrical at 240 volts.

C. Full-voltage controllers shall be NEMA rated. IEC only rated starters shall not be used.

D. The manufacturer shall verify the motor ratings and coordinate the starter overloads with the actual horsepower ratings of the motors installed.

E. Provide indicating lights, control switches, elapsed time meters, ammeter, etc., as shown in the schematic wiring diagrams and single-line diagrams. Mount on the front panel of the starter.

F. Provide solid-state overload relays for protection of the motors. The relay shall be listed under UL 508. The relay shall be ambient compensated and shall have the following features:

1. Self-powered.

2. Class 10, 15, or 20 selectable tripping characteristics.

3. Manual or automatic reset.

4. Phase loss protection. The relay shall trip in two seconds or less under phase loss condition when applied to a fully loaded motor.

5. Visible trip indication.

6. Ground-fault protection.

7. One normally open and one normally closed isolated auxiliary contact.

8. Test button that operates the normally closed contact.

9. Test trip function that trips both the normally open and normally closed contacts.

G. Provide externally operable overload relay reset buttons and disconnect operators.

H. Provide relays, etc., within the starter enclosure as shown in the schematic wiring diagrams.

I. Starters shall have nameplates as specified in Section 260500.

2.03 RELAYS

A. Provide relays with the number of contacts shown on the schematic diagrams. Utilize additional contact blocks or relays to satisfy the required number of contacts shown at no additional cost to the Owner.

B. Control relays shall be magnetically held. Control relays shall be UL listed with NEMA A300 rated contacts and coil voltage, number of poles, and pole arrangement as indicated in the drawings. Relays may be plug-in type in which case they shall have retaining clips, check button for test operation, and indicating light for coil power indication. Relays shall be Allen-Bradley Bulletin 700, Cutler-Hammer Type Westinghouse Type AR, Idec RR Series, or equal.

C. Time-delay relays shall be UL listed with contacts rated 10-ampere noninductive load, 120 volts, with coil voltage, number of poles, pole arrangement, and maximum timing adjustment as indicated in the drawings. Relays may be plug-in, solid-state type with timing knob adjustment and retaining clip. Provide Potter Brumfield, Syracuse Electronics, ISSC, or equal.

D. Intrinsically safe relays shall be solid-state electronic type equipped with a variable resistance potentiometer that permits field adjustment of sensitivity. The relays shall have contacts rated at 20 amperes minimum at 120-volt ac or 24-volt dc. The contacts shall be double pole, double throw.

E. Time-delay relays with contacts indicated as instantaneous close time open (ICTO) or instantaneous open time close (IOTC) shall be solid-state digital timer with a self-contained adjustment potentiometer. Output contact shall be 5 amperes minimum. Relay shall be Allen-Bradley Bulletin 852S or equal.

F. Moisture detection control unit shall detect an influx of moisture within the motor. Provide the unit with a test push button and pilot light to check the moisture sensing components without simulating a leak. Coordinate type of relay or relays with type of sensors used with the motors. Relay shall have separate dry contacts for alarm and shutdown.

2.04 MISCELLANEOUS DEVICES

A. Control switches shall be round, oiltight type, complete with legend plates and quantity of contact blocks required for the control function.

B. Indicating lights shall be oiltight type, complete with color of lens indicated in drawings and legend plate. Provide superbright LED lamps. Indicating lights shall be push-to-test type.

C. Elapsed time meters shall be synchronous motor driven, 0- to 99,999.9-hour range, nonreset type, suitable for semiflush, panel mounting.

D. Install and connect owner-furnished temperature sensor relay. Adapt control wiring to accommodate this relay.

2.05 BACKUP CONTROLS DESCRIPTION

A. Refer to Dwg. E-106, Detail 2 Common Controls.

B. When a high-high level switch LSHH-011 is activated, it will initialize the backup system. The level switch will energize a timer TD10 (0-30 minutes field adjustable), which will call pump LP-01 to start after a time delay (TD11, 0-30 seconds, field adjustable). When LP-01 starts, it will initialize another time delay (TD12, 0-30 minutes, field adjustable), which controls pump LP-02. When timer TD10 expires and level has subsided, LP-01 will shut down, and the system will reset. When timer TD10 expires, but level is still above high-high, pump LP-01 will continue to run, and will be

augmented by LP-02 when TD12 expires. In order for this scheme to work, TD12 should be set at a longer timing out setting than TD10.

C. When LP-01 is called and it does not start, the time delay TD12 will be bypassed and LP-02 will be called to start.

2.06 FACTORY TESTS

A. Subject the MCCs to a complete functionality test. Simulate remote inputs and outputs and verify correct operation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Secure MCC rigidly to mounting pad with anchor bolts or Phillips Drill Company concrete anchors. Anchor bolts or concrete anchors shall be carbon steel per ASTM A307, Grade B Type 304 stainless steel. Installation shall be in accordance with manufacturer's installation instructions and Section 260548.

B. Provide the services of a qualified factory-trained manufacturer's representative to assist in installation of the equipment specified under this section. The manufacturer's representative shall provide technical direction and assistance in general assembly of the equipment, connections, and adjustments.

C. Perform the following minimum work under the technical direction of the manufacturer's service representative:

1. Rig the MCC assembly into final location and install on level surface.

2. Check removal cells and starter units for easy removal and insertion.

3.02 FIELD TESTS

A. Provide the services of a qualified factory-trained manufacturer's representative to assist in testing and start-up of the equipment specified under this section, in accordance with manufacturer's published start-up services. Additionally, perform the following minimum work under the technical direction of the manufacturer's service representative, if not included in their published start-up services:

1. Perform insulation tests on each phase and verify low-resistance ground connection on ground bus. Exclude such tests harmful to electronic components.

2. Torque bolted connections made in the field and verify factory-bolted connections.

3. Verify that factory-set adjustable set points of solid-state starter are in accordance with the motor manufacturer's recommendations.

4. A qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. Controller and motor nameplate information, settings, and operating parameters shall be documented. Equipment shall be inspected prior to the generation of any reports.

B. Test the operation of each interlock to verify that the interlock performs its function.

C. Test system for correct execution of control logic. Adjust wiring connections in panel to correct errors.

D. Operate each breaker and verify that all phases of each load are disconnected.

E. Set adjustable trip circuit breakers two settings above the setting that causes the breaker to trip during motor starting. Do not adjust the setting above 1,300% of the motor nameplate current rating.

F. Set protective relaying, main and feeder circuit breaker adjustable set points, and time delays in accordance with the recommended values from the protective device coordination study in Section 260573.

3.03 SPARE FUSES

Provide six spare fuses for fused disconnect switches of each type and ampere rating installed.

END OF SECTION

SECTION 263213 STANDBY ENGINE-GENERATORS (100 KW AND SMALLER)

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, installation, and testing of a natural gas engine-generator set and associated equipment to be used for standby power in the event of a utility power failure. The backup generator shall not be used for construction needs or to temporarily power the new lift station.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. General Electrical Requirements: 260500.

C. Seismic Restraint for Electrical Equipment: 260548.

D. Automatic Transfer Switch: 263623.

1.03 STANDARDS

Construct equipment in accordance with the applicable requirements of the following standards:

A. National Electrical Code (NEC).

B. American National Standards Institute (ANSI).

C. National Electrical Manufacturers Association (NEMA).

D. Institute of Electrical and Electronic Engineers (IEEE).

E. American Society for Testing and Materials (ASTM).

F. Underwriters' Laboratories, Inc. (UL).

1.04 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit shop and installation drawings and catalog data for the following equipment. Show applicable ratings, sizes, materials, manufacturers and part numbers, and overall dimensions and weights.

1. Itemized bill of material.

2. Engine-generator base with anchor bolt sizes and layout. Submit anchor bolt material listing. Submit catalog data for vibration isolators and calculations for size and number of anchor bolts.

3. Engine.

4. Generator.

5. Voltage regulator.

6. Sound attenuation enclosure.

7. Silencer.

8. Control panel, generator mounted

9. Battery charger.

10. batteries

11. Jacket water heater.

C. Submit system schematic diagram showing piping and wiring interconnections with sizes and quantities. Submit ladder-type schematic electrical diagrams with legend identifying devices on diagrams.

D. Submit installation data sheet giving natural gas, lubricating oil, and exhaust and ventilation requirements.

E. Submit a start-up inspection report signed by the engine manufacturer's authorized field service representative.

F. Submit factory test report including sound levels and exhaust emissions.

G. Submit copies of installation and permits obtained from the Air Pollution Control District.

H. Submit three copies of operation and maintenance manuals.

1.05 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

Two labor days to check the installation and advise during start-up, testing, and adjustment of the equipment and to instruct the Owner's personnel in the operation and maintenance of the equipment. Submit operation and maintenance manuals prior to this instruction.

1.06 WARRANTY

Equipment furnished under this section shall be guaranteed against defective parts or workmanship for a period of 24 months from date of acceptance by the Owner.

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. The engine, generator and generator control panel shall be manufactured in the U.S. by manufacturers currently engaged in the production of such equipment. An authorized distributor maintaining a parts depot and 168-hour-per-week service facility shall be located within a 75-mile radius of the jobsite.

B. The engine-generator shall be manufactured by Caterpillar, Inc., Cummins, Inc., Kohlar or equal.

2.02 RATING

The rating of the standby engine-generator shall be as listed below and based on operation of the set when equipped with all operating accessories, such as air cleaners, lubricating oil pump, fuel injection pump, and cooling fan. The specified standby kw shall be for continuous electrical service during interruption of the normal utility source.

A. Standby Rating: 60 kw (minimum).

B. Engine Speed: 1,800 rpm (maximum).

C. Voltage: 240/120 volts, 3 phase, 4 wire.

D. Frequency: 60 hertz.

E. Power Factor: 0.8.

F. Air Temperature: 110°F maximum, 20°F minimum.

G. Instantaneous voltage dip shall not be greater than 30% when full rated load and power factor are applied to generator set in one step.

2.03 ENGINE

A. General: The engine shall be the standard product of the manufacturer, a current production model, and have the following features:

1. Naturally aspirated.

2. Four-stroke cycle.

3. Water-cooled.

4. Capable of the rated output when operating on natural gas.

B. The engine shall meet AQMD requirements for Tier III.

C. Provide the engine with the following accessories:

1. Fuel, lube oil, and intake air filters.

2. Flexible fuel lines.

3. Jacket water heater.

4. Engine-mounted water pump.

5. Coolant shut-off valves for jacket water heater.

6. Lube oil cooler.

7. Combination intake filter/silencer.

D. Starting System:

1. Provide a 12- or 24-volt d-c electric starting system with positive engagement drive.

2. Provide lead-acid storage battery of the heavy-duty diesel-starting type. The battery shall have sufficient capacity to provide for one-and-one-half-minute total cranking time without recharging and shall be 20-hour rated. Provide a unit-mounted corrosion-resistant fiberglass battery box. Provide battery cables and replaceable connectors.

3. Provide a UL-listed, two rate, current-limiting battery charger to automatically recharge batteries. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressors, d-c ammeter, and fused a-c input. A-C input voltage shall be 120 volts. Output shall be no less than 2 amperes. Provide a dry contact for monitoring common fault and alarm.

E. Lubrication System: Fix a pressure-type lubricating system with gear-type oil pump and full flow oil filter to the engine. Filters shall be threaded spin-on type or can type with replaceable filter elements, conveniently located for servicing. Provide filters with a spring-loaded bypass valve to ensure oil circulation if filters are clogged. Provide an oil drain with manual valve.

F. Safety Switches: Provide generator control panel with devices for indication and control of the following conditions at the generator control panel. Provide full NFPA 99 meter and alarm kit including the following.

1. Low oil pressure (shutdown) and lamp (red).

2. Overcrank (shutdown) and lamp (red).

3. High engine temperature (shutdown) and lamp (red).

4. Overspeed (shutdown) and lamp (red).

   Overspeed trip and cranking termination shall be by a dual element electronic-type speed switch that operates on magnetic impulses from the flywheel ring gear or other engine-timed gear. Overspeed trip setting shall be 118% of synchronous speed. The low setting shall be used to automatically ensure continued engine cranking until the engine has reached 600 rpm, even if the oil pressure is up to an acceptable level at a lower speed.

G. Governing System:

1. Provide an adjustable isochronous governor of the electrical-hydraulic or all electric type with electrical speed sensing. Governor shall provide adjustable speed setting from 58- to 62-hertz adjustable speed regulation, adjustable load limit from 100% to 110% of unit rating, and shall also control the engine at recommended idle speed. The governor shall be capable of maintaining the frequency constant within ±0.5% for any constant load from no load to full generator rating. After a sudden load change of 25% of rated load, the governor shall reestablish stable operating conditions in not less than two seconds. Stable operation is defined as operation at a frequency that is constant within ±1% of rated frequency. The maximum change of frequency during the two-second surging period shall not exceed 1.5 hertz.

2. Governor shall be Woodward, Barber Colman, DYNALCO, or equal.

2.04 JACKET WATER HEATER

Jacket water heater shall be factory installed on the engine with thermostat controls. Heater shall be sized by the manufacturer to maintain coolant temperature of 100°F minimum, 120 volts, single phase, 60 hertz.

2.05 GENERATOR

A. General:

1. The generator shall be a 3-phase, 60-hertz, single-bearing, dripproof, rotating field, synchronous type, with 3-phase rotating armature brushless permanent magnet exciter. Provide Class F or H insulation on the stator and rotor. Further protect both with 100% epoxy varnish impregnation and an overcoat of resilient epoxy asphalt insulating material to increase resistance to abrasive dust or sand, high humidity, and light acidic, oil, or salt-laden atmospheres, as well as prevent fungus growth.

2. The wave form deviation factor of the line-to-line voltage at no load and balanced rated load at 0.80 power factor shall not exceed 5%. The rms of all harmonics shall be less than 3% and that of any one harmonic less than 2% at full rated load.

3. Conform to the applicable NEMA standards for motors and generators, MG 1. Base rating of generator on continuous operation at 0.80 power factor.

4. Provide 120/240-volt anticondensation heater.

B. Regulator: The voltage regulator shall be a static type and shall maintain a constant and stable generator output voltage within ±2% of nominal for all steady-state loads from no load to full load. A 5% variation in frequency and the effects of field heating shall not affect the unit's regulation performance. Provide stability and voltage range adjustments.

2.06 STRUCTURAL STEEL BASE

A. Mount the engine-generator on a structural steel base. Provide holes for mounting bolts. Provide the structural steel base with means for lifting the unit for shipment and installation. Clearly identify lift points and total weight and permanently mark on the base.

B. Anchor the steel base to an equipment pad with an anchorage system designed per Section 260548. Submit calculations.

C. Isolate the structural steel base from the equipment pad by fiberglass pad-type isolators with bonded steel load plate and separate snubber washers. Isolators shall be Peabody Noise Control, Inc.; Kinetics brand, Type SN; or equal.

2.07 EXHAUST SYSTEM

A. Exhaust system shall consist of a silencer, flexible exhaust fitting, exhaust piping, insulation, and mounting hardware.

B. Provide a chamber-type critical grade silencer constructed of carbon steel with a baked on silicon-based coating rated for 1100°F minimum. Silencer shall include a condensate drain tapping. Exhaust noise shall not exceed 65 dBA at 25 feet. Provide brackets, companion flanges, gaskets, and fasteners for mounting on roof or from ceiling of enclosure. Silencer shall be as manufactured by Universal, GT Exhaust Systems, Riley-Beaird, or equal.

C. Silencer and exhaust pipe size shall be sufficient to ensure that measured exhaust backpressure does not exceed the maximum limitations specified by the generator set manufacturer.

D. Exhaust piping shall be carbon steel pipe conforming to ASTM A53, Type E or S, or ASTM A135. Provide standard weight per ASME B36.10. Provide flanged or welded type fittings. Provide sufficient flanged fittings to permit the system to be entirely dismantled in sections. Elbows shall be smooth long-radius type.

E. Mount the exhaust system in a manner to allow for thermal expansion and contraction over a temperature range of -20°F to 1200°F.

2.08 GENERATOR CONTROL PANEL

A. Provide a NEMA 1, vibration isolated, dead front, 16-gauge steel electronic modular control panel with lockable, hinged cover. Mount and wire the control panel to the engine-generator set. The panel shall include the following equipment:

1. Oil pressure gauge.

2. Water temperature gauge.

3. Automatic/manual start/stop engine control with programmable safety indicators for low oil pressure, high coolant temperature, overspeed, over-crank, and emergency stop.

4. Cycle Cranking: Adjustable crank/rest periods.

5. Energized to run or shut down fuel control systems.

6. Indicators for engine oil pressure, coolant temperature, engine rpm, system d-c volts, engine running hours, eight-system diagnostic codes, generator a-c amperes, and generator frequency.

7. Control system diagnostic codes for troubleshooting and system protection.

8. Engine control switch.

9. Ammeter-voltmeter indicators.

10. Emergency stop push button.

11. Indicator/display test switch.

12. Voltage adjust potentiometer.

B. Meters, circuit breakers, control switches, and current transformers shall be General Electric or equal.

C. Provide relays and timing devices with clear polycarbonate dust covers. Devices shall be plug-in type. Output contacts shall be rated 10 amperes at 12-volt dc.

D. Provide engraved or etched nameplates to show position of switches and function of pilot lights, push buttons, and meters. Do not provide embossed tape.

E. Provide fully automatic generator set start-stop controls in the generator panel. Controls shall operate as follows:

1. When the function switch is in automatic position and upon closure of a set of external contacts or when the switch is in manual position, the engine shall automatically crank. An adjustable cranking limiter shall allow 3 cycles of 15 seconds' crank followed by 15 seconds' rest. If the engine fails to start after this time, the starting circuit shall be locked out and the over-crank shutdown light initiated.

2. When operating in the automatic mode and the remote engine run contact opens, the engine shall shut down.

3. Initiation of any safety shutdown shall immediately stop the engine and light the appropriate light. Upon correction of the fault, the shutoff system shall be made operable by an appropriate reset switch.

4. Provide dry contacts for monitoring generator run status and generator common fault and alarm.

F. Provide dry contacts for the following signals:

1. Power available.

2. Common alarm.

3. Auto.

2.09 MAIN LINE CIRCUIT BREAKER

Provide a main line molded case circuit breaker sized in accordance with the NEC. Install on the generator in a NEMA 1 enclosure or in the generator control panel to function as a load circuit interrupting and protection device. It shall operate both manually for normal switching function and automatically during overload and short-circuit conditions. Circuit breaker shall trip free of the handle. The handle position, or a luminescent flag, shall indicate "Off," "On," or "Tripped" breaker positions. The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short-circuit protection. Provide and mark insulated neutral terminals and a ground terminal. The circuit breaker shall meet standards established by UL, NEMA, and NEC. Do not use generator exciter field circuit breakers in lieu of a main line circuit breaker.

2.10 PRESSURE REGULATOR

Provide a pressure regulator, flex line connection to generator and ball valve for gas service to generator where shown on the plans. Pressure regulator shall non-electirc, min 1-inch NPT, rated for the maximum required throughput of the generator and capable of regulating service line regulated pressure provided by The Gas Company to the inlet pressure required for the generator.

2.11 SOUND ATTENUATION ENCLOSURE

Provide a weatherproof enclosure fabricated of 12-gauge galvanized steel with baked enamel finish. Enclosure shall have lockable, hinged access doors, stainless steel hardware, sound attenuating interior insulation and noise reduction type air louvers. Full load sound level shall not exceed 68 dBA measured anywhere around the enclosure at a distance of 23 feet.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Apply for and obtain permits and licenses pertaining to the Air Pollution Control District for the installation and operation of this equipment in the name of the Owner. Obtain permits prior to installation of the equipment.

B. The Contractor shall coordinate the construction of engine-generator set foundations, piping systems, and conduit stub-ups with the generator set manufacturer's written requirements. Foundation blocks, anchor bolt layouts, and piping and quantity and locations of conduit stub-ups may have to be modified from those shown in the drawings. Such work shall be at the Contractor's expense.

C. The entire unit and other equipment shall be completely installed, wired, and plumbed by the engine supplier prior to shipment to the installation site.

3.02 PIPING

Pitch horizontal runs of exhaust pipe away from the engine. Provide condensate traps with petcocks or valves at low spots in the exhaust system. Fit pipe penetrating walls or roofs with a ventilated thimble.

3.03 START-UP

A. On completion of the installation, the initial start-up shall be performed by a factory-trained service representative of the engine supplier, who shall thoroughly inspect, activate the jacket water heater, operate, test, and adjust the equipment. The inspection shall include the soundness of all parts, completeness of all details, proper operation of all components with special emphasis on safety devices, correctness of settings, proper alignments, and correct phase rotation to match other sources.

B. Field tests shall include the following:

1. Simulate power failure by tripping the main breaker and demonstrate complete manual and automatic start, load, unload, and stop sequence of the engine-generator.

2. Conduct a two-hour run, utilizing maximum available load. If available load is less than 75% of the generator's rating, then add loads to obtain 75% generator loading (minimum). The generator supplier shall provide load banks and make necessary connections to provide the required 75% load.

C. Perform start-up in presence of the Engineer. Provide notification of start-up date a minimum of three days prior to the date.

END OF SECTION

SECTION 263623 AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of automatic transfer switches.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Electrical Requirements: 260500.

B. Seismic Restraint for Electrical Equipment: 260548.

C. Motor Control Center: 262419.

D. Standby Engine-Generators: 263213.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 260500.

B. Submit manufacturer's descriptive data including ratings, circuit diagrams, dimensional data, conduit entry restrictions, and a list of accessories.

1.04 OPERATION AND MAINTENANCE MANUALS

Submit operation and maintenance manuals in accordance with Section 260500.

1.05 MANUFACTURER'S SERVICES

Provide manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

Two labor days to check the installation and advise during start-up, testing, and adjustment of the transfer switch.

PART 2 - MATERIALS

2.01 TRANSFER SWITCH

A. Transfer switch shall be open type and installed in a vertical section of a motor control center as shown in the drawings. Transfer switch shall have number of poles, amperage, and voltage ratings as shown in the drawings. Withstand current rating shall not be less than 42,000-ampere rms symmetrical.

B. Switch shall be listed per UL 1008 as a recognized component for emergency systems and rated for all classes of loads.

C. Transfer switch shall be electrically operated and mechanically held in each direction by a single operating mechanism momentarily energized from the source to which the load shall be transferred. Accomplish mechanical locking in each direction without the aid of latching solenoids, toggle mechanisms, or gear arrangements. Total operating transfer time shall not exceed one-sixth of a second.

D. Operation shall allow for delayed transition**.** An overload or short circuit shall not cause the switch to go to a neutral position. Do not use main contact structures not originally manufactured for transfer switch service (molded case circuit breakers or contactors). Inspection and replacement of all contacts (stationary and arcing) shall be possible from the front of the switch without any disassembly of operating linkages or power conductors. Provide a handle to permit no-load manual operation.

2.02 ACCESSORIES

A. Provide a solid-state sensing and control logic panel. Include the following operational characteristics:

1. Adjustable (0.5 to 6.0 seconds) time delay on engine starting to override momentary dips in normal source, set at 1 second.

2. Full phase voltage relay supervision of the normal source with at least one close differential relay to detect "brownout" condition, set at 70% dropout and 90% pickup.

3. Voltage/frequency lockout relay to prevent premature transfer, set at 90% voltage and 90% frequency.

4. Engine starting control contacts (one normally open and one normally closed).

5. Adjustable (2 to 25 minutes) time delay on retransfer to normal, set at 20 minutes.

6. Unloaded running time delay for generator cool down (adjustable 0.1 to 10 minutes), set at 5 minutes.

7. Transfer to emergency time delay (adjustable 1 to 300 seconds), set at 1 second..

B. Provide a system test switch (momentary type) on the front of the enclosure.

C. Manual push button to bypass the time delay on retransfer.

D. Indicating lights to indicate source to which the load is connected.

E. Indicating light to indicate presence of normal power source.

F. Engine Exerciser: The controller shall provide an internal engine exerciser. The engine exerciser shall allow the user to program up to seven different exercise routines. For each routine, the user shall be able to:

1. Enable or disable the routine.

2. Enable or disable transfer of the load during routine.

3. Set the start time.

4. Time of day.

5. Day of week.

6. Week of month (first, second, third, fourth, alternate, or every).

G. Set the duration of the run control switches and indicating lights shall comply with Section 262419.

H. Auxiliary contacts for remote indication of switch position, one normally open and one normally closed contact for normal and emergency position and utility fail

I. Transfer switch shall include two pilot contacts (10 amperes at 240-volt ac) that open three seconds (nominal) prior to transfer and reclose three seconds (nominal) after transfer. These contacts will deenergize motor loads during the transfer time of the switch.

J. The complete assembly including anchors shall be capable of withstanding seismic forces per Section 260548.

K. If ethernet capable, provide Cat 6 ethernet connection to Instrument Control Panel.

END OF SECTION

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SECTION 311100 CLEARING, STRIPPING, AND GRUBBING

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the work included in clearing, stripping, grubbing, and preparing the project site for construction operations.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Existing Conditions: Standard Specifications.

B. Protecting Existing Underground Utilities: 020120.

C. Earthwork: 312300.

D. Trenching, Backfilling, and Compacting: 312316.

1.03 CLEARING

Remove and dispose of trees, snags, stumps, shrubs, brush, limbs, sticks, branches, and other vegetative growth. Remove rocks, tiles, and lumps of concrete. Remove all evidence of their presence from the surface. Remove and dispose of trash piles and rubbish. Protect structures and piping above and below ground, trees, shrubs, vegetative growth, and fencing which are not designated for removal.

1.04 STRIPPING

A. Remove and dispose of organic sod, grass and grass roots, and other objectionable material remaining after clearing from the areas designated to be stripped.

1.05 GRUBBING

After clearing and stripping, remove and dispose of wood or root matter, including stumps, logs, trunks, roots, or root systems greater than 1 inch in diameter or thickness to a depth of 12 inches below the ground surface.

1.06 TOPSOIL SALVAGE

A. Salvage, at a minimum, the top 8 inches of soil (12 inches in agricultural areas or areas containing organic-rich topsoil as determined by City Representative) during grading, blading, trenching, or other earth moving activities.

B. Stockpile topsoil separately from subsoils. Stockpile in windrows not exceeding 3 feet in height.

A. If topsoil windrows be stored and unused for more than 1 month, protect salvaged topsoil from erosion by temporary seeding with a native seed mix consisting of species and in amounts listed in Table 1 below. Overhead-spray irrigate with a watering truck with nozzles set to "mist" to prevent runoff. Irrigate weekly from April 1 – May 31 and September 1 – October 31, and twice per week from June 1 – August 31 until topsoil is reused for restoration. Do not cover soil with any type of waterproof cover as this will result in topsoil degradation.

Table 1. Topsoil Erosion Protection Seed Mix:

Scientific Name	Common Name	Rate per Acre
Bromus carinatus 'Cucamonga'	Cucamonga brome	35 lbs PLS
Festuca microstachys	three-weeks fescue	6 lbs PLS
Trifolium wildenovii	tomcat clover	4 lbs PLS
Nassela cernua	nodding needlegrass	5 lbs PLS
Elymus glaucus	blue wildrye	10 lbs PLS
Hordeum californicum	California meadow barley	5 lbs PLS
	TOTAL:	65 lbs PLS

PART 2 - MATERIALS

2.02 TREES AND SHRUBBERY

Existing trees, shrubbery, and other vegetative material may not be shown in the drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve in place trees that are specifically shown in the drawings and designated to be preserved.

2.03 PRESERVATION OF TREES, SHRUBS, AND OTHER PLANT MATERIAL

A. Save and protect plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.

B. Cut and remove tree branches where necessary for construction. Remove branches other than those required for a balanced appearance of any tree. Treat cuts with a tree sealant.

PART 3 - EXECUTION

3.01 CLEARING, STRIPPING, AND GRUBBING AREAS AND LIMITS

A. Clear, strip, and grub excavation and embankment areas associated with new structures, slabs, walks, and roadways.

B. Limits of clearing, stripping, and grubbing:

1. Excavation, Excluding Trenches: 3 feet beyond tops of cut slopes.

2. Trench excavation for piping and electrical conduits: 3 feet from edge of trench.

3. Earth Fill: 3 feet beyond toe of permanent fill as indicated in the drawings.

4. Structures: 5 feet beyond footings.

5. Streets, Roadways, and Parking Areas: 3 from toe of fill or top of cut.

6. Sidewalks: 1 feet beyond edges.

3.02 DISPOSAL OF CLEARING AND GRUBBING DEBRIS

Do not burn combustible materials. Remove cleared and grubbed material from the worksite and dispose.

3.03 DISPOSAL OF STRIPPED MATERIAL

Remove stripped material and dispose offsite.

END OF SECTION

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SECTION 312300 EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of earthwork for excavations, fills, and embankments for roadways, structures, and sites and accessory items such as filter fabric.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Existing Conditions: Standard Specifications.

B. Protecting Existing Underground Utilities: 020120.

C. General Concrete Construction: 030500.

D. Clearing, Stripping, and Grubbing: 311100.

E. Trenching, Backfilling, and Compacting: 312316.

F. Dewatering: 312319

G. Gravel and Crushed Rock Base for Structures: 312323.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit report from a testing laboratory verifying that the material contains less than 0.25% asbestos by weight or volume and conforms to the gradation specified. Submit asbestos test results with the submittals for materials gradation. Material gradation reports without the accompanying asbestos test results will be rejected as incomplete.

C. Submit dewatering plan including disposition of groundwater.

D. Submit manufacturer's catalog data and a sample of filter fabric.

E. Submit a shoring plan for all excavations where shoring is required.

1.04 TESTING FOR COMPACTION

A. The Owner will test for compaction and relative density as described below.

B. Determine the density of soil in place by by nuclear methods, ASTM D6938. Additional densities will be required if the backfill material is visually variable. The minimum size

shall be 8 inches, and size 16/30 or 10/20 silica sand shall be used. Compaction tests will be performed for each lift or layer.

C. Determine laboratory moisture-density relations of soils per ASTM D1557. If nuclear methods are used for in-place density determination, the compaction test results for maximum dry density and optimum water content shall be adjusted in accordance with ASTM D4718. This will be required for determination of percent relative compaction and moisture variation from optimum.

D. Determine the relative density of cohesionless soils per ASTM D4253 and D4254.

E. Sample materials per ASTM D75.

F. "Relative compaction" is the ratio, expressed as a percentage, of the inplace dry density to the laboratory maximum dry density.

G. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction. The Contractor shall pay the costs of any retesting of work not conforming to the specifications.

1.05 DISPOSAL OF EXCESS MATERIALS

Excess site excavated or wasted material shall be disposed of offsite by the Contractor at his expense. No prearranged disposal site or related permits have been determined or secured by the Owner.

1.06 MATERIAL AVAILABILITY

If sufficient earthwork material to complete the work is not available at the site, secure source of material and permits to complete the project requirements.

1.07 MEASUREMENT AND PAYMENT

Payment for all the work in this section, exclusive of authorized overexcavation, shall not be paid as a separate item but shall be included in other bid items that include this work.

1.08 MEASUREMENT AND PAYMENT FOR AUTHORIZED OVEREXCAVATION

Measurement of the volume of material for payment of authorized overexcavation will be made by taking cross sections after excavation and calculating the volume using the average end area method. The Owner will measure and calculate the volume. The volume for payment will be the gross volume, up to the elevation of the finished earthwork subgrade. A change order will be made as described in the Standard Specificatoins based upon a unit price according to actual time and material volume of earthwork. No payment will be made for unauthorized excavated and fill material exceeding the contract lines and grades.

PART 2 - MATERIALS

2.01 STRUCTURAL BACKFILL

A. Structural backfill is material that is to be placed adjacent to and around piping and structures.

B. Structural backfill shall be sand per paragraph 2.03.

C. Excavated onsite material may not be used for structural backfill.

2.02 FILL

Fill material is material that is to be placed in locations that are not to be constructed as structural backfill. Fill material shall be granular material with a minimum cohesion of 100 PSF and a minimum internal angle of friction of 27 degrees.

2.03 SAND, INCLUDING IMPORTED SAND FOR PIPE ZONE AND PIPE BASE IN PIPE TRENCHES

A. Granular material free from clay balls, organic matter, and other deleterious substances and conforming to the following gradations:

Sieve Size	Percent Passing By Weight
1 inch	100
No. 4	85 to 95
No. 30	35 to 70
No. 200	0 to 15

B. Sand shall have a minimum sand equivalent of 30 per ASTM D2419.

2.04 SAND-CEMENT SLURRY BACKFILL

Sand-cement slurry backfill shall consist of one sack (94 pounds) sacks of Type I or II portland cement added per cubic yard of imported sand and sufficient water for workability.

2.05 AGGREGATE BASE FOR HYDRAULIC STRUCTURES

See Section 312323.

PART 3 - EXECUTION

3.01 DEWATERING

Provide and operate equipment adequate to keep excavations and trenches free of water. Remove water during period when concrete is being deposited, when pipe is being laid, and during the placing of backfill. Avoid settlement or damage to adjacent property. Dispose of water in a manner that will not damage adjacent property. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation. See Section 312319.

3.02 EXCAVATION

A. Excavations shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926 Subpart P-Excavations, CAL/OSHA requirements, and the General Provisions.

B. Protect the existing lift station during construction. Existing lift station shall be continuously operated until after successful completion of commissioning and startup. Shoring shall be designed to protect existing facilities.

C. Construction noise shall be limited to 80 dBA at 300 feet during working hours.

D. BMPs (Best Management Practices) shall be installed per the SWPPP (Storm Water Pollution Prevention Plan) included as Appendix F.

E. Contractor shall make their own arrangements for disposal of excavated soil.

F. Excavation is unclassified. Perform excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Do not operate excavation equipment within 5 feet of existing structures or newly completed construction. Excavate with hand tools in these areas.

G. After the required excavation has been completed, the Owner will observe the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation is to be conducted in all areas within the influence of the structure where unacceptable subgrade materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exists directly beneath the structure or within a zone outside and below the structure defined by a line sloping at 1-horizontal to 1-vertical from 1 foot outside the edge of the footing. Refill the overexcavated areas with structural backfill material.

H. The Contractor will not receive any additional payment for refill material used for his convenience.

3.03 LIMITS OF FOUNDATION EXCAVATION

Excavate to the depths and widths needed to accomplish the construction. Allow for forms, working space, structural backfill, and site grading. Do not excavate for footings, slabs, or conduits below elevations indicated. Unless unacceptable material is encountered and overexcavation is authorized by the Owner, backfill overexcavations with compacted structural backfill material. Correct cuts below grade by benching adjoining areas and creating a smooth transition. The Contractor shall bear all costs for correcting unauthorized overexcavated areas.

3.04 PREPARATION OF FOUNDATION SUBGRADE

A. The finished subgrade shall be within a tolerance of ±0.08 of a foot of the grade and cross section indicated, shall be smooth and free from irregularities, and shall be at the specified relative compaction. The subgrade shall extend over the full width and extend 1 foot beyond the edge of the foundations as indicated in the plans.

B. Remove soft material encountered and replace with structural backfill. Fill holes and depressions to the required line, grade, and cross sections with structural backfill.

C. If rock is encountered at final grade, overexcavate to a depth of 6 inches and place structural backfill to establish final grade.

3.05 PREPARATION FOR PLACING FILL OR BACKFILL

A. After excavation of existing material or removal of unacceptable material at the exposed subgrade, place layer of crushed gravel per Section 312323.

B. Remove foreign materials and trash from the excavation before placing any fill material. Obtain the specified compressive strength and finish of concrete work per Sections 030500 before backfilling.

C. Place and compact a 6-inch thick layer of Class 2 aggregate base over the encapsulated crushed gravel.

3.06 PLACING AND COMPACTING FILL

A. Place in maximum 8-inch lifts and compact each lift to 90% relative compaction.

B. Where fill is to be constructed on slopes steeper than 5:1, bench the fill into competent undisturbed materials as the fill progresses up the slope. Benches shall be sloped at least 2% into the slope and shall be of a width at least equal to the height of fill lift.

3.07 PLACING AND COMPACTING STRUCTURAL BACKFILL

A. Place structural backfill material around piping, structures, channels, and other areas, including authorized overexcavation areas, to the lines and grades shown or specified. Do not exceed loose lifts of 8 inches.

B. Limits of Structural Backfill: Limits of structural backfill shall be from edge of footing and shall extend to the finish grade.

C. Compact each lift to 95% relative compaction, unless otherwise shown in the drawings. Stop structural backfill at least 6 inches below finished grade in all areas where topsoil is to be placed.

D. Backfill around concrete structures as specified in Section 030500.

E. Do not operate earthmoving equipment within 5 feet of walls of concrete structures. Place and compact backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.

3.08 MOISTURE CONTROL

During the compacting operations, maintain optimum practicable moisture content required for compaction purposes in each lift of the material. Maintain uniform moisture content throughout the lift. Insofar as practicable, add water to the material at the site of excavation. Supplement by sprinkling the material. At the time of compaction, the water content of the material shall be at optimum water content or within 2 percentage points above optimum. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

3.09 SITE GRADING

Perform earthwork to the lines and grades shown in the drawings. Shape, trim, and finish slopes of channels to conform to the lines, grades, and cross sections as shown. Remove exposed roots and loose rocks exceeding 3 inches in diameter. Round tops of banks to circular curves of not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces. Do not overexcavate and backfill to achieve the proper grade.

END OF SECTION

SECTION 312316 TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation for pipeline trench excavation, backfilling, and compacting.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Existing Conditions: Standard Specifications.

B. Protecting Existing Underground Utilities: 020120.

C. General Concrete Construction: 030500.

D. Clearing, Stripping, and Grubbing: 311100.

E. Earthwork: 312300.

F. Gravel and Crushed Rock Base for Structures: 312323.

G. Asphalt Concrete Paving: 321216.

H. Concrete Curbs, Gutters, and Sidewalks: 321613.

I. Pressure Testing of Force Main Piping: 400515.

1.03 SUBMITTALS

A. Submit a report from a testing laboratory verifying that material is asbestos free and conforms to the specified gradations or characteristics for pea gravel, granular material, imported sand, rock refill for foundation stabilization, and water. Submit asbestos test results with the submittals for materials gradation. Material gradation reports without the accompanying asbestos test results will be rejected as incomplete.

B. Submit method(s) of compaction including removal sequence of shoring where used.

1.04 TRENCH DETAIL

Trench installation, except for siphon, shall conform to Trench Detail #1 of the Standard Specifications.

1.05 TESTING FOR COMPACTION

The Owner will test for compaction as described in Section 312300.

1.06 PAVEMENT ZONE

The pavement zone includes the asphalt concrete and aggregate base pavement section placed over the trench backfill.

1.07 STREET ZONE

The street zone is the top 12 inches of the trench immediately below the pavement zone in paved areas. Where the depth of cover over the pipe does not permit the full specified thickness of the street zone, construct a thinner street zone, extending from the top of the pipe zone to the bottom of the pavement zone.

1.08 TRENCH ZONE

The trench zone includes the portion of the trench from the top of the pipe zone to the bottom of the street zone in paved areas or to the existing surface in unpaved areas. If the resulting trench zone is less than 12 inches thick, the street zone shall extend to the top of the pipe zone and there shall be no separate trench zone.

1.09 PIPE ZONE

The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level above the top of the pipe, as specified below. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipe to a horizontal level above the top of the highest or topmost pipe. Thickness of pipe zone above the highest top of pipe shall be as follows unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed.

Pipe Diameter	**Thickness of Pipe Zone Above Top of Pipe**
6 inches or smaller	6 inches
8 inches and larger	6 inches

1.10 PIPE BASE OR BEDDING

The pipe base or bedding shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe base shall be as follows unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed.

Pipe Diameter	Thickness of Pipe Base
Smaller than 4 inches	4 inches
4 inches through 16 inches	4 inches
18 inches and larger	4 inches

PART 2 - MATERIALS

2.01 IMPORTED SAND--PIPE ZONE, PIPE BASE, STREET AND TRENCH ZONES

See Section 312300.

2.02 GRANULAR MATERIAL—PIPE ZONE, PIPE BASE, STREET AND TRENCH ZONES

A. Granular Material shall be crushed rock containing, asbestos free, with the following gradation:

Sieve Size	Percent Passing By Weight
1 inch	100
3/4 inch	85 to 95
1/2 inch	20 to 24
3/8 inch	5 to 10
No. 4	2 to 5
No. 8	0 to 5

B. The crushed gravel should be completely encapsulated in a two-layer (woven and non-woven) geotextile system. The system should consist of a layer of woven geotextile stabilization fabric conforming to Section 88-1.02O-Class B1 and a layer of heavy-duty filter fabric conforming to Section 88-1.02I – Class 8.

C. Gravel shall be placed in maximum 8-inch lifts and compacted.

D. Filter fabric shall be placed between initial and subsequent backfill and wrapped up trench sides 6-inches.

2.03 SAND-CEMENT SLURRY BACKFILL--PIPE ZONE

One-Sack Slurry: Sand-cement slurry backfill shall consist of one sack (94 pounds) of Type I or II portland cement added per cubic yard of imported sand and sufficient water for workability.

Two-Sack Slurry: Sand-cement slurry backfill shall consist of two sack (188 pounds) of Type I or II portland cement added per cubic yard of imported sand and sufficient water for workability.

2.04 ROCK REFILL FOR FOUNDATION STABILIZATION

See Section 312323.

2.05 CONCRETE FOR PIPE ENCASEMENT AND THRUST BLOCKS

A. Concrete for unreinforced pipe encasement and thrust blocks shall be Class C per Section 030500, unless otherwise shown in the drawings.

B. Provide thrust blocks at fittings in pipe having rubber gasket bell-and-spigot or unrestrained mechanical joints. Do not provide thrust blocks for steel pipe having welded, flanged, or butt-strap joints unless detailed in the drawings or required in the detailed piping specification.

C. See the details in the drawings for thrust block sizes. Install thrust blocks based on the test pressures given in Section 400515. Size thrust blocks in accordance with the following table:

Pipe Test Pressure (psi)	**Use Thrust Block Sizing for**
0 to 25	25 psi
26 to 50	50 psi
51 to 100	100 psi
101 to 150	150 psi
151 to 200	200 psi

2.06 WATER FOR COMPACTION

See Section 312300. Water shall be free of organic materials injurious to the pipe coatings.

2.07 UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

See Section 400775.

2.08 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

See Section 400775.

2.09 GEOTEXTILE FABRIC

See Section 312300.

PART 3 - EXECUTION

3.01 SLOPING, SHEETING, SHORING, AND BRACING OF TRENCHES

Trenches shall have sloping, sheeting, shoring, and bracing conforming with 29CFR1926, Subpart P--Excavations, CAL/OSHA requirements, and the Standard Specifications.

3.02 SIDEWALK, PAVEMENT, AND CURB REMOVAL

Cut bituminous and concrete pavements regardless of the thickness and curbs and sidewalks prior to excavation of the trenches with a pavement saw or pavement cutter. Width of the pavement cut shall be at least equal to the required width of the trench at ground surface. Haul pavement and concrete materials from the site. Do not use for trench backfill.

3.03 TRENCH EXCAVATION

A. Excavate the trench to the lines and grades shown in the drawings with allowance for pipe thickness, sheeting and shoring if used, and for pipe base or special bedding. If the trench is excavated below the required grade, refill any part of the trench excavated below the grade at no additional cost to the Owner with foundation stabilization material. Place the refilling material over the full width of trench in compacted layers not exceeding 6 inches deep to the established grade with allowance for the pipe base or special bedding.

B. Trench widths in the pipe zone shall be as shown in the drawings. If no details are shown, maximum width shall be 24 inches greater than the pipe outside diameter. Comply with 29CFR Part 1926 Subpart P--Excavations. Trench width at the top of the trench will not be limited except where width of excavation would undercut adjacent structures and footings. In such case, width of trench shall be such that there is at least 2 feet between the top edge of the trench and the structure or footing.

3.04 TRENCH EXCAVATION IN BACKFILL AND EMBANKMENT AREAS

A. Construct and compact the embankment to an elevation of 1-foot minimum over the top of the largest pipe or conduit to be installed.

B. Excavate trench in the compacted backfill or embankment.

3.05 LOCATION OF EXCAVATED MATERIAL

A. During trench excavation, place the excavated material only within the working area or within the areas shown in the drawings. Do not obstruct any roadways or streets. Do not place trench spoil over pipe, buried utilities, manholes, or vaults. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.

B. Locate trench spoil piles at least 20 feet from the tops of the slopes of trenches. Do not operate cranes and other equipment on the same side of the trench as the spoil piles.

C. Remove at the end of each day.

3.06 LENGTH OF OPEN TRENCH

Within public rights-of-way, limit the length of open trench to the amount of pipe installed in one working day.

3.07 DEWATERING

See Section 312319

3.08 FOUNDATION STABILIZATION

A. After the required excavation has been completed, the Owner will inspect the exposed subgrade to determine the need for any additional excavation. It is the intent that additional excavation be conducted in all areas within the influence of the pipeline where unacceptable materials exist at the exposed subgrade. Overexcavation shall include the removal of all such unacceptable material that exist directly beneath the pipeline to a width 24 inches greater than the pipe outside diameter and to the depth required.

B. Place woven geotextile fabric on the bottom of the trench and up the sides a sufficient height to retain rock refill material. Backfill the trench to subgrade of pipe base with rock refill material for foundation stabilization. Place the foundation stabilization material over the full width of the trench and compact in layers not exceeding 6 inches deep to the required grade. Fully encapsulate rock refill material with filter fabric. Provide a minimum 12-inch overlap. Foundation stabilization work shall be executed in accordance with a change order.

C. Rock refill used by the Contractor for his convenience will not be cause for any additional payment.

3.09 INSTALLING BURIED PIPING

A. Grade the bottom of the trench to the line and grade to which the pipe is to be laid, with allowance for pipe thickness. Remove hard spots that would prevent a uniform thickness of bedding. Place the specified thickness of pipe base material over the full width of trench. Grade the top of the pipe base ahead of the pipe laying to provide firm, continuous, uniform support along the full length of pipe, and compact to the relative compaction specified herein. Before laying each section of the pipe, check the grade and correct any irregularities.

B. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Fill the area excavated for the joints with the bedding material specified or indicated in the drawings for use in the pipe zone.

C. Inspect each pipe and fitting before lowering the buried pipe or fitting into the trench. Inspect the interior and exterior protective coatings. Patch damaged areas in the field with material recommended by the protective coating manufacturer. Clean ends of pipe thoroughly. Remove foreign matter and dirt from inside of pipe and keep clean during and after installation.

D. Handle pipe in such a manner as to avoid damage to the pipe. Do not drop or dump pipe into trenches under any circumstances.

E. When installing pipe, do not deviate more than 1 inch from line or 1/4 inch from grade. Measure elevation at the pipe invert.

F. After pipe has been bedded, place pipe zone material simultaneously on both sides of the pipe, in maximum 6-inch lifts, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported, and no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

G. Compact each lift to the relative compaction specified herein.

H. Push the backfill material carefully onto the backfill previously placed in the pipe zone. Do not permit free-fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe. Do not operate heavy equipment or a sheepsfoot wheel mounted on a backhoe over the pipe until at least 3 feet or one-half of the internal diameter, whichever is greater, of backfill has been placed and compacted over the pipe.

I. When the pipe laying is not in progress, including the noon hours, close the open ends of pipe. Do not allow trench water, animals, or foreign material to enter the pipe.

J. Keep the trench dry until the pipe laying and jointing are completed.

3.10 BACKFILL COMPACTION

A. Unless otherwise shown in the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as follows:

1. Pipe Zone: 90% relative compaction.

2. Backfill in Trench Zone Not Beneath Paving: 90% relative compaction. Compact backfill within embankment above the pipe zone to the same relative compaction as the adjacent embankment as specified in Section 312300.

3. Backfill in Trench Zone to Street Zone in Paved Areas: 90% relative compaction.

4. Backfill in Street Zone in Paved Areas: 95% relative compaction.

B. Compact trench backfill to the specified relative compaction. Compact by using mechanical compaction, water jetting, or hand tamping. Do not use high-impact hammer-type equipment except where the pipe manufacturer warrants in writing that such use will not damage the pipe.

C. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

D. Do not use any axle-driven or tractor-drawn compaction equipment within 5 feet of building walls, foundations, and other structures.

3.11 MATERIAL REPLACEMENT

Remove and replace any trenching and backfilling material that does not meet the specifications, at the Contractor's expense.

3.12 PLACING SAND-CEMENT SLURRY BACKFILL

Place sand-cement slurry backfill in a uniform manner that will prevent voids in or segregation of the material. Remove foreign material that falls into the excavation or trench. Do not commence backfilling over or place any material over the slurry cement backfill until at least four hours after placing the sand-cement slurry.

END OF SECTION

SECTION 312319 DEWATERING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Design, furnish, operate, maintain, and remove temporary dewatering systems to provide dewatering for the construction period, control surface and groundwater to maintain stable, undisturbed subgrades, and permit work to be performed under dry and stable conditions. Work to be done as part of dewatering includes, but is not limited to:

1. Lower the groundwater.

2. Lower hydrostatic pressure.

3. Implement erosion control measures for disposing of discharge water.

4. Provide groundwater recharging systems as specified and as indicated.

5. Provide and monitor observation wells and geotechnical instrumentation as specified and indicated.

B. Groundwater within the excavation area shall be lowered to at least 2 feet below the lowest excavation levels as specified and as indicated.

C. Common dewatering methods include, but are not limited to, sump pumping, deep wells, well points, vacuum well points or combinations thereof.

D. Common groundwater recharge methods include, but are not limited to, deep wells, large sumps or combination thereof.

E. At a minimum, the Contractor shall ensure that all water returned to Froom Creek and San Luis Obispo Creek shall meet the criteria of the approved California Regional Water Quality Control Board Permit and the Contractor’s approved Storm Water Pollution Prevention Plan (SWPPP).

F. The Contractor shall not pollute the waters of San Luis Obispo Creek or adjacent wetland areas or nearby habitat areas with fuels, oils, or other materials that would have an adverse effect on aquatic life or its habitat or degrade water quality for any beneficial use. It is the responsibility of the Contractor to investigate and comply with all applicable Federal, State, County, and Municipal regulations concerning discharges into San Luis Obispo Creek or adjacent wetlands.

1.02 REFERENCES:

A. Code of Federal Regulations, Title 40 – Protection of Environment (CFR):

1. 40 CFR Part 122: EPA Administered Permit Programs: The National Pollutant Discharge Elimination System.

1.03 SUBMITTALS:

A. Submit the following in accordance with General Provisions and Section 013300.

1. Qualification of the Contractor’s dewatering specialist's or firm's qualifications a minimum of 4 weeks prior to dewatering work. The submittal shall include, but not be limited to:

a. Qualifications of specialist's or firm's California Registered Professional Engineer.

b. Qualifications of specialist's or firm's field representative who will oversee the installation, operation and maintenance of the dewatering system.

2. Submit a dewatering plan, and, if applicable, a groundwater recharge plan at least 2 weeks prior to start of dewatering work. The review will be for the information of the Owner and third parties for an overall understanding of the project relating to access, maintenance of existing facilities and proper utilization of the site. The Contractor shall remain responsible for the adequacy and safety of the means, methods and sequencing of construction. Acceptance of the Contractor's method of dewatering by the Owner shall not be construed to relieve the Contractor in any way from his responsibility for the successful performance of the dewatering system or for repairing any damage to permanent structures, or damage to any part of the work caused by the operation, failure, or inadequacy of the system. The Contractor shall have sole responsibility for all aspects of the dewatering system. The dewatering plan shall include the following items at a minimum:

a. Dewatering plan and details stamped and signed by a Registered Professional Engineer in the State of California.

b. A list of equipment including, but not limited to, pumps, prime movers, and standby equipment.

c. Detailed description of dewatering, maintenance, and system removal procedures.

d. A description of the time period during which the dewatering system will be in place and a plan for what will happen if the Contractor is unable to complete work and remove the system by the stop-work deadline.

e. An analysis of historic rainfall and/or flow data in the watershed identifying the range of flow events (quantity and likelihood) that could occur during the period in which the system is in place.

f. A water quality impact analysis that assesses the potential risks to water quality and channel stability if a flow event should occur that exceeds the capacity of the system.

g. Detailed drawings of the proposed system.

h. The capacity of the proposed system, including an assessment of the capacity relative to the information generated for item ‘e’ above.

i. An inspection, assessment, and action plan the Contractor will follow to observe flow conditions upstream of the system, assess the need to increase the flow capacity of the system, and measures the Contractor will implement to increase the flow capacity of the system, if warranted. The plan must be implemented whenever rain occurs anywhere in the watershed upstream of the project site.

j. A contingency plan describing what the Contractor will do should a flow event occur that exceeds the flow capacity of the system. The plan should address at least a description of the following:

   (1) The length of time the Contractor will take to enact the above measures.

   (2) The availability of reliable weather forecast providing enough lead-time to enact the measures and consideration of the implications of rain upstream in the watershed.

   (3) The cumulative impact of a series of smaller events.

   (4) A description of how the Contractor will interpret the weather forecast to account for these implications.

k. Weekly monitoring plan and details, including, but not limited to, number and locations of observation wells, and geotechnical instruments such as settlement markers and piezometers, and frequency of reading the monitoring devices. At a minimum, monitor movement of the following facilities:

   (1) Other facilities as directed by the Owner’s Representative.

l. Erosion and sedimentation control measures, and methods for disposal of pumped water.

m. List of all applicable laws, regulations, rules, and codes to which dewatering design conforms.

n. List of data used for the design of dewatering and for groundwater recharge systems, including but not limited to groundwater levels, soil profile, permeabilities, and duration of pumping and or recharge.

3. Measurement records consisting of observation well groundwater records and the geotechnical instrumentation readings within one day of monitoring.

4. A modified dewatering plan within 24 hours, if open pumping from sumps and ditches results in boils, loss of fines or softening of the ground.

1.04 QUALITY ASSURANCE:

A. Employ the services of a geotechnical engineer and a dewatering specialist or firm having the following qualifications:

1. Have completed at least 5 successful dewatering projects of equal size and complexity and with equal systems within the last 5 years.

2. Retain the services of a Registered Professional Engineer in the State of California having a minimum of 5 years experience in the design of well points, deep wells, recharge systems, or equal systems.

3. Retain the services of a field representative having a minimum of 5 years' experience in installation of well points, deep wells, recharge systems, or equal systems.

B. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the owner's representative, stabilize the subgrade, and modify system to perform as specified.

C. Notify the owner's representative immediately if settlement or movement is detected on structures. If the settlement or movement is deemed by the owner's representative to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the owner's representative within 24 hours. Implement the modified plan and repair damage incurred to adjacent structures.

D. Immediately notify the owner's representative if oil or other hazardous materials are encountered after dewatering begins.

1.05 HYDRAULIC UPLIFT OF STRUCTURES:

A. The Contractor shall be responsible for the protection of all structures against hydraulic uplift until such structures have been accepted by the Owner.

B. The Contractor is advised that the structures, when completed and backfilled, are designed to resist hydraulic uplift from groundwater up to the elevation indicated on the structural drawings when the structure is completed. The concrete slab bottoms shall be placed in the dry, with the use of wellpoints or other dewatering means to keep the water elevation sufficiently low to carry on the work.

1.06 PRECAUTIONS AGAINST HYDROSTATIC UPLIFT DURING CONSTRUCTION:

A. The Contractor shall maintain a low groundwater elevation in the vicinity of the structures until they are complete. In case of extremely high water during construction of the structures, it may be necessary to flood the structures to maintain stable conditions.

1.07 SITE CONDITIONS:

A. Subsurface Conditions: Geotechnical Engineering Report by Earth Systems Pacific available for review at the City's office for review only. The contractor shall develop his own geotechnical investigation to support the design and implementation of the dewatering system.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Provide observation wells in accordance with the submitted dewatering plan or as specified.

B. Provide settlement markers, piezometers and other geotechnical instruments in accordance with the submitted dewatering plan or as specified.

C. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system.

D. Provide sand and gravel filter around the well screen. Wrapping geotextile fabric directly around the well screen shall not be allowed.

E. When deep wells, well points, or vacuum well points are used, provide pumping units capable of maintaining high vacuum and handling large volumes of air and water at the same time.

F. Provide auxiliary dewatering equipment in the event of breakdown. Equipment shall consist of pumps and hoses and be stored on site. Provide at least 1 pump for every 5 pumps used.

G. Provide and maintain erosion and sedimentation control devices as indicated or specified and in accordance with the dewatering plan.

H. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.

I. Provide cement grout having a water cement ratio of 1 to 1 by volume.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Contractor shall obtain and comply with all required Governmental Approvals and Laws or Regulations for dewatering.

B. Water treatment during construction will likely be necessary to meet water quality discharge requirements for pH and turbidity specified in the General Permit for Discharges of Storm Water Associated with Construction Activity Construction General Permit Order 2009-0009-DWQ (General Construction NPDES permit).

C. Contractor shall sequence its construction to minimize the intrusion of ground water and surface-water into grading areas.

D. Contractor shall provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components as necessary to meet the general requirements of this section

E. Execution of earth excavation, installing earth retention systems, and dewatering shall not commence until the related submittals have been reviewed by the owner's representative with all owner's representative's comments satisfactorily addressed and the geotechnical instrumentation has been installed.

F. Provide and maintain dewatering system in accordance with the dewatering plan.

G. Carry out dewatering program in such a manner as to prevent undermining or disturbing foundations of existing structures or of work ongoing or previously completed.

H. Do not excavate until the dewatering system is operational.

I. Unless otherwise specified, continue dewatering uninterrupted until all structures, pipes, and appurtenances below groundwater level have been completed such that they will not be floated or otherwise damaged by an increase in groundwater elevation.

J. Discontinue open pumping from sumps and ditches when such pumping results in boils, loss of fines, softening of the ground, or instability of the slopes. Modify dewatering plan and submit revised plan to the owner's representative for acceptance.

K. Where subgrade materials are disturbed or become unstable due to dewatering operations, remove and replace the materials in accordance with Section 312300.

L. Dewatering Discharge:

1. Install sand and gravel filters in conjunction with well points and deep wells to prevent the migration of fines from the existing soil during the dewatering operation.

2. Transport pumped or drained water to discharge location without interference to other work, damage to pavement, other surfaces, or property.

3. Do not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, or any surface water. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels. Provide the infrastructure to discharge into the Owner's existing storm drain system. Provide the Owner's Representative with sufficient information on the groundwater quality and sufficiently reduce sediment prior to discharge into the storm drain system. Discharge to the storm drain system must be coordinated with the owner's representative seven days ahead of the Contractor's planned operations. If the existing storm drain system cannot accommodate the volume of the discharge from the dewatering operations, provide the infrastructure to discharge to the appointed land disposal site within City of San Luis Obispo Water Reclamation Facility property as indicated by the Owner.

4. Provide separately controllable pumping lines.

5. The owner reserves the right to sample discharge water at any time.

6. Immediately notify the owner's representative if suspected contaminated groundwater is encountered. Do not pump water found to be contaminated with oil or other hazardous material to the discharge locations.

M. Monitoring Devices and Records:

1. Install, maintain, monitor and take readings from the observation wells and geotechnical instruments in accordance with the dewatering plan.

2. Perform and report baseline settlement survey readings prior to dewatering.

3. Install settlement markers on structures or surfaces designated by the engineer within the zone of influence for dewatering a distance equal to twice the depth of the excavation, from the closest edge of the excavation. Conduct and report settlement surveys to 1/8-inch.

N. Install and maintain erosion/sedimentation control devices at the point of discharge as indicated or specified and in accordance with the dewatering plan.

O. Removal:

1. Do not remove dewatering system without written acceptance from the Owner's Representative.

2. Backfill and compact sumps or ditches with screened gravel or crushed stone wrapped with geotextile fabric in accordance with Section 312300.

3. All dewatering wells shall be abandoned upon completion of the work, and completely backfilled with cement grout.

END OF SECTION

SECTION 312323 GRAVEL AND CRUSHED ROCK BASE FOR STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

This includes materials, testing, and installation of gravel and crushed rock bases for structures such as manholes and vaults.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Earthwork: 312300.

C. Trenching, Backfilling, and Compacting: 312316.

1.03 SUBMITTALS

Submit report from a testing laboratory verifying that material contains less than 0.25% asbestos by weight or volume and conforms to the specified gradations or characteristics. Submit asbestos test results with the submittals for materials gradation. Material gradation reports without the accompanying asbestos test results will be rejected as incomplete.

1.04 TESTING FOR COMPACTION

The Owner will test for compaction or relative density as described in Section 312300.

PART 2 - MATERIALS

2.01 CRUSHED ROCK AND GRAVEL

A. Crushed rock base and gravel are defined as natural or crushed rock, free from organic matter and containing less than 0.25% asbestos by weight or volume, and meeting the following gradation:

Sieve Size	Percent Passing By Weight
2 inches	100
1 1/2 inch	90 to 100
1 inch	20 to 55
3/4 inch	0 to 15
3/8 inch	0 to 5

B. Durability Index shall be at least 40 per ASTM D3744.

C. The crushed gravel should be completely encapsulated in a two-layer (woven and non-woven) geotextile system. The system should consist of a layer of woven geotextile stabilization fabric conforming to Section 88-1.02O-Class B1 and a layer of heavy-duty filter fabric conforming to Section 88-1.02I – Class 8.

D. Gravel shall be placed in maximum 8-inch lifts and compacted.

E. Filter fabric shall be placed between initial and subsequent backfill and wrapped up trench sides 6-inches.

PART 3 - EXECUTION

3.01 PLACEMENT OF CRUSHED ROCK OR GRAVEL

A. Place crushed rock or gravel base beneath structures where shown in the drawings as indicated. Excavate below the required grade for the bottom of the structure and refill with crushed rock or gravel as specified above. The rock base shall extend a minimum distance, as indicated, beyond the structure base, floor slab, or footing.

B. Prior to placement of the crushed gravel, the excavation should be dewatered and the bottom compacted to the degree practicable to facilitate the placement of geotextiles and subsequent crushed gravel. The crushed gravel should be completely encapsulated in a two-layer (woven and non-woven) geotextile system. The system should consist of a layer of woven geotextile stabilization fabric conforming to the Caltrans Section 88-1.020-Class B1 and a layer of heavy-duty filter fabric conforming to Caltrans Section 88-1.02I-Class 8.

C. Compact base with four full passes with a vibratory compactor per lift.

D. Place base material in maximum lifts of 8 inches.

END OF SECTION

SECTION 314100 SHORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including general conditions, special provision which applies to this work.

B. Geotechnical report by Earth Systems Pacific dated June 2012.

C. Geotechnical report addendum by Earth Systems Pacific dated June 2015

1.02 REFERENCE STANDARDS

A. City of San Luis Obispo Standard Drawings and Specifications, latest edition.

B. APWA standard specifications for public works construction, latest edition.

C. OSHA standard 29 CFR 1926.650-652 /Subpart P Excavation Standard and other pertinent requirements of OSHA's "occupational and health standards for the construction industry".

D. Caltrans Engineering Support Standards for Excavation Support Systems, 2003.

1.03 DESCRIPTION

The Work specified in this Section includes the requirements necessary to design, provide, and maintain shielding, shoring, sheeting, bracing, excavation support and trench support systems, hereinafter called "shoring," as necessary to support the sides of excavations and to prevent detrimental settlement lateral movement or collapse of existing facilities, adjacent properties and structure, and to protect workmen, the general public, structural and site components associated with the completed Work.

The Contractor shall be solely responsible for materials, means and methods for construction of temporary shoring. He shall secure all required approvals, including from the City and adjacent property owners if required.

1.04 DEFINITIONS

A. Positive Excavation Support: Excavation support systems shall be designed by the Contractor and a professional engineer licensed in the State of California and shall be designed to limit horizontal and vertical movement to less than 1 percent of the height of excavation. These limits will be reduced to 1-inch horizontal and vertical movement for excavation support systems adjacent to existing structures or pipelines. Attention is directed to the geotechnical report by Earth Systems Pacific at its Addendum 1 dated Jun 2015, relative to ground conditions and groundwater in the excavation area.

B. Shoring Influence Area: Area within planes sloped downward and outward at 34-degree angle from horizontal or where identified, the angle of repose designated in the geotechnical report or by OSHA criteria for excavation slope angle measured from:

1. 2-foot outside outermost edge at base of foundations or slabs.

2. 2-foot outside outermost edge at surface of roadways or shoulder.

3. 1-foot outside exterior at spring line of pipes.

1.05 SUBMITTALS

A. Informational Submittals:

B. All submittal shall comply with City provisions for preparation, review, and approval of construction documents for temporary shoring. Construction documents shall be prepared, signed, and sealed by a Registered Design Professional, licensed by the State of California and experienced in the design of temporary shoring. Construction documents shall be reviewed and approved by the City prior to beginning work requiring temporary shoring. Submit three (3) copies of approved construction documents for record and distribution to Owner

They shall include the following:

1. Excavation support plan.

2. Engineered systems working Drawings.

3. Utility protection plan.

4. Movement monitoring plan.

5. Movement measurement and data reduced results indicating movement trends.

1.06 SEQUENCING AND SCHEDULING

Dewatering: Conform to applicable requirements of Section 312319, Dewatering, prior to initiating excavation.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.01 GENERAL

A. For trench excavation exceeding 4 feet in depth, provide adequate safety system meeting requirements of applicable state and local construction safety orders, and federal requirements including OSHA.

B. “Construction Slopes” may be shown on the Drawings. These are shown for illustrative purposes only and are not intended to be inferred to represent a stable slope configuration. Contractor shall design slope and determine construction method and slope configuration necessary to complete excavations for the specified Work. Slope stability analysis and documentation shall be in accordance with recommendations provided in the Geotechnical Report.

C. Excavation sloping and benching may be used for excavations that are outside the influence area of existing structures and pipelines. Sloping and benching limits shall be within the work limits.

D. Provide active excavation support consisting of a sheet pile system for construction of the Jacking Pit/Calle Joaquin Lift Station, 72-inch manhole, inverted siphon, and inverted siphon manholes.

E. Engineered Systems:

1. Engineered shoring is required for temporary earth support for trenches or excavations greater than 8 feet deep.

2. Engineered shoring is required for areas subject to groundwater, utility crossings, or where required on the Drawings.

3. Contractor shall retain a professional engineer licensed in the State of California to design engineered shoring conforming to OSHA and California OSHA.

4. The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction, or be performed by a qualified OSHA competent person where applicable, in coordination with the geotechnical engineer. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall recommend updates the excavation, sheeting and dewatering plans as construction progresses as needed to reflect changing conditions.

5. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the shoring plans and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Shoring design engineer, Geotechnical Engineer and OSHA competent person

shall be available to meet with the Contracting Officer at any time throughout the contract duration.

F. Other Systems: Instrumented shoring systems generating tabulated data may be used for shoring systems other than Engineered Systems. Tabulated data shall be provided to the Contractor's competent person and the Owner's Representative, with example data output before installation, and daily during construction.

G. Slide rail shoring systems are not acceptable for excavations below the water table.

3.02 EXCAVATION SUPPORT PLAN

Prepare excavation support plan addressing following topics:

1. Details of shoring, bracing, sloping, or other provisions for worker protection from hazards of caving ground.

2. Detailed Construction Sequence Description: Detail installation, excavation, maintenance, pipe installation sequencing, backfill, and removal requirements.

3. Engineered system working Drawings shall be sealed by qualified professional engineer licensed in the State of California and experienced in design of shoring systems proposed, as specified in Article 6, Engineered System Working Drawings, hereinafter.

4. Other Shoring Systems: Detail pipe installation, manhole installation, structure installation, support and protection of existing utilities, lateral connection, miters, and other non-linear area. Provided tabulated data.

5. Proposed locations of stockpiled excavated material with height and size limits to maintain design surcharge loads.

6. Minimum lateral distance from the crest of slopes for vehicles and stockpiled excavated materials, in accordance with paragraph 1.04 –B, Shoring Influence Area

7. Anticipated difficulties and proposed resolutions and contingency measures including public safety and access protection requirements.

3.03 ENGINEERED SYSTEM WORKING DRAWINGS

A. Address the following in accordance with the Excavation Support Plan:

1. Details, arrangement and methods of assembly, method of disassembly of proposed system, and sequence of construction.

2. Method of supporting horizontal loading by bracing or tiebacks. Provide method details for preloading the bracing, preload values, and tieback loads.

3. Full excavation depth.

4. Loads on the support system for various stages of excavation, bracing, and/or tieback installation and removal and concrete and backfill placement.

5. Expected surcharge loads.

6. Maximum design load and duration to be carried by the various members of the support system.

7. The depth below the main excavation to which the support system is to be installed.

8. Existing Utilities and Facilities: After field verifying or exposing locations of existing utilities and facilities, revise Drawings to show actual locations of facilities and excavation supports, interference with proposed work, and measures proposed to overcome such interference.

9. Allowable shoring deflections.

10. Equipment used for installation.

3.04 UTILITY PROTECTION PLAN

Prepare utility protection plan by a professional engineer licensed in the State of California addressing the following topics:

1. Location of all utilities impacted by construction by type, size, and condition of use.

2. Methods to locate each and every utility.

3. List of utility owners and 24-hour emergency contact number.

4. Condition information, performance requirements, deformation tolerances, and setback tolerances of potentially impacted utilities, to be obtained the utility owners and confirm conformance to deformation tolerances specified herein for this project. Where more stringent the utility owners required deformation tolerances shall prevail.

5. Methods to support utilities to maintain deformation tolerances while in full operation. Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk.

6. Hours of planned shutdown of utilities, if planned with contingency measures or mitigations to satisfy requirements of the utility owner or impacted community.

7. Correspondence confirmation from all utilities that proposed plans meet utility’s approval.

3.05 MOVEMENT MONITORING PLAN

A. Prepare movement monitoring plan addressing following topics:

1. Survey control.

2. Location of monitoring points, including a map and schedule of points for excavations, slopes, shoring, existing utilities and existing structures. Include proposed monitoring frequency for approval by the Engineer and the City.

3. Plots of data trends.

4. Intervals between surveys.

5. Corrective measures, means and methods in the event of exceeding tolerances specified in Paragraph 1.04-A Article Definitions, Paragraph Positive Excavation Support.

B. Monitor movement of other facilities as directed by the Owner's Representative.

3.06 REMOVAL OF EXCAVATION SUPPORT

A. After work requiring temporary shoring is completed, remove all materials and components associated with the shoring, and remove from site.

B. Remove excavation support in a manner that will maintain support as excavation is backfilled.

C. Do not begin to remove excavation support until support can be removed without damage to existing facilities, completed Work, or adjacent property and work has been inspected.

D. Remove excavation support in a manner that does not leave voids in the backfill.

E. Dispose of excess materials and debris in a legal manner.

END OF SECTION

SECTION 317216 STEEL CASING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation for tunneling by jacked steel casing method for highway crossings and other shallow depth tunnels.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Storm Water Runoff Control for Pipelines (California): 015723.

B. General Concrete Construction: 030500.

C. Trenching, Backfilling, and Compacting: 312316.

D. HDPE Pipe, 20 Inches and Smaller: 402097

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit materials list showing material of casing with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM A36, A139, and A283 and AWWA C200.

C. Submit manufacturer's certificates of compliance with referenced pipe standards, e.g., ASTM A36, ASTM A139, and ASTM A283. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

D. Submit certificates of welding consumables used for shop and field welding.

E. Submit welding procedure specifications (WPS) and procedure qualification records (PQR) for each welding process and welder qualification records (WQR) for each welder and welding operator. Submit bend and tensile test coupons concurrently with welder qualification and procedure qualification records. Welding procedures shall be required for welds for pipe cylinders, casing joint welds, and grout coupling connections.

F. Submit shop drawings showing the method of preventing pipe flotation and how the concrete backfill will be terminated at the end of the tunnel.

G. Submit diameter, thickness, and class of steel casing.

H. Submit location of approach trench.

I. Submit schedule and method of tunnel construction. Include also approach trench backfill and pipe installation and backfill.

1.04 CODES AND STANDARDS AND TUNNEL CLASSIFICATION

The Owner has obtained from the California Division of Industrial Relations a classification for each bore. A copy of the classification is included in the Appendix of these specifications. It shall be the Contractor's responsibility to post the classification at the site and see that the work is done in conformance with the state requirements. It shall also be the Contractor's responsibility to call the required safety meeting with representatives from the State Division of Industrial Relations prior to beginning of construction of each bore.

1.05 SCHEDULING

If the pipeline is not installed within the casing as a continuous operation following completion of jacking, then bulkhead the portals and backfill the approach trenches and later reopen them for pipe installation.

1.06 JURISDICTION

A. Comply with the applicable regulations of 29CFR 1926, Subpart S, "Underground Construction, Caisson, Cofferdams, and Compressed Air" as amended.

B. For casing pipe crossing under roadways, railroads, or other installations not within the jurisdiction of the Owner, comply with regulations and permit requirements of said authority.

1.07 INSPECTION

Perform work in the presence of the Owner’s Representative unless the Owner’s Representative has granted prior approval to perform such work in its absence.

PART 2 - MATERIALS

2.01 STEEL CASING

A. Fabrication of casing shall be in accordance with AWWA C200, as modified below. Casing material shall conform to ASTM A283, Grade C; ASTM A139, Grade B; or ASTM A36. Obtain minimum diameter and wall thickness from drawings. The Contractor may select a greater thickness and diameter to accommodate the method of work, loadings involved, the site and possible interferences, but at no additional cost to Owner.

B. Join casing sections by butt-welding in the field. Prepare ends of casings for welding in accordance with the submitted welding procedure.

2.02 CASING SPACERS

Casing spacers shall be bolt-on style with a shell made in two sections of Type 304 stainless steel. Connecting flanges shall be ribbed. The shell shall be lined with a PVC liner 0.090 inch thick with 85-90 durometer. Nuts and bolts shall be 18-8 stainless steel. Construct runners of ultra high molecular weight polymer. Support runners by risers made of Type 304 stainless steel. Weld the supports to the shell, and passivate the welds. Casing spacers shall be Cascade Waterworks Mfg. Co., PSI, APS, or equal.

2.03 CASING SEALS

Casing seals shall be 1/8-inch-thick synthetic rubber, designed to fit snugly around pipe and casing. Casing seals shall be one piece with no field seams. Bands and hardware for attachment to pipe and casing outside diameter shall be stainless steel. Products: PSI or equal.

2.04 SAND BACKFILL

Sand shall comply with the requirements of 26-1.02G of the Standard Specifications.

2.05 BENTONITE

Bentonite shall be a commercially processed powdered bentonite, Wyoming type, such as Immacco-gel, Black Hills, or Big Horn Brand, as distributed by Industrial Mineral and Chemical Company, 7275 Reese Road, Florin, California; Los Angeles Chemical Company, 4545 Ardine, South Gate, California; Brumley-Donaldson Company, 3050 Slauson Avenue, Huntington Park, California; or equal.

PART 3 - EXECUTION

3.01 FABRICATION, ASSEMBLY, AND ERECTION

A. Beveled ends for butt-welding shall conform to ASME B16.25. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding. When welding the reverse side, chip out slag before welding.

B. The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inch)	**Minimum Number of Passes for Welds**
Less than 0.1875	1
0.1875 through 0.25	2
Greater than 0.25	3

C. Welds shall be full penetration, except that partial-penetration butt-welds, where used, shall develop the full compressive and tensile strength of the mating plates.

D. Use the shielded metal arc welding (SMAW) submerged arc welding (SAW), flux-cored arc welding (FCAW), or gas-metal arc welding (GMAW) process for shop welding. Use the SMAW process for field welding.

E. Prepare edges of plate to be butt-welded. Butt-weld all joints.

F. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a power-driven wire brush.

G. Welding electrodes shall comply with AWS A5.1.

3.02 SECTIONAL SHIELD OR JACKING HEAD

Fit a sectional shield or steel jacking head to the leading section of the casing to extend around the outer surface of the upper two-thirds of the casing and project at least 18 inches beyond the driving end of the casing but do not protrude more than 1/2 inch outside of the outer casing surface. Anchor the head to prevent wobble or alignment variation during the jacking operation. To avoid causing a collapse of ground outside the casing, carry out excavation entirely within the jacking head and not in advance of the head.

3.03 JACKING PIT

A. Place in the approach trench or jacking pit and firmly bed on the required line and grade guide rails, structural steel, or concrete cradle of sufficient length to provide accurate control of jacking alignment. Provide space to permit the insertion of the lengths of casing to be jacked. Anchor the guide rails and structural steel sections to ensure action of the jacks in line with the axis of the casing. Interpose between the jacks and the end of the casing a bearing block consisting of a timber or structural steel framework constructed to provide uniform end bearing over the perimeter of the casing and distribute the jacking pressure evenly.

B. If utilities are required to be supported or relocated for construction of the jacking pits, include such cost in the bid.

3.04 CONTROL OF ALIGNMENT AND GRADE

Control the application of jacking pressure and excavation of material ahead of the casing as it advances to prevent the casing from becoming earthbound or deviating from required line and grade. Do not encroach upon the minimum annular space detailed. Restrict the excavation of material to the least clearance necessary to prevent binding in order to avoid causing a collapse of ground and consequent settlement or possible damage to overlying structures.

3.05 SAND BACKFILL

After placement of the pipe within the casing, construct a permanent bulkhead at each end of the casing or use casing seals and fill the intervening annular space between the pipe and the casing with sand, placed by a pneumatic gun. Refer to the drawings for locations of casings to be filled with sand.

3.06 CLOSING THE JACKING PIT

Seal the end of the casing with casing seals. After jacking equipment and muck from the tunnel have been removed from the approach trench or jacking pit, prepare the bottom of the jacking pit as a pipe foundation. Remove loose and disturbed material below pipe grade to undisturbed earth and recompact the material in accordance with Section 312316.

3.07 ALIGNMENT

The variation in the field position of the casing from the line and grade as indicated in the drawings shall be limited to 1 inch in lateral alignment and 1/4 inch in vertical grade providing that, in the case of gravity flow pipes, the final grade of the flow line shall be in the indicated direction.

END OF SECTION

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SECTION 321216 ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of asphalt concrete pavement, aggregate base course, herbicide, prime coat, tack coat, seal coat, striping paint, and pavement markers.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Earthwork: 312300.

B. Trenching, Backfilling, and Compacting: 312316.

C. Concrete Curbs, Gutters, and Sidewalks: 321613.

1.03 SUBMITTALS

A. Submit shop drawings per Section 013300.

B. Submit report from a testing laboratory verifying that aggregate material contains less than 0.25% asbestos by weight or volume and conforms to the specified gradations or characteristics.

C. Submit manufacturer's certificate of compliance or product literature for the following materials:

1. Aggregate: Gradation.

2. Asphalt for Binder: Type and grade.

3. Prime Coat: Type and grade of asphalt.

4. Tack Coat: Type and grade of asphalt.

5. Seal Coat: Type and grade of asphalt.

6. Mixes: Conforms to job-mix formula.

7. Herbicide.

8. Paint for traffic and parking lot striping.

9. Pavement markers.

1.04 TESTING FOR COMPACTION

The Owner will test for compaction as described in Section 312300.

1.05 STANDARD SPECIFICATIONS

Wherever reference is made to the State Specifications and Plans, such reference shall mean the City of San Luis Obispo Standard Specifications dated 2018.

PART 2 - MATERIALS

2.01 ASPHALT CONCRETE PAVING

Asphalt concrete paving shall conform to Type A or B in Section 39 of the Caltrans Standard Specifications, having 1/2-inch-maximum medium grading and PG 64-10 asphalt per Section 92 in the Caltrans Standard Specifications.

2.02 AGGREGATE BASE COURSE

Aggregate base shall be Class 2 aggregate base, 3/4-inch-maximum size per Section 26 of the Caltrans Standard Specifications. Aggregate shall contain less than 0.25% asbestos by weight or volume.

2.03 PRIME COAT

All areas to be paved shall receive prime coat. Prime coat shall be per Section 39-4.02 in the Caltrans Standard Specifications.

2.04 TACK COAT

Tack coat shall conform with Section 94, Grade SC-70 or MC-250 in the Caltrans Standard Specifications.

2.05 ASPHALT

Asphalt shall be Performance Grade PG 64-10 per Section 92 in the Caltrans Standard Specifications.

2.06 AGGREGATE FOR ASPHALT CONCRETE

Aggregate shall be Type B per Section 39-2.02 in the Caltrans Standard Specifications. Aggregate shall contain less than 0.25% asbestos by weight or volume.

2.07 SEAL COAT

Seal coat shall be Type II slurry seal per Section 37 of the Caltrans Standard Specifications or fog type per Section 37 of the Caltrans Standard Specifications.

2.08 WOOD HEADERS

Size of wood headers shall be 2 inches by the depth of the asphalt concrete paving; minimum size shall be 2 inches by 4 inches. Wood shall be Douglas fir No. 1. Wood shall comply with Section 57 of the Caltrans Standard Specifications.

2.09 HERBICIDE OR WEED KILLER

Use Gallery (Isoxaben) or Surflan (Oryzalin) by Dow AgroSciences, Pre-M (Pendimethalin) by American Cyanamid Co., or equal.

2.10 PAINT FOR TRAFFIC AND PARKING LOT STRIPING AND MARKING

Provide thermoplastic paint per Section 84 of the Caltrans Standard Specifications.

2.11 PAVEMENT MARKERS

Markers shall be per Section 85 of the Caltrans Standard Specifications.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Initially cut asphalt concrete pavement with pneumatic pavement cutter or other equipment at the limits of the excavation and remove the pavement. After backfilling the excavation, saw cut asphalt concrete pavement to a minimum depth of 2 inches at a point not less than 9 inches outside the limits of the excavation or the previous pavement cut, whichever is greater, and remove the additional pavement.

B. Saw cut concrete pavement, including cross gutters, curbs and gutters, sidewalks, and driveways, to a minimum depth of 1 1/2 inches at a point 1 foot beyond the edge of the excavation and remove the pavement. The concrete pavement may initially be cut at the limits of the excavation by other methods prior to removal and the saw cut made after backfilling the excavation. If the saw cut falls within 3 feet of a concrete joint or pavement edge, remove the concrete to the joint or edge.

C. Make arrangements for and dispose of the removed pavement.

D. Final pavement saw cuts shall be straight along both sides of trenches, parallel to the pipeline alignment, and provide clean, solid, vertical faces free from loose material. Saw cut and remove damaged or disturbed adjoining pavement. Saw cuts shall be parallel to the pipeline alignment or the roadway centerline or perpendicular to same.

3.02 PAVEMENT REPLACEMENT

A. The pavement replacement shall be as shown in the drawings:

3.03 INSTALLATION

Producing, hauling, placing, compacting, and finishing of asphalt concrete shall conform to Section 39 of the Caltrans Standard Specifications. Apply seal coat to all paving except open asphalt concrete.

3.04 CONNECTIONS WITH EXISTING PAVEMENT

Where new paving joins existing paving, chip the existing surfaces 12 inches back from the joint line so that there will be sufficient depth to provide a minimum of 1 inch of asphalt concrete. Dispose of waste material offsite. Tack chipped areas prior to placing the asphalt concrete. Meet lines shall be straight and the edges vertical. Paint the edges of meet line cuts with liquid asphalt or emulsified asphalt prior to placing asphalt concrete. After placing the asphalt concrete, seal the meet line by painting with a liquid asphalt or emulsified asphalt and then immediately cover with clean, dry sand.

3.05 PREPARATION OF SUBGRADE

A. Remove soft material disclosed by the subgrade preparation, replace with aggregate base course material, and recompact.

B. Compact the top 12 inches of subgrade to 95% relative compaction.

C. The finished subgrade shall be within a tolerance of ±0.08 of a foot of the grade and cross-section shown and shall be smooth and free from irregularities and at the specified relative compaction.

3.06 INSTALLING WOOD HEADERS

Provide wood header at edges of paving except where paving is adjacent to concrete slabs, gutters, walks, existing paving, or structures.

3.07 PLACING AGGREGATE BASE COURSE

Place aggregate base course to a minimum thickness of 12 inches, unless shown otherwise in the drawings. Compact to 95% relative compaction. Install in accordance with Section 26 of the Caltrans Standard Specifications.

3.08 COMPACTION OF AGGREGATE BASE AND LEVELING COURSES

Compaction and rolling shall begin at the outer edges of the surfacing and continue toward the center. Apply water uniformly throughout the material to provide moisture for obtaining the specified compaction. Compact each layer to the specified relative compaction before placing the next layer.

3.09 APPLYING HERBICIDE OR WEED KILLER

Apply weed killer or herbicide on base prior to placing pavement. Apply herbicide along with water at the rate recommended by the manufacturer to control dawny brome grass, puncture vine, and plaintain. Apply from outside of curb to opposite outside of curb and for the full width of roadways and parking areas.

3.10 PLACING PRIME COAT

Apply prime coat to the surface of the leveling course of aggregate base at the rate of 0.25 gallon per square yard per Section 39-4.02 in the Caltrans Standard Specifications.

3.11 PLACING TACK COAT

Apply tack coat on surfaces to receive finish pavement per Section 39-4.02 in the Caltrans Standard Specifications. Apply tack coat to metal or concrete surfaces that will be in contact with the asphalt concrete paving.

3.12 PLACING ASPHALT PAVING

Place asphalt paving to the minimum thickness shown in the drawings. Install in accordance with Section 39-6 in the Caltrans Standard Specifications.

3.13 COMPACTION OF ASPHALT CONCRETE PAVING

Compact until roller marks are eliminated and a density of 92% minimum to 98% maximum has been attained per ASTM D2041.

3.14 APPLYING SEAL COAT

Apply fog-type seal coat at the rate of 0.05 to 0.10 gallon per square yard or slurry seal coat at the rate of 10 to 15 pounds of dry aggregate per square yard.

3.15 SURFACE TOLERANCE

A. Finished grade shall not deviate more than 0.02 foot in elevation from the grade indicated in the drawings. Slopes shall not vary more than 1/4 inch in 10 feet from the slopes shown in the drawings.

B. After paving has been installed and compacted, spray water over the entire paved area. Correct any areas where water collects and does not drain away.

3.16 APPLYING PAINT FOR TRAFFIC AND PARKING LOT STRIPING AND MARKING

Apply in accordance with Section 84 of the Caltrans Standard Specifications.

3.17 INSTALLING PAVEMENT MARKERS

A. After the application of pavement striping and markings, install markers on new paved surfaces and existing surfaces that were damaged by the construction. Install in accordance with Section 85 of the Caltrans Standard Specifications.

B. Use markers that are reflective and match the color or combination of colors of existing markers within the area of work. Install markers along the alignment and match spacing of the existing.

END OF SECTION

SECTION 321613 CONCRETE CURBS, GUTTERS, AND SIDEWALKS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of concrete curbs, gutters, and sidewalks.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Earthwork: 312300.

1.03 SUBMITTALS

Submit a report from a testing laboratory verifying that crushed rock and aggregate material is asbestos free and conforms to the specified gradations or characteristics.

1.04 TESTING FOR COMPACTION

A. The Owner will test for compaction as described in Section 312300.

1.05 STANDARD SPECIFICATIONS

Wherever reference is made to the State Specifications and Plans, such reference shall mean the City of San Luis Obispo Standard Specifications dated 2018.

PART 2 - MATERIALS

2.01 FORMS

A. Forms shall conform to the requirements of Section 030500. Provide stakes and bracing materials to hold forms securely in place.

B. Materials for sidewalk forms shall be 2-inch dressed lumber straight and free from defects, or standard metal forms. Where short-radius forms are required, 1-inch dressed lumber or plywood may be used. Provide stakes and bracing materials to hold forms securely in place.

2.02 CRUSHED ROCK BASE

Clean 3/4-inch and smaller crushed rock or crushed gravel, free from foreign material and, asbestos free, and conforming to Class 2R or aggregate base per Section 26, City of San Luis Obispo Standard Specifications Class 3.

2.03 EXPANSION JOINT FILLER

Expansion joint filler shall be 1/2 inch thick for curbs and 1/4 inch thick for sidewalks and shall conform to premolded joint filler in Section 030500.

2.04 CONCRETE

Concrete shall be Class A per Section 030500, except that the maximum water-cement ratio for concrete in curbs and gutters shall be 0.55.

2.05 REINFORCING STEEL

Conform to Section 030500.

2.06 CURING COMPOUND

Curing compound shall be as specified in Section 030500.

2.07 EXCAVATION AND BACKFILL

Conform to Section 312300.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

Excavate and shape subgrade to line, grade, and cross-section. Compact subgrade until the top 12 inches are compacted to 90% relative compaction. Remove all soft material disclosed by compacting and replace with crushed rock base. The finished subgrade shall be within a tolerance of ±0.08 of a foot of the grade and cross-section shown and shall be smooth and free from irregularities at the specified relative compaction. The subgrade shall be considered to extend over the full width of the base course.

3.02 PLACING CRUSHED ROCK BASE

After the subgrade for curbs, sidewalks, and roadway slabs is compacted and at the proper grade, spread crushed rock base material. Sprinkle with water and compact. Top of the compacted gravel shall be at the proper level to receive the concrete. Compact crushed rock base to 90% relative density. Curbs and sidewalks shall receive 6 inches or more of compacted crushed rock base material.

3.03 SETTING FORMS

A. Conform to Section 030500.

B. Forms on the face of the curb shall not have any horizontal joints within 7 inches of the top of the curb. Brace forms to prevent change of shape of movement in any direction resulting from the weight of the concrete during placement. Construct short-radius

curved forms to exact radius. Tops of forms shall not depart from gradeline more than 1/8 inch when checked with a 10-foot straightedge. Alignment of straight sections shall not vary more than 1/8 inch in 10 feet.

3.04 CURB CONSTRUCTION

A. Construct curbs to line and grade shown. Curbs shall conform to the details shown.

B. Construct ramps in accordance with the details and locations as shown in the drawings.

C. Place preformed asphalt-impregnated expansion joints at intervals not exceeding 100 feet or less than 20 feet, at the beginning and end of curved portions of the curb, at each change in thickness in section, at the end of curbs at buildings and other structures, and at connections to existing curbs.

D. Place contraction joints in the curb at uniform intervals not exceeding 20 feet. Contraction joints shall be of the open-joint type. Construct by inserting a thin, oiled steel sheet vertically in the fresh concrete to force coarse aggregate away from the joint. Insert the steel sheet the full depth of the curb. After initial set has occurred in the concrete and prior to removing the front curb form, remove the steel sheet with a sawing motion. Finish top of curb with a steel trowel and finish edges with a steel edging tool.

E. As soon as the concrete has set sufficiently to support its own weight, remove the front form and finish exposed surfaces. Finish formed face by rubbing with a burlap sack or similar device that will produce a uniformly textured surface, free of form marks, honeycomb, and other defects. Remove and replace defective concrete at the Contractor's expense. Upon completion of the finishing, apply curing compound to exposed surfaces of the curb. Curing shall continue for a minimum of five days.

F. Upon completion of the curing period, but not before seven days have elapsed since pouring the concrete, backfill the curb with earth free from rocks 2 inches and larger and other foreign material. Tamp backfill firmly in place.

G. Finished curb shall present a uniform appearance for both grade and alignment. Remove any section of curb showing abrupt changes in alignment or grade or that is more than 1/4 inch away from its location as staked and construct new curb in its place at no additional cost to the Owner.

3.05 SIDEWALK CONSTRUCTION

A. Sidewalks shall be 4 inches thick in walk areas and 6 inches thick in driveway areas, unless otherwise shown in the drawings. Walks shall slope 1/4 inch per foot away from structures, unless otherwise shown in the drawings.

B. At locations where the new sidewalk is to abut existing concrete, saw concrete for a depth of 2 inches, chip the old concrete down to sound material and a plane surface, clean the surface, and apply a neat cement paste just prior to pouring the new sidewalk.

C. Place preformed asphalt expansion joints at intervals not exceeding 100 feet, where the sidewalk ends at a curb, and around posts, poles, or other objects protruding through the sidewalk. Place expansion joints between sidewalks and buildings or other structures.

D. Place preformed asphalt expansion joint material between back of curbs and sidewalks.

E. Provide contraction joints transversely to the walks at locations opposite the contraction joints in the curb and at intervals along the sidewalk such that the distance between contraction joints does not exceed 1.5 times the sidewalk width. These joints shall be 3/16 inch by one-fourth of the slab thickness weakened plane joints. They shall be straight and at right angles to the surface of the walk.

F. Place, process, finish, and cure concrete in conformance with Section 030500.

G. Broom the surface with a fine-hair broom at right angles to the length of the walk and tool at all edges, joints, and markings. Mark the walks transversely at 5-foot intervals with a jointing tool. Upon completion of the finishing, apply a curing compound to exposed surfaces. Protect the sidewalk from damage.

H. Finished sidewalk shall present a uniform appearance for both grade and alignment. Remove any section of sidewalk showing abrupt changes in alignment or grade or that is more than 2 inches away from its location as shown in the drawings and construct new sidewalk in its place at no additional cost to the Owner.

END OF SECTION

SECTION 323112 STEEL CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of galvanized steel chain link fence and gates, top rail and bottom tension wire.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's descriptive literature and drawings of fence and gate installation.

C. Submit manufacturer's certificate or original shipping tags showing compliance with cited U.S. Federal and ASTM specifications.

PART 2 - MATERIALS

2.01 GALVANIZED CHAIN LINK FABRIC

A. Fabric height shall be 72 inches unless otherwise shown in the drawings.

B. ASTM A392, Class 1; or U.S. Federal Specification RR-F-191/1D, Type I; 1.2 ounces per square foot zinc coating, hot-dip galvanized after weaving, 2-inch diamond mesh, 11-gauge steel wire for height 60 inches or less, 9 gauge for height over 60 inches.

C. Top and bottom selvage knuckled.

D. Tie wire shall be same material and gauge as the chain link fabric.

2.02 GALVANIZED POSTS AND BRACES

A. Steel Pipe: ASTM F1083. Galvanize 1.8 ounces per square foot.

B. Provide posts and braces in compliance with the over 6-foot classification of U.S. Federal Specification RR-F-191/3D, as follows:

1. End, Corner, and Pull Posts: 2-1/2-inch steel pipe, 5.79 pounds per linear foot.

2. Line Posts: 2-inch steel pipe, 3.65 pounds per linear foot.

3. Gateposts for up to 6-Foot Leaf Width Gate: 2 1/2-inches, 5.79 pounds per linear foot.

4. Gatepost for 6-foot Leaf Width Gate: 3 1/2-inches, 9.1 pounds per linear foot.

C. Alternatively, provide steel pipe, posts, and braces as follows:

Steel pipe shall conform to ASTM A1011 or A653, cold-formed, electric welded, minimum yield strength of 50,000 psi. Provide posts and braces with Type A galvanized coating or Type B coating (hot-dipped zinc primer, chromate intermediate, and clear UV-resistant acrylic finish coat) in compliance with ASTM F1043 for heavy industrial fence, Group IA pipe or Group II rolled shapes as follows:

1. End, Corner, and Pull Posts: 3-inch (outside diameter) steel pipe, 4.64 pounds per linear foot.

2. Line Posts: 3-inch (outside diameter) steel pipe, 3.12 pounds per linear foot.

3. Gateposts for up to 6-Foot Leaf Width Gate: 3 inches (outside diameter), 4.64 pounds per linear foot.

4. Gatepost for 6- to 13-Foot Leaf width Gate: 4 inches (outside diameter), 6.56 pounds per linear foot.

D. Post Brace Assembly: At gateposts and end posts and at each side of corner and pull posts, place a horizontal compression brace to the next post at mid-height of fabric. Truss the two posts together with a diagonal tension rod. Use 1-1/4-inch minimum pipe for the horizontal brace and 3/8-inch (nominal, 5/16-inch true) diameter adjustable diagonal truss rod.

E. Length of Posts Into Footing: At line posts for fabric height of less than 72 inches, provide 30 inches. At line posts for fabric height of 72 inches and more, provide 30 inches. At end, corner, and pull posts, provide 6 inches more than at line posts. At gateposts, provide 12 inches more than at line posts. In solid rock, the portion of the depth of footing that is in solid rock may be reduced to one-half of the above lengths.

F. Fence posts on top of wall shall be removable, as shown in the plans.

2.03 GALVANIZED HARDWARE

Comply with U.S. Federal Specification RR-F-191/4D or ASTM F626 and the following:

A. Caps: Weathertight caps on exposed ends of tubular members.

B. Tension Wires: 7-gauge galvanized steel coil spring steel.

C. Tension or Stretcher Bars: One piece, 2 inches less than fabric height, 3/16 inch by 3/4 inch. Provide one bar for each gatepost and end post and two for each corner and pull post.

2.04 GALVANIZED GATES

A. Provide gates in accordance with ASTM F900, except as modified.

B. Tubular Perimeter Members: Provide 2-inch pipe, 3.65 pounds per linear foot. Provide intermediate vertical member for width over 8 feet and intermediate horizontal member for width over 10 feet. Assemble frame by welding or with malleable or pressed steel corner fittings, riveted for rigid connection. Provide fabric and barbed wire as for fence. Use stretcher bars at vertical edges and optional at top and bottom edges. Diagonal cross bracing of 3/8-inch (nominal, 5/16-inch true) diameter adjustable truss rods. Form anticlimb extension by extending vertical members 12 inches above fabric. Provide hinged gates to swing through 90 degrees from closed to open.

C. Gate Hardware:

1. Hinges: Provide pressed or forged steel or malleable iron, nonlift-off type, one and one-half pairs for each leaf over 6 feet high.

2. Latch: Provide forked type or plunger-bar type for operation from either side, with padlock eye as integral part.

3. Cane Bolt: Provide one 24-inch-long cane bolt at each leaf more than 4 feet 0 inches wide.

2.05 FILLER STRIPS

Fiberglass filler strips for diagonal installation into chain link fence shall be fabricated from large sheets of a durable, semirigid fiberglass-reinforced polyester resin, pigments, and acrylic modifier for protection against sunlight. Strips are to be 1.77 inches wide by 8 feet long, with a nominal thickness of 0.060 inch. Color shall be dark green.

2.06 CONCRETE

Five, 94-pound sacks of portland cement per cubic yard. Do not use accelerating admixtures.

PART 3 - EXECUTION

3.01 PREPARATION FOR INSTALLATION

Clear the line of the fence and dispose of resulting material. Grade between post centers, excavate high spots, and fill low spots so bottom of fabric will be between 1 and 2 inches above finished grade.

3.02 INSTALLATION

Install in accordance with ASTM F567, except as modified herein.

3.03 SETTING POSTS

A. Space line posts uniformly at maximum intervals of 8 feet between gateposts and corner posts.

B. Excavate postholes so concrete will be 3 inches below and around metal posts, except that minimum diameter of concrete footing for end, corner, pull, and gateposts is 12 inches. In solid rock, diameters may be reduced to post outside diameter plus 3 inches.

C. Set posts plumb to within 1/4 inch of the post vertical centerline.

D. Fill postholes with concrete to 2 inches above finish grade and crown to slope away from post. In solid rock, emplace posts with a grout of one part portland cement to three parts sand, with sufficient water for workability.

3.04 INSTALLING FABRIC

A. Place fabric on security side of fence. Place tension bands on side opposite fabric side and peen bolt ends or score threads.

B. Tie fabric to line posts and clip tension bar to end, corner, pull, and gateposts at 15-inch intervals. Tie fabric to tension wires or weave tension wires through fabric at 24-inch intervals. Gauge of tie wire equal to gauge of fabric. Tie tension wires to line posts with 6-gauge wire. Twist tie wires two full turns and bend back edges to reduce hazard.

C. Join rolls of fabric by weaving a single strand into ends of the rolls to form a continuous mesh.

3.05 INSTALLING FILLER STRIPS

Starting at one end of a run of fence, insert strips into the "tunnel like" rows in the fence fabric. Continue until the entire height of a section of fence is completed.

END OF SECTION

SECTION 330130 LEAKAGE AND INFILTRATION TESTING

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes testing of gravity pipelines, sewers, culverts, drains, and manholes not intended to be pressurized in excess of 5 psi or 12 feet head of water. Leakage test is by internal air pressure or water. Infiltration test is by measurement of rate of flow of water.

PART 2 - MATERIALS

2.01 TEST PLUGS

Inflatable and expandable type, braced to contain 5 psi over the pipe cross-section area.

2.02 PRESSURE-RELIEF VALVE

Set to limit the internal pipe test pressure to 5 psi.

PART 3 - EXECUTION

3.01 PREPARATION OF THE PIPELINE

A. Prior to testing, flush and clean the pipeline to wet the pipe surface and clean out debris.

B. Plug pipe outlets, including stoppers in laterals, to resist the leakage test pressure.

3.02 LEAKAGE TEST

A. Test for leakage by means of an air test. Test each section of pipe between manholes.

B. Test each section of pipe subsequent to the last backfill compacting operation.

3.03 AIR TEST

A. Conduct air tests per the following standards:

Pipe Material	Specification Section	ASTM Specification
HDPE		F1417, Table 1

B. Test each section of pipe between two successive manholes by plugging pipe outlets with test plugs. Add air slowly until the internal pressure is raised to 4.0 psig. The

compressor used to add air to the pipe shall have a blowoff valve set at 5 psig so that the internal pressure in the pipe never exceeds 5 psig. Maintain the internal pressure of 4 psig for at least two minutes to allow the air temperature to stabilize, then disconnect the air supply and allow the pressure to decrease to 3.5 psig. Measure the time in minutes that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig. Compare the results with the values tabulated in the referenced ASTM specifications in paragraph A above.

C. If the pressure drop from 3.5 psig to 2.5 psig occurs in less time than the specified values, overhaul the pipe and, if necessary, replace and re-lay the pipe until the joints and pipe hold satisfactorily under this test.

D. Guard against the sudden expulsion of a poorly installed plug or a plug that is partially deflated.

3.04 TEST FOR INFILTRATION

A. If, in the construction of a section of the sewer between structures, excessive groundwater is encountered, close the end of the pipe at the upper structure sufficiently to prevent the entrance of water. Discontinue pumping groundwater for at least three days. Then test the section for infiltration. The infiltration shall not exceed 0.025 gpm per inch of diameter per 1,000 feet of main line pipe being tested as measured at the downstream structure. Test period shall be at least eight hours.

B. Where infiltration exceeds the maximum acceptable, immediately uncover the pipe and reduce the infiltration to within the maximum acceptable by replacing, re-laying, or encasing the pipe in concrete.

3.05 MANHOLE TEST

A. Manholes shall be tested per the vacuum method per ASTM C1244.

1. Test each manhole immediately after assembling the precast manhole segments together and prior to backfilling. If the manhole fails this initial test, make repairs to any cracks or other sources of leaks. Cracks longer than 2 inches shall be cause for rejection of the entire manhole segment or casting, and no patching shall be allowed in such segments.

2. Plug lift holes with grout. Do not place grout in the circumferential manhole joints containing the butyl rubber sealing compound before testing; see Sections 034210. Plug pipes entering the manholes, and securely brace the plugs from being drawn into the manhole.

3. Test each manhole a second time for final acceptance after backfilling in order to assure that the backfill operation did not damage the manhole. Retest any manholes that were damaged or moved during final grading and paving.

3.06 CORRECTION OF OBSERVED LEAKS

Even though the infiltration is less than the maximum acceptable, stop any individual leaks that may be observed.

3.07 INSPECTION BY CONTRACTOR FOR DAMAGED OR DEFECTIVE PIPE IN PLACE

A. After backfilling and pavement replacement is complete and upon completion of the air test or infiltration test, inspect the pipe for damage and other defects by means of closed circuit television (CCTV). Television inspection shall be in accordance with the Standard Specifications City of San Luis Obispo.

B. Schedule the inspection in advance with the Owner's Representative.

C. If the CCTV inspection indicates any defects, excavate and repair or replace the faulty materials and construction and restore the work and the damage to work of others.

END OF SECTION

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SECTION 330522 DIRECTIONAL BORING OF PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of high-density polyethylene pipe (HDPE) by the directional boring method.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Trenching, Backfilling, and Compacting: 312316.

B. General Piping Requirements: 400500.

C. Pressure Testing of Piping: 400515.

D. HDPE Pipe, 20 Inches and Smaller: 402097.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit list and description of materials and equipment to be used.

C. Submit a boring plan that outlines work to be done. Proposed profiles can be changed to include lengthening of the siphon as needed, as well as modifications to the proposed manhole locations. The plan shall include, but not be limited to, drawings showing proposed methods of construction including location of receiving and sending pits., a proposed sequence of construction, proposed pressure testing location for pipe before directional boring, and calculations.

D. Submit an accurate record of the crossing location in plan view and profile depth. Record all changes on the contract drawings as work progresses.

E. Calculations signed and sealed by a professional engineer licensed in the state of California demonstrating a sufficient factor of safety for the pipe sizing (dimension ratio), against failure due to buckling and tension forces during pipe pullback, considering the materials and equipment to be used.

PART 2 - MATERIALS

2.01 HIGH-DENSITY POLYETHYLENE PIPE (HDPE)

The Contractor shall work with a California licensed professional engineer to determine the wall thickness sufficient for directional boring of the pipe. See Section 402097 for additional information.

2.02 BOLTS AND NUTS FOR FLANGED CONNECTIONS

See Section 400500.

2.03 DRILLING FLUID

Drilling fluid shall be bentonite and water or a combination of bentonite and polymers and water formulated to move cuttings to the surface and lubricate the pipe during pullback.

2.04 DRILL PIPE

Drill pipe shall be steel with sufficient strength to withstand the maximum rated pullback and pushing load of the drilling equipment. Drill pipe joints shall be flush and capable of transmitting maximum rated torque of the drilling equipment.

2.05 DRILLING EQUIPMENT

A. Drilling equipment shall have a maximum sound power level of 80 dBA (as defined in ANSI S1.4) at 10 feet when operating within 100 feet of a residential unit. Measure sound power level in accordance with ISO 3740 and 3744.

B. Mixing, pumping, and holding/separation tanks shall be capable of delivering mixed drilling fluid to the cutting head. Drilling fluids circulating equipment shall be designed to minimize spillage.

2.06 DOWNHOLE TOOLS

A. Cutting heads, backreamers, and hole openers shall be suitable for the soil and rock conditions anticipated by the Contractor.

B. Grips, pulling heads, and swivels shall be compatible with the pipe material. Design to transmit without distortion the maximum rated pullback force of the equipment used. Grips, pulling heads, and swivels shall be specifically engineered for directional drilling applications.

C. Tracking equipment shall be capable of determining the location of the cutting head at depth within ±3 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install the pipe in a manner that does not cause upheaval, settlement, cracking, movement, or distortion of the surface material including the channel bottom.

B. Locate the entrance and exit pits to be within the Owner's right-of-way and temporary construction easements.

3.02 TRENCHING AND EARTHWORK

Accomplish trenching and earthwork in accordance with Section 312316.

3.03 PIPE JOINING

A. HDPE Pipe: See Section 402097.

B. Where the staging area permits, join entire length of pipe to be pulled through bore prior to commencement of pullback operation. If not feasible because of the length of the bore and the size of the staging area, each pipe section may be fused or welded to the previous section before the pull back. Support weight of joined pipe suspended on rollers to minimize pulling forces.

3.04 FLANGED CONNECTIONS

See Section 402097.

3.05 PRE-BORE AND POST-BORE PRESSURE TESTING

A. Prior to pulling the HDPE pipe through the directional bore hole, the pipe shall be pressure tested in accordance with Section 400515. Perform pressure testing again after final installation of the pipe and before final acceptance by the Owner.

B. At the Contractor's option, pipe need not be pressure tested before pulling the pipe through the bore hole. In such case, if the pipe does not pass the pressure test after installation, then remove the entire pipe from the bore hole, repair the pipe, and perform pressure testing prior to reinstalling the pipe and again after reinstallation.

C. The Owner's Representative will witness the pressure tests and shall be informed 48 hours in advance of pressure tests.

3.06 PILOT BORE

A. Construct a pilot bore at the centerline alignment and grade as shown in the drawings. Circulate drilling fluids to maintain an open bore at all times. If the path of the pilot bore is successfully completed, then proceed with the reaming procedure, and pull the pipe from the receiving location (exit pit) to the sending location (entry pit). If the pilot bore could not be successfully completed, then do not proceed with the reaming procedure until

the Owner, Owner's Representative, Engineer, and Contractor have met to discuss alternative options for the pipeline crossing. The pilot bore and reaming procedure shall be controlled by a magnetic survey system including accelerometers, magnetometers, connector wire, and survey probe. The guidance system shall be capable of measuring depth, location, pitch, and roll of the bore and shall be able to indicate depth up to 40 feet.

3.07 DRILLING FLUID CONTAINMENT AND DISPOSAL

Contain and dispose of the drilling mud in accordance with state and federal regulations and permit conditions. Install erosion and sedimentation control measures including straw bales to prevent drilling mud from inadvertently spilling out of the entrance/exit pit. Monitor drilling fluids at the surface to avoid excessive downhole pressures which may buckle the surface or the pipe during installation.

3.08 BACKREAMING BORE AND PIPE INSTALLATION

Upon completing the pilot bore, pull the drill pipe back through the bore using an oversized backreamer larger than the proposed pipe to be pulled back through the bore hole. Repeat backreaming as necessary to enlarge the bore to provide sufficient clearance for the pipe. Attach pulling head and swivel and pull pipe through with closed end. Pull pipe back in one continuous pull to avoid closure of the bore hole.

END OF SECTION

SECTION 331125 PREFABRICATED FRP WET WELL, VALVE BOX, AND PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

Contractor shall furnish all labor, materials, equipment and performance of all work necessary or incidental to furnish and install a simplex/duplex prefabricated fiberglass reinforced polyester (FRP) lift station. The lift station shall be a completely factory-assembled unit, requiring only minor adjustments and reassembly in the field.

The manufacturer shall demonstrate the ability to fabricate the various lift station components, as shown in the plans and as specified herein, utilizing adequate number of skilled workmen, equipment, tools, facilities, and subcontractors. The complete lift station shall be manufactured by Topp Industries, Inc. or pre-approved equal.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Motor Control Center: 262419.

B. Manual, Check, and Process Valves: 400520.

C. Ductile Iron Pipe: 402040.

D. Screw Centrifugal Pumps: 432132.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. The prefabricated FRP lift station manufacturer shall prepare shop drawings for the complete lift station including structural and opening details, equipment mounting and location details, and manufacturer's cut sheets for each item of equipment in the lift station. The main component of the submittals shall be an 8½" x 11" drawing of the complete prefabricated FRP lift station prepared by the manufacturer. Manufacturer's cut sheets shall indicate capacities, dimensions, and materials of construction for all equipment in the prefabricated FRP lift station.

1.04 REFERENCES

A. ASTM A36 (Latest Revision): Standard Specification for Structural Steel.

B. ASTM A283D (Latest Revision): Standard Specification for Structural Steel.

C. ASTM D883 (Latest Revision): Definitions of Terms Relating to Plastics.

D. ASTM D3753 (Latest Revision): Standard Specification for Glass-Fiber-Reinforced Polyester Manholes.

E. ANSI B16.1 (Latest Revision): Standard Specification for 125 lb. Standard Flat Face Cast Iron Flanges.

1.05 O&M MANUALS

The prefabricated FRP lift station supplier shall prepare a complete operations and maintenance (O&M) manual for the complete lift station. The O&M manual shall include routine maintenance requirements and spare parts lists for each major item of equipment in the lift station. The names and telephone numbers of companies where spare parts and/or trained service technicians are available shall also be included for each item of equipment.

1.06 DELIVERY AND HANDLING

The manufacturer of the prefabricated FRP lift station shall coordinate with the contractor so that the lift station is delivered to the jobsite on time for installation. Handling instructions shall be provided by the lift station manufacturer with the lift station to insure proper handling of the lift station structure. After delivery to the jobsite, the contractor shall store the motor control panel off the ground in a dry location until it is mounted and supplied with electrical service. The contractor shall also insure that all pump power and control cables, as well as float cables are protected from submergence until they are properly installed and sealed.

1.07 GUARANTEE

The prefabricated FRP lift station manufacturer shall guarantee the complete prefabricated FRP lift station to be free from defects in materials and workmanship for a period of one year from the date of delivery.

PART 2 - MATERIALS

2.01 FIBERGLASS REINFORCED POLYESTER WET WELL (AND INTEGRAL VALVE BOX)

Unless otherwise indicated the plastic terminology used in this specification shall be in accordance with the definitions given in American Society for Testing and Materials (ASTM) designations D883 - Definitions of Terms Relating to Plastics.

2.02 RESINS

The resins used shall be a commercial grade polyester and shall be evaluated as a laminate by test or determined by previous service to be acceptable for the intended environment. The resins used may contain the minimum amount of fillers or additives required to improve handling properties. Up to 5% by weight of thixotropic agent, which

will not interfere with visual inspection, may be added to the resin for viscosity control. Resins may contain pigments and dyes by agreement between manufacturer and engineer, recognizing that such additives may interfere with visual inspection of FRP laminate quality.

2.03 REINFORCED MATERIAL

The reinforcing material shall be a commercial grade of glass fiber (continuous strand, chopped-strand, continuous mat and non-continuous mat) having a coupling agent, which will provide a suitable bond between the glass reinforcement material and resin.

2.04 LAMINATE STRUCTURE

A. The FRP laminate shall consist of a resin rich inner surface: chop-spray interior liner and a chop-hoop filament-wound structural exterior layer.

B. Inner surface:

1. The resin rich inner surface shall be free of cracks and crazing with smooth finish and with an average of not over two (2) pits per square foot, providing the pits are less than 0.125 inches in diameter and 0.3125 inches in depth and are covered with sufficient resin to avoid exposure of any fiberglass reinforcement material. Some waviness shall be permissible as long as the surface is smooth. Between 0.01 to 0.02 inches of resin, rich surface shall be provided.

2. Chop-Spray Interior Liner: The interior liner shall be reinforced by 25 to 35% by weight of chopped strand glass fiber having fiber lengths from 0.5 to 2.0 inches. The chop-spray interior liner protects the chop-hoop filament-wound structural exterior liner from corrosion damage caused by “wicking” of the wet well liquid contents. A minimum of 0.100 inches of chop-spray interior liner shall be provided.

3. Chop-Hoop Filament-Wound Structural Exterior Layer: The structural reinforcement of the wet well shall be by the chop-hoop filament-wound manufacturing method only. The axial reinforcement shall be continuous-strand glass fiber. The longitudinal reinforcement shall be chopped-strand glass fiber. The glass fiber reinforcement content of the chop-hoop filament wound structural exterior layer shall be 50 to 80% by weight. The exterior surface of the wet well shall be relatively smooth with no exposed reinforcement fibers or sharp projections. Hand finish work is permissible to prevent reinforcement fiber exposure. The wall thickness of the chop-hoop filament-wound structural exterior layer shall vary with the wet well height to provide the aggregate strength necessary to meet the tensile and flexural physical properties requirements.

2.05 PHYSICAL PROPERTIES

A. Wet Well FRP Wall Laminate

The wet well FRP wall laminate must be designed to withstand wall collapse or buckling based on the following assumptions and third party specifications:

1. Hydrostatic Pressure of 62.4 lbs. per square foot

2. Saturated soil weight of 120 lbs. per cubic foot

3. Soil Modulus of 700 pounds per square foot

4. Pipe stiffness values as specified in ASTM D3753. The wet well FRP laminate must be constructed to withstand or exceed two times the assumed loading on any depth of the wet well.

B. Wet Well FRP Bottom Laminate

The wet well FRP bottom laminate shall have less than 0.375 inches of center elastic deflection (deformation) when in service in totally submerged conditions

C. FRP Laminate Surface Hardness

The finished FRP laminate will have a Barcol Hardness of at least 90% of the resin manufacturer’s specified hardness for the fully cured resin. The Barcol Hardness shall be the same for both interior and exterior surfaces.

D. Wet Well Top Flange

1. The wet well top flange shall have an outside diameter at least 4.0 inches greater than the inside diameter of the well.

2. A six-hole pattern shall accommodate the mounting of a cover with at least 0.375 inches in diameter 300 series stainless steel fasteners. Non-corroding stainless steel threaded inserts shall be fully encapsulated with noncontinuous mat or chopped-strand glass fiber reinforcement. The inserts shall have an offset tab to prevent stripping or spinning out when removing and reinserting cover fasteners

E. Steel Anti-Floatation Flange

The steel anti-floatation flange shall be constructed from 0.1875 inches thick ASTM A36 structural steel plate, encapsulated in at least 0.125 inches of chopped-strand glass fiber reinforcement on all sides. The steel anti-floatation flange shall be square with outside dimensions of at least 4.0 inches greater than the wet well inside diameter. The steel anti-floatation flange shall be attached to the wet well bottom with chopped-strand glass fiber reinforcement. Contractor shall place the wet well on a concrete pad and fill with grout covering the entire steel anti-floatation flange. The amount of grout shall be

sufficient to prevent floatation of the wet well based on the jobsite conditions. The steel anti-floatation flange shall not require bolt holes to secure it to the concrete pad.

F. Pump Quick Disconnect Mounting Studs

Shall be 300 series stainless steel threaded studs of at least 0.375 inches in diameter shall be used. The studs shall first be threaded into the 0.1875" inches thick ASTM A36 structural steel anti-floatation flange/bottom of the wet well and then welded into place. Once installed, the studs shall be sealed with at least two layers of noncontinuous glass fiber mat or chopped-strand glass fiber reinforcement.

G. Discharge Coupling

1¼" and 2" Systems: A 1¼” or 2” NPT full coupling full welded in the center of a 14 gauge steel plate, finished with black enamel, shall be factory installed with at least 0.375 inches in diameter 300 series stainless steel fasteners. The wet well wall penetrations shall be sealed with silicone sealer. Couplings are also available in 304 stainless steel material. (3" and 4" systems) A sufficient quantity and type of “Link-Seal” type modular, mechanical, inter-locking, synthetic rubber links shaped to continuously fill the annular space between the discharge pipe and the aluminum sleeve shall be used to provide a hydrostatic seal. The aluminum sleeve shall be bolted on the wet well or valve box wall and sealed with silicone sealer.

H. Electrical Coupling

An NPT full coupling full welded in the center of an 14 gauge steel plate, finished with black enamel, shall be factory installed with at least 0.375 inches in diameter 300 series stainless steel fasteners. The wet well wall penetrations shall be sealed with silicone sealer. Couplings are also available in 304 stainless steel material.

I. Inlet Hub

A 4” nominal pipe diameter thermoplastic pipe grommet shall be field installed by the contractor in a 5” diameter hole in the wet well wall. The pipe grommet shall provide a mechanical seal and shall not require any secondary sealing materials.

J. Float Bracket

Float bracket shall be fabricated from 300 series stainless steel with four compression style cord grips to maintain float level position. It shall be factory installed with at least 0.375 inches in diameter 300 series stainless steel fasteners. The wet well wall penetrations shall be sealed with silicone sealer.

K. Ventilation

Wet well ventilation shall comply with all applicable codes.

L. Slide Rail Assembly

The slide rail assembly shall include pump quick disconnect discharge elbow, sealing flange with rail guide, upper guiderail bracket, lifting cable and guiderails.

M. Pump Quick Disconnect Discharge Elbow

The pump quick disconnect (QDC) discharge elbow, made of cast iron, designed to mount directly on the wet well floor, shall be supplied for each pump. It shall have a standard ANSI B16.1 125 lb. flange, flat faced and drilled on the discharge side, with a machined mating pump connection. The design shall be such that connection between the pump and QDC is made without the need for any nuts, bolts or gaskets.

N. Sealing Flange with Rail Guide

The sealing flange with rail guide shall be mounted on each pump discharge. It shall have a machined mating flange, which matches the QDC discharge elbow. Sealing of this pump and discharge piping connection shall be accomplished by a simple linear downward motion of the pump along the guiderails culminating with the entire weight of the pumping unit supported by the QDC discharge elbow.

O. Upper Guiderail Bracket

The upper guiderail bracket, made from ASTM A283D structural steel, shall align and support the two guiderails at the top of the wet well. It shall bolt directly to the hatch frame (or aluminum upper guiderail bracket in wet wells with solid fiberglass covers) and incorporate a beveled stainless steel inserts for secure rail installation.

P. Lifting Cable

The lifting cable shall be 300 series stainless steel with a diameter of at least 3/16” and a nominal breaking strength of at least 2500 pounds.

Q. Guiderails

The guiderails shall be 1½ inch schedule 40 galvanized / stainless steel pipe. There shall be two guiderails per pump to insure proper alignment with the QDC discharge elbow and stationary piping.

R. Submersible Pumps

See Section 432132.

S. Motor Control Panel

See Section 262419.

T. Discharge Pipe and Fittings

See Section 402040.

U. Valves

See Section 400520.

V. Aluminum Hatch Cover

The wet well (and integral valvebox) cover shall be constructed of 0.250 inches thick mill finish aluminum diamond plate with 300 series stainless steel hardware. The access hatch shall have a recessed handle and locking pin. The hatch shall be held open in the vertical position by means of a hold open arm of corrosion resistant design. The cover shall be mounted to the wet well (and integral valvebox) with a least six 300 series stainless steel fasteners of at least 0.375 inches in diameter.

PART 3 - EXECUTION

3.01 LIFT STATION INSTALLATION

The prefabricated FRP lift station shall be installed by the contractor according to the lift station manufacturer's published instruction.

3.02 START-UP

The initial startup of the prefabricated FRP lift station shall be performed by a qualified factory representative of the lift station manufacturer. It shall be the responsibility of the factory representative to supervise the startup and instruct the owner's personnel in the proper operation and maintenance procedures for the entire prefabricated FRP lift station.

END OF SECTION

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SECTION 400500 GENERAL PIPING REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes the general requirements for selecting piping materials; selecting the associated bolts, nuts, and gaskets for flanges for the various piping services in the project; and miscellaneous piping items.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit affidavit of compliance with referenced standards (e.g., AWWA, ANSI, ASTM, etc.).

C. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.

D. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.

1.03 DEFINITIONS OF BURIED AND EXPOSED PIPING

A. Buried piping is piping buried in the soil, commencing at the wall or beneath the slab of a structure. Where a coating is specified, provide the coating up to the structure wall. Unless detailed otherwise, coating shall penetrate wall no less than 1 inch. Piping encased in concrete is considered to be buried. Do not coat encased pipe.

B. Exposed piping is piping in any of the following conditions or locations:

1. Above ground.

2. Inside buildings, vaults, or other structures.

3. In underground concrete trenches or galleries.

1.04 PIPING SERVICE

Piping service is determined by the fluid conveyed, regardless of the pipe designation. For example, pipes designated "Air Low Pressure," "Air High Pressure," and "Air" are all considered to be in air service.

PART 2 - MATERIALS

2.01 THREAD FORMING FOR STAINLESS STEEL BOLTS

Form threads by means of rolling, not cutting or grinding.

2.02 BOLTS AND NUTS FOR FLANGES FOR DUCTILE-IRON PIPING

A. Bolts and nuts for buried or submerged Class 125 or 150 flanges and Class 125 or 150 flanges located outdoors above ground or in vaults and structures shall be Type 304 stainless steel conforming to ASTM A193 (Grade B8) for bolts and ASTM A194 (Grade 8) for nuts.

B. Fit shall be Classes 2A and 2B per ASME B1.1 when connecting to cast-iron valves having body bolt holes.

C. Bolts used in flange insulation kits shall conform to ASTM A193 (Grade B7). Nuts shall conform to ASTM A194 (Grade 2H).

D. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.03 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

Lubricant shall be chloride free and shall be RAMCO TG-50, Anti-Seize by RAMCO, Specialty Lubricants Corporation Husky™ Lube O'Seal, or equal.

2.04 GASKETS FOR FLANGES FOR DUCTILE-IRON PIPING AND FITTINGS IN RAW SEWAGE, SLUDGE, AND SCUM SERVICE (SPECIFICATION SECTION 402040)

Gaskets shall be full face, 1/8-inch thick, Buna-N having a hardness of 55 to 65 durometer. Gaskets shall be suitable for a water pressure of 200 psi at a temperature of 250°F. Gaskets shall have "nominal" pipe size inside diameters not the inside diameters per ASME B16.21. Provide Garlock Style 9122 or equal.

2.05 THREADED CAPS FOR PROTECTION OF NUTS AND BOLT THREADS

Caps shall be high-density polyethylene, color black. The caps shall be filled with an anticorrosive lubricant to prevent nuts and bolts from rusting and corroding. Caps shall withstand temperatures from -40°F to 200°F. Caps shall be suitable to use in exposed, buried, and submerged service conditions. Products: Sap-Seal Products, Inc.; Advance Products and Systems, Inc., "Radolid"; or equal.

2.06 MOLDABLE FILLER TAPE FOR PIPE SURFACE TRANSITION AREAS

A. Filler tape shall be a 100% solids mastic-like butyl-rubber filler designed to fill and smooth the transition areas between adjacent coating surfaces such as step-down weld areas, surface irregularities beneath heat-shrink sleeves, pipefittings, and exothermic welds for cathodic protection bonding wire connections. Characteristics:

1. Thickness per ASTM D1000: 1/8 inch minimum.

2. Peel adhesion to primed pipe: 300 ounces per inch minimum.

3. Elongation: 600% minimum.

B. Products: Tapecoat “Moldable Sealant,” Polyken No. 939 Filler Tape, or equal.

2.07 FLANGE ISOLATION KIT

A. Flange isolation kit shall be Type “E” and include a full face gasket with the same outside diameter as the outside diameter of the flange.

PART 3 - EXECUTION

3.01 INSTALLING PIPE SPOOLS IN CONCRETE

Install pipes in walls and slabs before placing concrete. See Sections 030500 and 400762.

3.02 RAISED FACE AND FLAT FACE FLANGES

Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

3.03 INSTALLING ABOVEGROUND OR EXPOSED PIPING

A. Provide pipe hangers and supports as detailed in the drawings.

B. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment.

3.04 INSTALLING FLANGED PIPING

A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16 inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.

B. Inspect each gasket to verify that it is the correct size, material, and type for the specified service and that it is clean and undamaged. Examine bolts or studs, nuts, and washers for defects such as burrs or cracks and rust and replace as needed.

C. Clean flanges by wire brushing before installing flanged fittings. Clean flange bolts and nuts by wire brushing, lubricate carbon steel bolts with oil and graphite, and tighten nuts uniformly and progressively.

D. Bolt lengths shall extend completely through their nuts. Any that fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.

E. Do not use more than one gasket between contact faces in assembling a flanged joint.

F. Tighten the bolts to the manufacturer’s specifications, using the recommended cross bolt pattern in multiple steps of increasing torque, until the final torque requirements are achieved. Do not over torque.

G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

H. Install threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation. Install on exposed and buried and submerged piping.

3.05 INSTALLING BLIND FLANGES

A. At outlets not indicated to be connected to valves or to other pipes and to complete the installed pipeline hydrostatic test, provide blind flanges with bolts, nuts, and gaskets.

B. Coat the inside face of blind flanges per Section 099000, System No. 1.

3.06 INSTALLING GROOVED-END PIPING

A. Install grooved-end pipe and fittings in accordance with the coupling manufacturer's recommendations and the following.

B. Clean loose scale, rust, oil, grease, and dirt from the pipe or fitting groove before installing coupling. Apply the coupling manufacturer's gasket lubricant to the gasket exterior including lips, pipe ends, and housing interiors.

C. Fasten coupling alternately and evenly until coupling halves are seated. Use torques as recommended by the coupling manufacturer.

3.07 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

END OF SECTION

SECTION 400515 PRESSURE TESTING OF FORCE MAIN PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies hydrostatic and leakage testing of pressure piping for raw sewage force mains.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Manual, Check, and Process Valves: 400520.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.

C. Submit six copies of the test records to the Owner's Representative upon completion of the testing.

1.04 TEST PRESSURES

Test pressures for the various services and types of piping are shown in the subsection on “Test Pressure and Test Fluids” in Part 3.

1.05 TESTING RECORDS

Provide records of each piping installation during the testing. These records shall include:

A. Date and times of test.

B. Identification of pipeline, or pipeline section tested or retested.

C. Identification of pipeline material.

D. Identification of pipe specification.

E. Test fluid.

F. Test pressure at low point in pipeline or pipeline section.

G. Remarks: Leaks identified (type and location), types of repairs, or corrections made.

H. Certification by Contractor that the leakage rate measured conformed to the specifications.

PART 2 - MATERIALS

2.01 MANUAL AIR-RELEASE VALVES FOR BURIED PIPING

Provide temporary manual air-release valves for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and after use, seal with a blind flange, pipe cap, or plug and coat the same as the adjacent pipe.

2.02 TEST BULKHEADS

Design and fabricate test bulkheads per Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

2.03 TESTING FLUID

A. Testing fluid shall be water.

B. For potable water pipelines, obtain and use only potable water for hydrostatic testing.

C. Submit request for use of water from waterlines of Owner 48 hours in advance.

D. The Contractor may obtain the water from the Owner at the Owner's rate of charges.

2.04 TESTING EQUIPMENT

Provide calibrated pressure gauges, pipes, bulkheads, pumps, chart recorder, and meters to perform the hydrostatic testing.

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Pipes shall be in place, backfilled, and anchored before commencing pressure testing.

B. Conduct pressure tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

C. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. Perform the final pressure test, however, after completely backfilling and compacting the trench.

D. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.

E. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing. Drain the pipes after they have been tested.

F. Prior to starting the test, the Contractor shall notify the Owner's Representative.

3.02 CLEANING

Before conducting hydrostatic tests, flush pipes with water to remove dirt and debris.

3.03 LENGTH OF TEST SECTION FOR BURIED PIPING

The maximum length of test section for buried pipe of 12 inches or smaller in diameter is 3,500 feet; for buried pipe larger than 12 inches, 1 mile. Provide intermediate test bulkheads where the pipeline length exceeds these limits.

3.04 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

Maximum rate of filling shall not cause water velocity in pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

3.05 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

Prior to testing new pipelines that are to be connected to existing pipelines, isolate the new line from the existing line by means of test bulkheads, spectacle flanges, or blind flanges. After successfully testing the new line, remove test bulkheads or flanges and connect to the existing piping.

3.06 HYDROSTATIC TESTING OF ABOVEGROUND OR EXPOSED PIPING

A. Open vents at high points of the piping system to purge air while filling the pipe with water. Venting during system filling may also be provided by temporarily loosening flanges.

B. Subject the piping system to the test pressure indicated. Maintain the test pressure for a minimum of 2 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained.

3.07 HYDROSTATIC TESTING OF BURIED PIPING

A. Where any section of the piping contains concrete thrust blocks or encasement, do not perform the pressure test until at least 10 days after placing the concrete. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

B. Apply and maintain the test pressure by means of a positive displacement hydraulic force pump.

C. Maintain the test pressure 2 hours by restoring it whenever it falls an amount of 5 psi:

D. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage shall not exceed 100 gallons per mile, per24 hours, per inch of nominal diameter.

E. Repair and retest any pipes showing leakage rates greater than that allowed in the above criteria.

3.08 REPETITION OF TEST

If the actual leakage exceeds the allowable, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

3.09 BULKHEAD AND TEST FACILITY REMOVAL

After a satisfactory test, remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings.

3.10 TEST PRESSURE AND TEST FLUIDS

Testing and design pressures (psig) shall be as listed below:

Pipe Service	**Pipe Material**	**Testing Fluid**	**Design Pressure**	**Test Pressure**
FM	HDPE	Water	50	75 psi

END OF SECTION

SECTION 400520 MANUAL, CHECK, AND PROCESS VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, testing, and installation of manually operated valves, check valves, and process valves including eccentric plug, ball and check valves,.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Operation and Maintenance Manuals: 019310.

B. Painting and Coating: 099000.

C. Cold-Applied Wax Tape Coating: 099752.

D. Polyethylene Sheet Encasement (AWWA C105): 099754.

E. Fusion-Bonded Epoxy Linings and Coatings: 09976.

F. Miscellaneous Electrical Devices: 260590.

G. General Piping Requirements: 400500.

H. Pressure Testing of Force Main Piping: 400515.

I. Air-Release and Vacuum-Relief Valves: 400560.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data and detail construction sheets showing all valve parts. Describe each part by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type.

C. Show valve dimensions including laying lengths. Show port sizes. Show dimensions and orientation of valve actuators, as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the hand wheel diameter.

D. Show valve linings and coatings. Submit manufacturer's catalog data and descriptive literature.

E. Submit six copies of a report verifying that the valve interior linings and exterior coatings have been tested for holidays and lining thickness. Describe test results and repair procedures for each valve. Do not ship valves to project site until the reports have been returned by the Owner's Representative and marked "Resubmittal not required."

F. For butterfly and eccentric plug valves, show the clear diameter or size of the port. Show the actual area of the port as a percentage of the area as calculated for the nominal valve size.

1.04 PROOF OF DESIGN TEST FOR ECCENTRIC PLUG VALVES (TYPES 500, 510, 520, AND 525)

A. The Contractor shall require the valve manufacturer to furnish six certified copies of reports covering the design tests for the eccentric plug valves as described in AWWA C517 and the following. One prototype valve of each size and class of a manufacturer's design shall be tested for leakage at the specified design pressure and hydrostatically tested with twice the specified design pressure. The hydrostatic test shall be performed with the plug in the open position. The leakage test shall be performed with the plug in the closed position. The duration of each test shall be 10 minutes minimum. During the leakage test, there shall be no indication of leakage past the valve plug. Valves specified to have bi-directional seats shall be leak tight in both directions. In the case of flanged valves, the valve body shall be bolted to a flanged test head.

B. No part of the valve or plug shall be permanently deformed by the hydrostatic test. During the hydrostatic test, there shall be no leakage through the metal, the end joints, or the shaft seal.

C. It is the intent that the valve manufacturer provide evidence of the adequacy of each type offered to perform under design pressures within the applicable rating for a sufficient number of test cycles simulating a full service life. The adequacy is to be proven by tests, made on one or more valves selected to represent each basic type of seat design of a size within each applicable group, in a pressure class or classes equal to or greater than that specified. The required number of test cycles appears in the following table:

TEST CYCLES REQUIRED		
Size Group (inches)	**No. of Cycles**	**Minimum Differential Pressure (psig)**
3 to 20	10,000	150
24 to 42	5,000	150

Every test cycle shall consist of applying the specified differential pressure to the plug in the closed position, then opening the plug (which will relieve the pressure) to the wide-open position and then closing the plug.

D. The valve shall be leak tight under the specified pressure differential upon completion of the cycle test without having to stop during the test to repair the valve, modify or reinforce the seat, or install shims or wedges around the seat.

E. The plug shall not be rotated past the center position to jam the plug onto the seat during the hydrostatic test, the leakage test, or the cycle test.

PART 2 - MATERIALS

2.01 GENERAL

A. Install valves complete with operating handwheels or levers, chainwheels, extension stems, floor stands, gear actuators, operating nuts, chains, and wrenches required for operation.

B. Valves shall have the name of the manufacturer and the size of the valve cast or molded onto the valve body or bonnet or shown on a permanently attached plate.

2.02 VALVE ACTUATORS

A. Provide lever or wrench actuators for exposed valves 6 inches and smaller. For larger valves, provide handwheels.

B. Where manually operated valves (size 4 inches and larger) are installed with their centerlines more than 6 feet 9 inches above the floor, provide chainwheel and guide actuators.

C. Provide 2-inch AWWA operating nuts for buried and submerged valves.

D. Provide enclosed gear actuators on butterfly, ball, and plug valves 6 inches and larger, unless electric motorized valve actuators are shown in the drawings. Gear actuators for valves 6 through 20 inches shall be of the worm and gear, or of the traveling nut type. Gear actuators for valves 24 inches and larger shall be of the worm and gear types. Gear actuators for motorized valves shall be of the worm and gear type, regardless of size.

E. Design gear actuators assuming that the differential pressure across the plug, gate, or disc is equal to the pressure rating of the valve and assuming a fluid velocity of 16 fps and a line fluid temperature range of 33°F to 125°F unless otherwise required in the detailed valve specifications. Size actuators using a minimum safety factor of 1.5 for valves in open/close service and 2.0 in modulating service.

F. Gear actuators shall be enclosed, oil lubricated, with seals provided on shafts to prevent entry of dirt and water into the actuator. Gear actuators for valves located above ground or in vaults and structures shall have handwheels. The actuators for valves in exposed service shall contain a dial indicating the position of the valve disc or plug. Gear actuators for buried or submerged valves shall have 2-inch-square AWWA operating nuts.

G. For buried or submerged service or valves installed in buried vaults, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.

H. Traveling nut and worm and gear actuators shall be of the totally enclosed design so proportioned as to permit operation of the valve under full differential pressure rating of the valve with a maximum pull of 40 pounds on the handwheel or crank. Provide stop limiting devices in the actuators in the open and closed positions. Actuators shall be of the self-locking type to prevent the disc or plug from creeping. Design actuator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel actuators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.

I. Handwheel diameters for traveling nut actuators shall not exceed 8 inches for valves 12 inches and smaller and shall not exceed 12 inches for valves 20 inches and smaller.

J. Self-locking worm gear shall be a one-piece design of gear bronze material (ASTM B427; or ASTM B84, Alloy C86200), accurately machine cut. Actuators for eccentric and lubricated plug valves may use ductile-iron gears provided the gearing is totally enclosed with spring-loaded rubber lip seals on the shafts. The worm shall be hardened alloy steel (ASTM A322, Grade G41500 or G41400; or ASTM A148, Grade 105-85), with thread ground and polished. Support worm-gear shaft at each end by ball or tapered roller bearings. The reduction gearing shall run in a proper lubricant. The handwheel diameter shall be no more than twice the radius of the gear sector in contact with the worm. Worm-gear actuators shall be Limitorque Model HBC, EIM Series W, or equal.

K. Design actuators on buried valves to produce the required torque on the operating nut with a maximum input of 150 foot-pounds.

L. Valve actuators, handwheels, or levers shall open by turning counterclockwise.

2.03 EXTENSION STEMS FOR BURIED AND SUBMERGED VALVE ACTUATORS

A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Where the valve is submerged, provide operating extension stems to bring the operating nut to 6 inches above the water surface. Extension stems shall be steel, solid core, and shall be complete with 2-inch-square operating nut. The connections of the extension stems to the operating nuts and to the valves shall withstand without damage a pull of 300 foot-pounds.

B. Extension stem diameters shall be as tabulated below:

Valve Size (inches)	Minimum Extension Stem Diameter (inches)
2	3/4
3, 4	7/8
6	1
8	1 1/8
10, 12	1 1/4
14	1 3/8
16, 18	1 1/2
20, 24, 30, 36	1 3/4
42, 48, 54	2

2.04 BOLTS AND NUTS FOR FLANGED VALVES

Bolts and nuts for flanged valves shall be as described in Section 400500.

2.05 GASKETS FOR FLANGES

Gaskets for flanged end valves shall be as described in Section 400500.

2.06 LIMIT SWITCHES FOR CHECK VALVES

See Section 260590.

2.07 PAINTING AND COATING

A. Coat metal valves located above ground or in vaults and structures in accordance with Section 099000, System No. 10. Apply the specified prime and intermediate and finish coat at the place of manufacture. Finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.

B. Coat buried metal valves at the place of manufacture per Section 099000, System No. 21.

C. Coat submerged metal valves, stem guides, extension stems, and bonnets at the place of manufacture per Section 099000, System No. 1.

D. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless steel pieces, per Section 099000, System No. 1. Apply lining at the place of manufacture.

E. Alternatively, line and coat valves with fusion-bonded epoxy per Section 099761.

F. Coat floor stands per Section 099000, System No. 10.

G. Test the valve interior linings and exterior coatings at the factory with a low-voltage (22.5 to 80 volts, with approximately 80,000-ohm resistance) holiday detector, using a sponge saturated with a 0.5% sodium chloride solution. The lining shall be holiday free.

H. Measure the thickness of the valve interior linings per Section 099000. Repair areas having insufficient film thickness per Section 099000.

2.08 PACKING, O-RINGS, AND GASKETS

Unless otherwise stated in the detailed valve specifications, packing, O-rings, and gaskets shall be one of the following nonasbestos materials:

A. Teflon.

B. Kevlar aramid fiber.

C. Acrylic or aramid fiber bound by nitrile. Products: Garlock "Bluegard," Klinger "Klingersil C4400," or equal.

D. Buna-N (nitrile).

2.09 RUBBER SEATS

Rubber seats shall be made of a rubber compound that is resistant to free chlorine and monochloramine concentrations up to 10 mg/L in the fluid conveyed.

2.10 VALVES

A. Plug Valves:

1. Plug and Seating Design for Eccentric Plug Valves (Types 500, 510, 515, 520, and 525):

Eccentric plug valves shall comply with AWWA C517 and the following. Provide a rectangular or circular plug design, with an associated rectangular or round seat. Provide bidirectional seating design. The valve shall seat with the rated pressure both upstream and downstream of the closed plug. Provide geared actuators sized for bidirectional operation.

2. For Types 500, 510, 515, 520, and 525 eccentric plug valves, the metallic portion of the plug shall be one-piece design and shall be without external reinforcing ribs which result in there being a space between the rib and the main body of the plug through which water can pass. Valves shall be repackable without any disassembly of valve or actuator. The valve shall be capable of being repacked while under the design pressure in the open position. Nowhere in the valve or actuators shall the valve shaft be exposed to iron on iron contact. Sleeve bearings shall be stainless steel in valve sizes 20 inches and smaller and bronze or stainless steel in valve

sizes 24 inches and larger. Provide enclosed worm-gear actuators for valves 6 inches and larger.

3. Rubber compounds shall have less than 2% volume increase when tested in accordance with ASTM D471 after being immersed in distilled water at a temperature of 73.4°F ±2°F for 70 hours.

4. Type 510—Eccentric Plug Valves 4 Through 12 Inches:

Eccentric plug valves, 4 through 12 inches, shall be nonlubricated type. Minimum pressure rating shall be 175 psi. Bodies shall be cast iron per ASTM A126, Class B. Ends shall be flanged, Class 125 per ASME B16.1. Plugs shall be cast iron (ASTM A126, Class B), or ductile iron (ASTM A536, Grade 65-45-12) with Buna-N or neoprene facing. Design plugs to seat over a pressure range of 1 psi to the valve design pressure rating. Valve body seats shall be Type 304 or 316 stainless steel or have a raised welded-in overlay at least 1/8-inch thick of not less than 90% nickel. Body cap screws and bolts and nuts shall be Type 316 stainless steel. Packing shall be butadiene-filled Teflon. Alternatively, U-cup seals may be provided. Provide 100% port area. Valves shall be DeZurik PEC or PEF, Clow F-5412 or F5413 for buried service, Val-Matic "Cam-Centric," Milliken "Millcentric," or equal.

B. Ball Valves:

1. Type 320--Regular Port Threaded Stainless Steel Ball Valves 2 Inches and Smaller:

Stainless steel ball valves, 2 inches and smaller, for water service shall be rated at a minimum pressure of 1,500 psi WOG at a temperature of 100°F. Valve body, ball, and stem shall be Type 316 stainless steel, ASTM A276 or A351. Seat and seals shall be reinforced Teflon. Valves shall have lever actuators, plastic coated. Valves shall have threaded ends (ASME B1.20.1) and nonblowout stems. Valves shall be McCanna Figure M402, Worcester Series 48, Stockham Figure SD 2120-SSMO-R-T, Apollo 76-100 Series, or equal.

C. Hose Bibbs:

1. Type 420—Bronze Hose Bibbs:

Hose bibbs of size 1/2 inch, 3/4 inch, and 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or nonrising stem, composition disc, bronze or malleable iron handwheel, and bronze stem (ASTM B99, Alloy C65100; ASTM B371, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be Teflon or graphite. Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlet shall be American National Standard fire hose coupling screw thread (ASME B1.20.7). Valves shall be Jenkins Figure 112, 113, or 372; Nibco Figure T-113-HC; or equal.

D. Check Valves:

1. Type 720—Cast-Iron Swing Check Valves 3 Inches and Larger, Class 125:

Swing check valves, 3 inches and larger, shall be iron body, bronze mounted complying with AWWA C508 with the following materials of construction:

Description	Material	Specification
Disc or clapper seat ring and valve body seat ring	Bronze or brass	ASTM B62 or B584 (Alloy C84400 or C87600)
Body and cap (bonnet)	Cast iron	ASTM A126, Class B
Disc and hinge or arm (valves 4 inches and smaller)	Bronze	ASTM B62 or ASTM B584 (Alloy C84400)
Disc and hinge or arm (valves larger than 4 inches)	Cast iron or bronze	ASTM A126, Class B; ASTM B62.
Hinge pin	Stainless steel	Type 303, 304, or 410 stainless
Cover bolts and nuts	Stainless steel	ASTM A193, Grade B8M; ASTM A194, Grade 8M
Internal fasteners and accessories	Bronze or Type 304 or 316 stainless steel	

Ends shall be flanged, Class 125, ASME B16.1. Minimum valve working pressure shall be 150 psi. Provide check valves with outside lever and spring.

The shop drawing submittal shall include a detail showing how the hinge pin extends through the valve body. Show packing gland, hinge pin gland, cap, and other pieces utilized.

Valves shall be M&H Style 259-02, Clow 106SL, or equal.

PART 3 - EXECUTION

3.01 VALVE SHIPMENT AND STORAGE

A. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Install closures at the place of valve manufacture prior to shipping. For studded openings, use all the nuts needed for the

intended service to secure closures. Alternatively, ship flanged valves 3 inches and smaller in separate sealed cartons or boxes.

B. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Install caps or plugs at the place of valve manufacture prior to shipping. Alternatively, ship valves having threaded openings or end connections in separate sealed cartons or boxes.

C. Store resilient seated valves in sealed polyethylene plastic enclosures with a minimum of one package of desiccant inside. Store resilient seated valves in the open or unseated position. Valves with adjustable packing glands shall have the packing gland loosened prior to storage. Inspect valves at least once per week, replace desiccant if required and repair damaged storage enclosures. Do not store valves with resilient seats near electric motors or other electrical equipment.

D. Inspect valves on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload valves carefully to the ground without dropping. Use forklifts or slings under skids. Do not lift valves with slings or chain around operating shaft, actuator, or through waterway. Lift valves with eyebolts or rods through flange holes or chain hooks at ends of valve parts.

E. Protect the valve and actuators from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer's specific storage instructions.

F. Make sure flange faces, joint sealing surfaces, body seats, and disc seats are clean. Check the bolting attaching the actuator to the valve for loosening in transit and handling. If loose, tighten firmly. Open and close valves having manual or power actuators to make sure the valve operates properly and that stops or limit switches are correctly set so that the valve seats fully. Close valve before installing.

3.02 FACTORY PRESSURE TESTING

A. Hydrostatically test the valve pressure-containing parts at the factory per the valve specification or per the referenced standard. If no testing requirement is otherwise specified or described in the referenced standards, then test with water for 30 minutes minimum at a pressure of 1.5 times the rated pressure but not less than 20 psig. Test shall show zero leakage. If leaks are observed, repair the valve and retest. If dismantling is necessary to correct valve deficiencies, then provide an additional operational test and verify that the valve components function.

B. The chloride content of liquids used to test austenitic stainless steel materials shall not exceed 50 ppm. To prevent deposition of chlorides as a result of evaporative drying, remove residual liquid from tested parts at the conclusion of the test.

3.03 INSTALLING VALVES—GENERAL

A. Remove covers over flanged openings and plugs from threaded openings, after valves have been placed at the point to which the valves will be connected to the adjacent piping. Do not remove valves from storage cartons or boxes until they are ready to be installed.

B. Handle valves carefully when positioning, avoiding contact or impact with other equipment, vault or building walls, or trench walls.

C. Clean valve interiors and adjacent piping of foreign material prior to making up valve to pipe joint connection. Prepare pipe ends and install valves in accordance with the pipe manufacturer's instructions for the joint used. Do not deflect pipe-valve joint. Do not use a valve as a jack to pull pipe into alignment. The installation procedure shall not result in bending of the valve/pipe connection with pipe loading.

D. Make sure valve ends and seats are clean. Check exposed bolting for loosening in transit and handling and tighten to manufacturer's recommendations. Open and close the valve to make sure it operates properly and that stops or limit switches are correctly set so that the vane, ball, gate, needle, diaphragm, disc, plug, or other seating element seats fully. Close the valve before installing. Check coatings for damage and repair. Handle valves carefully when positioning, avoiding contact or impact with other equipment or structures.

E. Prior to assembly, coat threaded portions of stainless steel bolts and nuts with lubricant.

3.04 INSTALLING EXPOSED VALVES

A. Unless otherwise indicated in the drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.

B. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

3.05 INSTALLING BURIED VALVES

A. Connect the valve, coat the flanges, apply tape wrapping and polyethylene encasement, and place and compact the backfill to the height of the valve stem.

B. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.

C. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.

D. In streets without concrete curbs and in open areas, install the valve box as for a paved area with concrete curb except include a marker post. Cut the marker post from 4-inch by 4-inch dense structural grade Douglas fir No. 2 surfaced on four sides to a length of 5 feet. Chamfer the top. Set the post in concrete, 2 feet into the ground, away from traffic, and to the side of the pipeline. Coat with a seal and finish coat of white alkyd exterior paint. On the side facing the valve, letter in black the word "VALVE" and the distance in feet from the marker post to the valve box cap.

3.06 FIELD COATING BURIED VALVES

A. Coat flanges of buried valves and the flanges of the adjacent piping, and the bolts and nuts of flanges and mechanical joints, per Section 099000, System No. 24.

B. Wrap buried metal valves smaller than 6 inches with cold-applied wax tape per Section 099752.

C. Wrap buried metal valves 6 inches and larger with polyethylene sheet per Section 099754.

3.07 INSTALLING ECCENTRIC PLUG VALVES

A. Unload, store, and install in accordance with AWWA C517, Appendix A and the following. Unload valves carefully to the ground without dropping. On valves larger than 12 inches, use forklifts or slings under skids. On smaller valves, do not lift valves with slings or chain around actuator or through waterway. Lift these valves with eyebolts or rods through flange holes or chain hooks at the ends of valve parts. If it is not practical to store the valve indoors, protect the valve and actuators from weather and the accumulation of dirt, rocks, and debris.

B. Install such that the rotation of the plug is about a horizontal axis. Install such that the plug stores in the top when the valve is open.

C. Orient the valve such that the seat is opposite the high-pressure side.

3.08 ASSEMBLING JOINTS

A. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.

C. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).

D. Install grooved-end couplings for valves in accordance with Section 400500.

3.09 INSTALLING EXTENSION STEM GUIDE BRACKETS

Install at 6- to 8-foot centers. Provide at least two support brackets for stems longer than 10 feet, with one support near the bottom of the stem and one near the top.

3.10 MOUNTING GEAR ACTUATORS

The valve manufacturer shall select and mount the gear actuator and accessories on each valve and stroke the valve from fully open to fully closed prior to shipment.

3.11 FIELD INSTALLATION OF GEAR ACTUATOR

Provide the actuator manufacturer's recommended lubricating oil in each actuator before commencing the field testing.

3.12 VALVE FIELD TESTING

A. Test valves for leakage at the same time that the connecting pipelines are hydrostatically tested. See Section 400515 for pressure testing requirements. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.

B. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind, or do not operate from full open to full closed, repair or replace the valve and repeat the tests.

C. Gear actuators shall operate valves from full open to full close through three cycles without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 40 pounds. The torque required to operate valves having 2-inch AWWA nuts shall not exceed 150 ft-lbs. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or replace the actuators and repeat the tests. Operators shall be fully lubricated in accordance with the manufacturer's recommendations prior to operating.

END OF SECTION

SECTION 400560 AIR-RELEASE AND VACUUM-RELIEF VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of combination air-release valves, for sewage service.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. Fusion-Bonded Epoxy Linings and Coatings: 099761.

C. Pressure Testing of Force Main Piping: 400515.

D. Manual, Check, and Process Valves: 400520.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data and detail drawings showing all valve parts and described by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show linings and coatings

PART 2 - MATERIALS

2.01 BOLTS, NUTS, AND GASKETS FOR FLANGED VALVES

See Section 400500 and specification for the pipe to which the valve is attached.

2.02 VALVE DESIGN AND OPERATION

A. The air-release and vacuum-relief valve shall be of a single chamber design with solid cylindrical HDPE control floats housed in a tubular stainless steel body with epoxy powder-coated cast iron, steel, or stainless steel ends secured by means of stainless steel tie rods or by a flanged connection. The valve shall have an integral orifice mechanism that shall operate automatically to limit transient pressure rise or shock induced by closure to twice valve rated working pressure. Provide a double (small and large) orifice design.

B. The intake orifice area shall be equal to the nominal size of the valve. The large orifice sealing shall be affected by the flat face of the control float seating against a nitrile rubber O-ring housed in dovetail groove circumferentially surrounding the orifice.

Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice nozzle on a natural rubber seal affixed into the control float. The nozzle shall have a flat seating land surrounding the orifice.

C. Provide a 1/4-inch NPT test/bleed cock.

D. Prior to the ingress of liquid into the valve chamber, as when the pipeline is being filled, valves shall vent through the large orifice. At higher water approach velocities, the valve shall automatically discharge air through the orifice mechanism and reduce water approach velocity.

E. Valve shall not exhibit leaks or weeping of liquid past the large orifice seal at operating pressures of 7 psi to twice rated working pressure.

F. Valves shall respond to the presence of air by discharging it through the small orifice at any pressures within the specified design range and shall remain leak tight in the absence of air.

G. Valves shall react immediately to pipeline drainage or water column separation by the full opening of the large orifice so as to allow unobstructed air intake at the lowest possible negative internal pipeline pressure.

2.03 MATERIALS OF CONSTRUCTION

Materials of construction for air-release valves/air and vacuum-relief valves for sewage service shall be as follows:

Item	Material	Specification
Top flange, lower flange, screen mesh, bolts, nuts, connecting screws, float screw, and assembly screws	Stainless steel	AISI Type 304
Top cover	ABS plastic	–
Barrel	Stainless steel	AISI Type 304L
Floats	HDPE	–
Air-release nozzle or orifice mechanism	Stainless steel	AISI Type 304
Nozzle seal and seat	Natural rubber	–
Nozzle seal retaining plate	Stainless steel	AISI Type 304
Tie rod assembly and support fasteners	Stainless steel	AISI Type 304
Float O-ring seals	Nitrile rubber	–

2.04 VALVE END CONNECTIONS

A. Valves 2 inches and smaller shall have threaded ends. Valves 3 inches and larger shall have flanged ends.

B. Threaded ends shall comply with ASME B1.20.1.

2.05 VALVES

Valves shall be APCO ASU Combination Air Valve or approved equal.

PART 3 - EXECUTION

3.01 SERVICE CONDITIONS

A. Special service conditions for valves shall be as described below. Design the valves to incorporate the various conditions presented.

	Minimum Operating Pressure (psig)	**Maximum Operating Pressure (psig)**	**Seating Pressure (psi)**
Raw Sewage	0	50	1

B. Valves shall seat driptight at the specified seating pressure.

3.02 FACTORY TESTING

A. Test each valve per AWWA C512, Section 5 and the following.

B. Hydrostatically test the pressure-containing parts at the factory with water for 30 minutes minimum at a pressure of 1.5 times the rated pressure but not less than 20 psig. Test shall show zero leakage. If leaks are observed, repair the valve and retest. If dismantling is necessary to correct valve deficiencies, provide an additional operational test per AWWA C512, Section 5 for each affected valve.

C. The chloride content of liquids used to test austenitic stainless steel materials shall not exceed 50 ppm. To prevent deposition of chlorides as a result of evaporative drying, remove residual liquid from tested parts at the conclusion of the test.

3.03 SHIPMENT AND STORAGE

A. Pack and ship one copy of the manufacturer’s standard installation instructions with the equipment. Provide the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite and before start-up.

B. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Provide closures at the place of pump manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.

C. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Provide caps or plugs at the place of pump manufacture prior to shipping.

D. Clearly identify lifting points and lifting lugs on the valves. Identify the recommended lifting arrangement on boxed equipment.

3.04 INSTALLATION

A. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseat or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.

B. Clean threaded joints by wire brushing or swabbing. Apply Teflon® joint compound or Teflon® tape to pipe threads before installing threaded valves. Joints shall be watertight.

C. Do not use duct tape and plastic for covering the ends of pipe flanges. Use a solid metal cover with rubber gasket to cover flange openings during installation. These metal covers shall remain in place until the piping is connected to the valves.

D. Do not spring flanges of connecting piping into position. Separately work connecting piping systems into position to bring the piping flanges into alignment with the matching valve flanges. Do not move valves to achieve piping alignment. Do not use electrical heating stress relieving to achieve piping alignment.

E. Line up pipe flange bolt holes with valve nozzle bolt holes within 1/16 inch maximum offset from the center of the bolt hole to permit insertion of bolts without applying any external force to the piping.

F. Flange face separation shall be within the gasket spacing ±1/16 inch. Use only one gasket per flanged connection.

3.05 VALVE FIELD PRESSURE TESTING

Test valves at the same time that the connecting pipelines are pressure tested. See Section 400515 for pressure testing requirements. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the test pressure.

END OF SECTION

SECTION 400580 FABRICATED STAINLESS STEEL SLIDE GATES

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of fabricated stainless steel slide gates, wall mounted conforming to AWWA C561 and as supplemented herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Operation and Maintenance Manuals: 019310.

B. Painting and Coating: 099000.

C. Equipment, Piping, Duct, and Valve Identification: 400775.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions and Section 013300.

B. Submit dimensional drawings.

C. Submit manufacturer’s catalog data and detail drawings showing slide gate parts and described by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type. Show coatings.

D. Submit calculations to show that gates, stems, and lifts meet the specifications.

E. Submit manufacturer's installation instructions.

1.04 MANUFACTURER'S SERVICES

Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

A. One labor day to check the installation and advise during start-up, testing, and adjustment of the equipment.

B. One labor day to instruct the Owner's personnel in the operation and maintenance of the equipment.

PART 2 - MATERIALS

2.01 MANUFACTURERS AND MODELS

A. Slide gates shall be of the self-contained upward opening type designed to mount on the face of concrete walls. Slide gates shall be Waterman Model SS-250, Whipps Series 900, or equal.

2.02 SLIDE GATE DESIGN

A. Slide gates and appurtenances shall comply with AWWA C561, except as modified herein.

B. Provide slide gates complete with gates, guides, frames, baseplates, seats, stems, stem guides, seals, actuators, and anchor bolts. Design slide gates for minimum seating and unseating heads of 10 feet. Measure the seating and unseating heads from the top surface of the water to the centerline of the disc.

C. Under the design seating and unseating heads, the leakage shall not exceed 0.1 gpm per foot of wetted seating perimeter.

D. Slide gates shall have rising stems.

2.03 FRAMES FOR SELF-CONTAINED SLIDE GATES

A. Design frames to be suitable for bolting to concrete walls or for grouting into channel recesses as noted herein. Furnish flush inverts for wall-mounted gates and flush inverts for channel-mounted gates as noted herein.

2.04 GUIDES

A. Guides shall incorporate a two-slot design. One slot shall accept the disc plate. The second slot shall accept the reinforcing ribs of the disc. The guides shall extend in one continuous piece from the gate invert to form posts for handwheel operator stand. The extended guides or posts shall require no additional reinforcing to support the operator. Construct the guides of formed plate into a rigid, continuous structural shape.

B. Provide a flush invert at the bottom of the frame. Provide a rubber insert to function as a seating surface for the gate disc.

C. Provide rubber J-bulb or UHMW polyurethane seals or seats along the sides of the gates.

D. For self-contained gates, provide replaceable polyethylene bearing strips in extruded retainer slots along the guides. Provide strips along both sides of the guide channels containing the disc. Mount strips in dovetail grooves in the guides. Alternatively, mount the replaceable polyethylene bearing strips on the disc.

E. Provide rubber or UHMWPE J-bulb seals along the top of the gate.

2.05 DISC

A. Fabricate the disc using stainless steel flat plate with stainless steel structural or formed members welded to the plate. Provide disc components with a minimum material thickness of 1/4 inch.

B. The disc shall be a one-piece plate, reinforced with ribs so that the disc will not deflect more than 1/720 the gate span when the upstream side of the gate is subjected to the specified seating head and the downstream side of the gate contains no liquid. Design the disc to limit deflection to a maximum of 1/8 inch when the disc is subjected to the maximum specified unseating head. Attach reinforcing ribs to disc by welding; do not use bolting. Reinforcing ribs shall extend into the guides such that they overlap the seating surface of the guide. Design the disc so that all surfaces are free of metal-to-metal contact with the frames.

2.06 ACTUATOR SUPPORT YOKE FOR SELF-CONTAINED SLIDE GATES

Attach the actuator support yoke to the extensions of the guides. Provide two angles or structural channels bolted to opposite sides of the guide extensions. Mount the actuator on a plate bolted to the support yoke. Maximum deflection of the yoke shall not exceed 1/4 inch when subjected to a load induced by an 80-pound pull on the actuator or 1/360 span when subjected to a load induced by a 40-pound pull on the actuator, whichever is less.

2.07 STEMS AND STEM GUIDES

A. Lifting stems shall be one piece, with a minimum diameter of 1 1/2 inches. The stem shall withstand an actuator effort of 80 pounds without buckling, assuming the critical buckling load as determined by using the Euler Column Formula with C = 2.0. Support the stems with stem guides such that the L/R ratio for the unsupported part of the stem does not exceed 200.

B. The stem connection to the disc shall be either the clevis type, with structural members welded to the slide and containing a bolt to act as a pivot pin, or a threaded and bolted or keyed thrust nut supported in a welded nut pocket. The pocket shall be capable of withstanding a load of 80 pounds on the actuator.

C. Provide tandem stems and actuators when the gate width is more than twice the gate height.

2.08 MATERIALS OF CONSTRUCTION

Materials of construction shall conform to the requirements listed below:

Component	Material	Specification
Guides	Stainless steel	ASTM A240 or A276, Type 316 or 316L
Disc, yoke	Stainless steel	ATSM A240 or A276, Type 316 or 316L
Stems, stem guides, bushings, pivot pin	Stainless steel	ASTM A276, Type 304
Bolts, fasteners (including anchor bolts)	Stainless steel	ASTM A193, F593 or F594; Grade B8M
Lift nut	Bronze	ASTM B62 or ASTM B584, Alloys C83600, C83800, or C86500
J-bulb seals, flush bottom seals	Rubber or UHMW polyurethane	ASTM D2000, Grades BC610, BC611, BC612, BC613, BC614, or BC615 or ASTM D4020

2.09 ACTUATORS

A. Provide manual actuators unless otherwise indicated in the drawings. Provide Acme threaded handwheel lifts without gear reduction for gates having design seating heads 10 feet or less. Provide a flanged lift nut to engage the threaded portion of the stem. Support the lift nut on nonmetallic thrust washers or ball or roller bearings. Provide manual crank-operated lift with gear reduction. Maximum pull required to open the gate shall not exceed 40 pounds. Support crank-operated lift nuts only on ball or roller bearings. The crank handle shall be removable.

B. Provide a graduated clear plastic stem cover to show the gate position in increments of 1/4 inch. Provide vent holes to prevent condensation.

2.10 FLOOR STANDS

A. Design crank-operated or handwheel-operated floor stand hoists to permit gate operation with 40 pounds of maximum effort under the head conditions noted in the drawings.

2.11 SPARE PARTS

A. Provide the following spare parts for each size of slide or weir gate:

Quantity	Description
2	Lift nuts
4	Stem guides of each type and size
2	Pivot pins
1 set	Sealing strips

B. Pack spare parts in a wooden box; label with the manufacturer's name and local representative's name, address, and telephone number; and attach list of materials contained within.

PART 3 - EXECUTION

3.01 WELDING

Welder qualification shall comply with AWS D1.6 Welding rod and electrodes shall comply with AWS A5.4. In addition to structural welds, seal weld interfaces between mating parts to prevent moisture intrusion.

3.02 PAINTING AND COATING

Coat cast-iron and steel surfaces above deck level, including actuators and floor stands, per Section 099000, System No. 10. Apply prime coat at factory. Color of finish coat shall be submitted for review and selection by Owner.

3.03 INSTALLATION

A. Cast the anchor bolts for wall-mounted gates into the wall using templates.

B. Comply with AWWA C561, paragraph 4.6.

3.04 FIELD TESTING

A. Operate each slide gate through two complete cycles. Gates shall operate without sticking or binding.

B. Determine the pulling force required to turn the handwheel with a torque wrench. Pulling force required shall be less than the limit specified.

C. Fill channels to which the gates are attached with water. Measure leakage through each slide gate. Measure the actual field seating and unseating heads. The allowable leakage shall be as specified above. If the leakage rate is exceeded, adjust or replace the gate and retest until it passes.

END OF SECTION

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SECTION 400722 FLEXIBLE PIPE COUPLINGS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of flexible gasketed sleeve-type compression pipe couplings for ductile-iron pipe and couplings for connecting different pipe materials.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. Polyethylene Sheet Encasement (AWWA C105): 099754.

C. Fusion-Bonded Epoxy Linings and Coatings: 099761.

D. General Piping Requirements: 400500.

E. Pressure Testing of Force Main Piping: 400515.

F. Wall Pipes, Seep Rings, and Penetrations: 400762.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data on flexible pipe couplings. Show manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings are used. Show coatings.

C. Submit manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible, gasketed sleeve-type compression pipe couplings.

D. Show materials of construction by ASTM reference and grade. Show dimensions.

E. Show number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

PART 2 - MATERIALS

2.01 COUPLING SYSTEM DESIGN AND COMPONENT UNIT RESPONSIBILITY

The coupling manufacturer shall furnish the gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings of all types and shall design these components as an integral

system. Design the gaskets for the coupling and appropriately size to provide a watertight seal at the design pressure and temperature. Ship gaskets, bolts, nuts, glands, end rings, and hardware for pipe couplings with the pipe coupling and clearly label indicating the origin of the material, including place and date of manufacture. Package the manufacturer's printed installation instructions with each pipe coupling.

2.02 DUCTILE-IRON FLEXIBLE PIPE COUPLINGS

A. Couplings shall have center sleeves and end rings made of ductile iron conforming to AWWA C219, Section 4.

B. Sleeve bolts shall be Type 316 stainless steel per AWWA C219, Section 4

2.03 JOINT HARNESSES

A. Tie bolts or studs shall be as shown in the following table. Bolt or stud material shall conform to ASTM A193, Grade B7. Nuts shall conform to ASTM A194, Grade 2H. Lug material shall conform to ASTM A36, ASTM A283, Grade B, C, or D, or ASTM A285, Grade C. Lug dimensions for steel pipe shall be as shown in AWWA Manual M11 (2004 edition), Figure 13-20, using the number and size of lugs as tabulated below.

TIE BOLTS OR STUD REQUIREMENTS FOR FLEXIBLE PIPE COUPLINGS FOR DUCTILE IRON PIPE						
	Tie Bolt or Stud Minimum Requirements					
	150 psi[1]			300 psi[2] Pipe		
Nominal Pipe Size (inches)	No. Bolts or Studs	Size (inch)	Ear[3] Type	No. Bolts or Studs	Size (inch)	Ear[3] Type
4	2	5/8	A	2	5/8	A
6	2	5/8	A	2	5/8	A
8	2	5/8	A	2	5/8	A
10	2	5/8	A	4	5/8	A
12	2	5/8	A	4	5/8	A
14	4	5/8	A	5	3/4	A
16	4	5/8	A	5	3/4	B
18	4	3/4	B	8	3/4	B
20	4	3/4	B	8	3/4	B
24	5	7/8	B	8	7/8	B
30	4	1 1/8	B	14	7/8	B
36	8	1	B	16	1	B
42	9	1	B	--	--	--
48	14	1	B	--	--	--
54	16	1	B	--	--	--

(1) Use ASME B16.1 Class 125 flanges.
(2) Use ASME B16.1 Class 250 flanges.
(3) Ear type as shown in the detail on the last page of Section 400722.

B. Select number and size of bolts based on the test pressure shown in Section 400515. Stagger bolts equally around pipe circumference. Where odd number is tabulated, place odd bolt at top. For test pressures less than or equal to 150 psi, use the 150-psi design in the table above. For test pressures between 150 and 300 psi, use the 300-psi design in the table above.

C. Provide washer for each nut. Washer material shall be the same as the nuts. Minimum washer thickness shall be 1/8 inch.

2.04 FLEXIBLE AND TRANSITION PIPE COUPLINGS FOR PLAIN-END PIPE

Couplings for pipe 12 inches and smaller shall be, Romac Alpha, Smith-Blair Type 471, Straub Metal Grip, or equal.

2.05 FLANGED COUPLING ADAPTERS FOR DUCTILE-IRON PIPE

A. Adapters for cast- and ductile-iron pipe 12 inches and smaller shall be cast iron: Romac RFCA, Smith-Blair Flange-Lock, or equal.

B. Flange ends shall match the flange of the connecting pipe; see detail piping specifications.

2.06 BOLTS AND NUTS FOR FLANGES

See Section 400500.

PART 3 - EXECUTION

3.01 SHIPMENT AND STORAGE OF FLEXIBLE PIPE COUPLINGS

A. Inspect on receipt for damage in shipment and conformance with quantity and description on the shipping notice and order. Unload carefully to the ground without dropping. Do not load or unload by inserting forklift tines or lifting chains inside the waterway. Use nonmetallic slings, padded chains, or padded forklift tines to lift items. Lift with eyebolts or rods through flange holes or chain hooks at ends.

B. Protect from weather and the accumulation of dirt, rocks, and debris. Do not expose rubber seats to sunlight or ozone for more than 30 days. Also, see the manufacturer's specific storage instructions.

C. Make sure flange faces, joint sealing surfaces, body seats, and disc seats are clean.

3.02 INSTALLATION OF FLEXIBLE PIPE COUPLINGS

A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installing.

B. Do not spring flanges or ends of connecting piping into position. Separately work connecting piping system into position to bring the piping flanges or ends into alignment with the matching coupling flanges or joints. Do not move couplings to achieve piping alignment.

C. Line up pipe flange bolt holes with coupling or joint flange bolt holes within 1/16 inch maximum offset from the center of the bolt hole to permit insertion of bolts without applying any external force to the piping.

D. Flange face separation shall be within the gasket spacing ±1/16 inch. Use only one gasket per flanged connection.

E. Lubricate bolt threads with graphite and oil prior to installation.

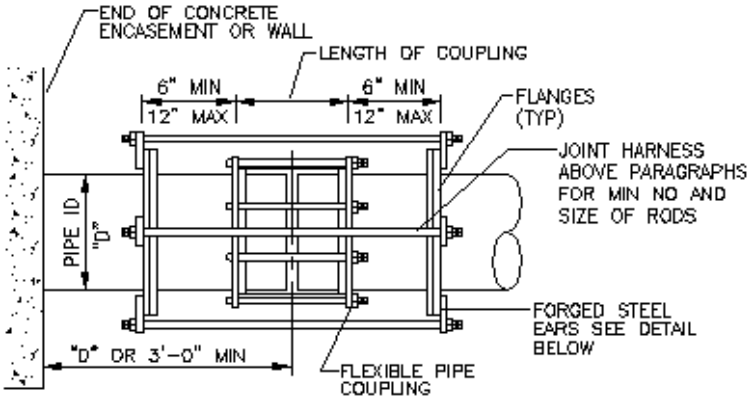
F. Thoroughly clean contact surfaces of gaskets and pipe ends of flexible pipe couplings just prior to assembly for a distance equal to center-sleeve length plus 2 inches. Install flexible pipe couplings such that the center sleeves are centered over the gap between the ends of the pipes being joined. Install centerline gaps per AWWA C219, Table 5 unless otherwise indicated. Install harnessed flexible pipe couplings in straight-run piping such that 50% of the total travel of the center sleeve or permissible centerline gap is available for expansion and 50% of the travel is available for contraction. In assembling the bolted or studded harnesses of flexible pipe couplings, tighten the nuts gradually and equally at diametrically opposite sides until snug. Do not misalign the harness bolts or studs. Tighten such that bolts or studs carry equal loads. Do not use wrenches or power fastening tools to tighten the nuts.

3.03 PAINTING AND COATING

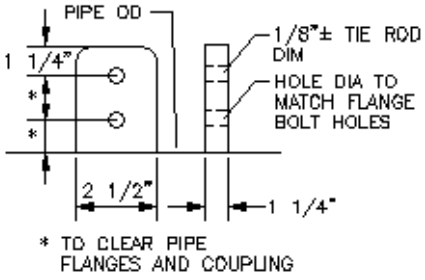
Wrap buried couplings with polyethylene per Section 099754.

3.04 HYDROSTATIC TESTING

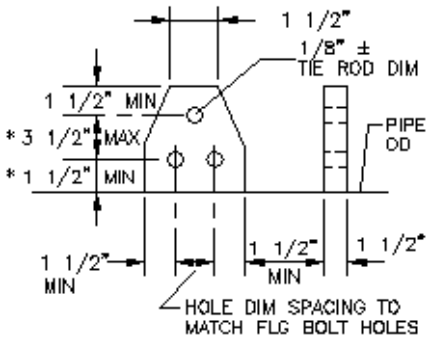
Hydrostatically test flexible pipe couplings, expansion joints, segmented sleeve couplings, and expansion compensators in place with the pipe being tested. Test in accordance with Section 400515.



FLEXIBLE PIPE COUPLING



FORGED STEEL EAR – TYPE "A"



FORGED STEEL EAR – TYPE "B"

FLEXIBLE PIPE COUPLING TIE RODS – DUCTILE IRON PIPE DETAIL

SCALE: NONE

END OF SECTION

SECTION 400762 WALL PIPES, SEEP RINGS, AND PENETRATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of cast-iron and ductile-iron wall pipes and sleeves (including wall collars and seepage rings) and penetrations.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Painting and Coating: 099000.

C. Fusion-Bonded Epoxy Linings and Coatings: 099761.

D. General Piping Requirements: 400500.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit detail drawings for ductile-iron or cast-iron wall and floor pipes and sleeves, wall flanges, seep rings, and sealing materials. Show dimensions and wall thicknesses.

C. Show flange sizes and the appropriate ANSI or AWWA flange dimensional standard where flanged end wall pipes or penetrations are used.

D. Show grooved-end dimensions and AWWA grooved-end dimensional standard where grooved-end wall pipes or penetrations are used.

E. List coating systems to be applied, manufacturer, and dry thickness of coatings. Call out coatings where coatings are to be applied.

F. List materials of construction, with ASTM material reference and grade.

G. Submit manufacturer's instructions for installing rubber annular hydrostatic sealing devices.

PART 2 - MATERIALS

2.01 GENERAL

A. Use cast-iron or ductile-iron wall sleeves when containing rubber annular hydrostatic sealing devices through which piping passes.

B. Use only cast-iron or ductile-iron wall pipes when connecting to cast-iron and ductile-iron pipe.

C. Cast-iron flanges shall conform to ASME B16.1, Class 125 or 250, to match the flange on the connecting pipe.

D. See Section 400500 for flange bolts and gaskets.

2.02 CAST-IRON OR DUCTILE-IRON WALL PIPES AND SLEEVES

A. Provide cast- or ductile-iron wall pipes with ends as shown in the drawings for connection to adjacent cast-iron and ductile-iron pipe or for containing pipes where they pass through concrete walls, ceilings, and floor slabs. Provide seepage ring on wall pipes and sleeves passing through concrete walls and slabs that are to be watertight. Locate collars such that the collar is at the center of the wall or floor slab, unless otherwise shown in the drawings.

B. Wall pipes and sleeves shall be of the following types:

1. Pipe or sleeve with integrally cast seep ring.

2. Pipe or sleeve with shrink-fit steel collar attached.

3. Pipe or sleeve with steel collar halves bottomed in a groove provided in the pipe or sleeve.

C. Minimum wall thickness for pipes and sleeves having integrally cast seep rings shall be as shown in the following table:

Pipe or Sleeve Size (inches)	**Minimum Wall Thickness (inches)**
3	0.48
4	0.52
6	0.55
8	0.60
10	0.68
12	0.75
14	0.66
16	0.70
18	0.75
20	0.80
24	0.89

D. Minimum wall thickness of pipes or sleeves having shrink-fit collars shall be special Class 52. Cut shrink-fit collars from a 1/4-inch-thick steel ring. Attach the collar to a cast-iron or ductile-iron pipe or sleeve by heating the steel collar and allowing it to shrink over the pipe at the necessary location. Provide an epoxy bond (Keysite 740 or 742 or Scotchkote 302) between the pipe and collar. Sandblast the area of the pipe to be epoxy coated per SSPC SP-10.

E. Wall pipes or sleeves having steel collar halves bottomed in a groove shall be ductile iron Special Class 54 minimum unless otherwise shown. Wall flanges shall consist of 1/4-inch-thick steel seep ring halves for pipes through 24-inch and 3/8-inch-thick halves for pipe 30 inches and larger, bottomed in a groove provided on the pipe. The pipe groove shall be machine cut to a depth of 1/16 to 5/64 inch to provide a press fit for the seep ring. Seep ring halves shall be welded together after fit into groove but shall not be welded to pipe. Seep rings shall be sealed completely around the pipe with silicon sealant manufactured by Dow-Corning No. 790, General Electric Silpruf, or equal.

F. The material used in cast- or ductile-iron wall flanges, wall sleeves, and wall penetrations shall conform to ASTM A395, A436, A536, A48 (Class 35), or A126 (Class B).

G. Pressure test at least one of each size of cast-iron pipes or sleeves having shrink-fit steel collars or collar halves installed in a groove in the pipe at the place of fabrication to demonstrate watertightness of the seal between the collar and the sleeve. The test shall be at a pressure of 20 psig for four hours' duration and shall show zero leakage.

2.03 RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

A. Rubber annular hydrostatic sealing devices shall be of the modular mechanical type, utilizing interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe sleeve and the passing pipe. Assemble links to form a continuous rubber belt around the pipe, with a pressure plate under each bolthead and nut.

B. Materials of construction shall be as follows:

Compound	Material
Pressure plate	Composite
Bolts and nuts for links	Type 303 or 316 stainless steel
Sealing element	EPDM rubber

C. The size of the wall sleeve needed to accommodate the passing pipe shall be as recommended by the rubber annular seal manufacturer.

D. Provide centering blocks in 25% of the sealing elements on pipelines larger than 12 inches in diameter.

E. The rubber annular hydrostatic sealing devices shall be Link Seal as manufactured by Thunderline Corporation; Innerlynx as manufactured by Advance Products & Systems, Inc.; or equal.

2.04 BOLTS, NUTS, AND GASKETS FOR FLANGED-END WALL PIPES

See Section 400500.

2.05 POLYETHYLENE FOAM FILLER FOR PIPE PENETRATIONS

Packing foam shall be an extruded closed-cell polyethylene foam rod, such as Minicel backer rod, manufactured by Industrial Systems Department, Plastic Products Group of Hercules, Inc., Middletown, Delaware; Ethafoam, as manufactured by Dow Chemical Company, Midland, Michigan; or equal. The rod shall be 1/2 inch larger in diameter than the annular space.

2.06 POLYURETHANE SEALANT FOR PIPE PENETRATIONS

Sealant shall be multipart, polyurethane sealant, to cure at ambient temperature, for continuous immersion in water. Install as recommended by the manufacturer. Products: SIKA Sikaflex 2C or equal.

2.07 PAINTING AND COATING

A. Line and coat sleeves and pipes with fusion-bonded epoxy per Section 099761.

B. Coat penetrations and sleeves exposed, above ground, or in vaults and with fusion-bonded epoxy per Section 099761.

C. Coat submerged sleeves and penetrations fusion-bonded epoxy per Section 099761.

D. Coat buried sleeves and penetrations with fusion-bonded epoxy per Section 099761.

E. Do not coat stainless steel sleeves and penetrations.

PART 3 - EXECUTION

3.01 INSTALLATION IN EXISTING CONCRETE WALLS AND SLABS

Core drill holes 1 to 2 inches larger in diameter than the outside diameter of the wall flange or collar. Install wall pipe and collar assembly axially aligned with the piping to which it will be connected or will contain. Pack the void space between the sleeve and concrete with non-shrink grout. See Section 030500 for grouting specification.

3.02 INSTALLATION IN NEW CONCRETE WALLS AND SLABS

Install wall pipes and sleeves in walls before placing concrete. Do not allow any portion of the pipe or sleeve to touch any of the reinforcing steel. Install wall pipe or sleeve and

collar assembly axially aligned with the piping to which it will be attached or will contain. Provide supports to prevent the pipe or sleeve from displacing or deforming while the concrete is being poured and is curing.

3.03 INSTALLATION OF WALL PIPES HAVING FLANGED END CONNECTIONS

A. Check alignment before grouting in place or pouring concrete. Realign if the sleeve is not properly aligned.

B. Install flanged end wall sleeves or penetrations with bolt holes of the end flanges straddling the horizontal and vertical centerlines of the sleeve.

3.04 QUALIFICATIONS OF WELDERS

Welder qualifications shall be in accordance with AWS D1.1.

3.05 INSTALLATION OF RUBBER ANNULAR HYDROSTATIC SEALING DEVICES

Install in accordance with the manufacturer's instructions.

3.06 FIELD TESTING

Check each wall penetration for leakage at the time the hydraulic structure is tested for leakage. Penetrations shall show zero leakage.

END OF SECTION

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SECTION 400775 EQUIPMENT AND PIPING IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of markers for pipes, and mechanical equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Painting and Coating: 099000.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.

PART 2 - MATERIALS

2.01 UNDERGROUND PLASTIC WARNING TAPE FOR METALLIC PIPE

Provide permanent, bright-colored, continuous-printed plastic tape, intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Chemical	Yellow
Electric	Red
Fuel Oil, Gasoline	Yellow
Gas	Yellow
Reclaimed Water	Violet
Sewer	Green
Telephone	Orange
Water	Blue

2.02 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE FOR NONMETALLIC PIPE

Provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than 2 inches wide by 3 mils thick. Provide tape with printing which most accurately indicates type of buried service. Provide the following colored tape for the various piping services:

Service	Color
Cable TV	Orange
Chemical	Yellow
Electric	Red
Fuel Oil, Gasoline	Yellow
Gas	Yellow
Reclaimed Water	Violet
Sewer	Green
Telephone	Orange
Water	Blue

PART 3 - EXECUTION

3.01 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

During backfilling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install single line marker.

3.02 INSTALLING UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

Install tape 4 to 6 inches below finished ground surface, located directly over buried pipelines. Where multiple small pipelines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker tape.

END OF SECTION

SECTION 401449 POLYETHYLENE PIPE FOR NATURAL GAS SERVICE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and field testing of polyethylene pipe and fittings for natural gas service.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. General Concrete Construction: 030500.

B. Cold-Applied Wax Tape Coating: 099752.

C. Trenching, Backfilling, and Compacting: 312316.

D. Manual, Check, and Process Valves: 400520.

E. Equipment and Piping Identification: 400775.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit manufacturer's catalog data on pipe, valves, and fittings. Include materials of construction by ASTM reference and grade.

C. Submit proof of polyethylene fusion welder's qualifications.

PART 2 - MATERIALS

2.01 POLYETHYLENE PIPE AND FITTINGS

Polyethylene pipe and fittings shall be made from medium or high-density polyethylene resin conforming to ASTM D1248, Type II, Class B, Category 5, Grade P24 or Type III, Class C, Category 5, Grade P34. Pipe shall comply with ASTM D2513. Design pressure shall be at least 69 psi at 120°F and have a standard dimensional ratio (SDR) of 11. Joints and fittings shall be joined by butt fusion in accordance with the manufacturer's procedures for making heat fusion butt joints. The pipe shall be yellow. Pipe and fitting systems shall be Performance Pipe Product PE2406, DriscoPlex 6500, or equal.

2.02 TRANSITION FITTINGS

Gas pipefittings for the transition from steel gas line to polyethylene gas line shall be constructed of Schedule 40 steel pipe, epoxy lined and coated with weld ends. The

polyethylene connection end shall be of the same material used for the polyethylene gas pipe and shall be joined to the polyethylene gas line by the heat fusion butt joint method. The fitting shall be of a double O-ring, gastight construction and shall conform to ASTM F1948. Transition fittings shall be as manufactured by Central Plastics, Phillips Driscopipe, or equal.

2.03 POLYETHYLENE BALL VALVES FOR NATURAL GAS SERVICE

Polyethylene ball valve used for gas service shall be made from medium-density polyethylene resin conforming to ASTM D1248, Type II, Class B, Category 5, Grade P24. Valve shall comply with ASME B16.40. The valve shall have standard stub ends suitable for heat fusion welding. The valve shall have seals and seats molded from nitrile (Buna-N) material and shall be compatible with gas service. Valve shall be Nordstrom Polyvalve, Kerotest Polyball, or equal.

2.04 VALVES BOXES

Provide a valve box for each buried valve consisting of a frame, lid, and one-piece extension pipe. Construct frame and lid of cast iron and design for traffic loading. Castings shall be smooth, clean, and free from blisters, blowholes, and shrinkage. Machine bearing surfaces of frame and lid to provide a close fit without rocking. Cast on the lid the word "GAS." Frame and lid shall be Parkson Inc. PS400, South Bay Foundry SBF 1208, or equal. Extension pipe shall be 8-inch-diameter PVC pipe conforming to ASTM D3034, SDR 35.

PART 3 - EXECUTION

3.01 QUALIFICATION OF FUSION WELDERS

Fusion welders and fusion welding procedures shall meet the requirements of 49 CFR 192.285

3.02 TRENCHING, BACKFILLING, AND COMPACTING

A. Install in accordance with Section 312316 and the following.

B. Pipe installed underground shall not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert. Maintain a minimum 36-inch cover over the pipe (except at risers). Maintain a minimum 12-inch clearance between the pipe and underground structures.

C. Do not install gas piping closer than 8 inches to a waterline, drain line, sewer, or other pipe.

D. Material for pipe zone and pipe base shall be sand per Section 312316. Backfill material above pipe zone shall be native material per Section 312316.

E. If the pipe contains dirt, sand, or other foreign materials after it has been strung along the trench or right-of-way, swab each length prior to fusion welding it into the pipeline. The swab may be cloth or rubber pig. Visually inspect each length internally prior to use.

F. Place pipe on 6-inch-minimum sand bed. In warm weather, provide extra slack in the pipeline to allow contraction of pipe in the ditch prior to backfilling without producing thermal stresses.

G. Backfill polyethylene pipe with 6-inch-minimum sand cover above the top of the pipe. Compact the first 12 inches of backfill by hand. Allow no rocks within the first 12 inches of backfill that could damage the pipe.

H. Provide detectable wire warning tape 24 inches above the top of the pipe per Section 400775.

3.03 STORAGE AND HANDLING

Store and handle polyethylene pipe and fittings in accordance with the manufacturer's recommendations. Do not drop or subject pipe to abrasion or concentrated external loads. Inspect pipe prior to installation. Make sure no damage has occurred during shipment and subsequent handling at the jobsite. Discard any pipe or fittings that have been damaged.

3.04 CLEANLINESS

Thoroughly clean inside of a pipe and fittings before installation. Blow lines clear using 80- to 100-psig clean dry compressed air. Cap or plug pipe ends as necessary to maintain cleanliness throughout installation.

3.05 CUTTING OF POLYETHYLENE PIPE

Cut pipe accurately to actual dimensions and assemble in such a manner as to preclude residual stress. Use a tubing cutter designed for plastic pipe.

3.06 INSTALLATION OF POLYETHYLENE PIPING

A. Install polyethylene piping in accordance with manufacturer's printed instructions.

B. Joints shall be fusion welded. Comply with ASTM F2620. Use electrically heated tools, thermostatically controlled, and equipped with temperature indication.

C. Present proof that supervisory and installing personnel have received training by a pipe manufacturer's sponsored course of not less than one-week duration or that personnel are currently and continuously engaged in the installation of polyethylene gas distribution lines.

3.07 COATING OF TRANSITION FITTINGS

A. Coat per Section 099752 and the following:

B. Extend the primer a minimum of 3 inches onto the adjacent surfaces of the polyethylene gas pipe.

C. Apply the wax tape immediately after the primer application. Work the tape into the crevices around the transition fitting. Wrap the wax tape spirally around the pipe and across the fitting to the other pipe. Use a minimum overlap of 55% of the tape width.

3.08 INSTALLATION OF BURIED POLYETHYLENE VALVES

Fuse valves to the pipe using heat fusion butt welding.

3.09 INSTALLATION OF VALVE BOXES

Place and compact trench backfill to the height of the valve stem. Set the one-piece extension pipe over the operating nut and center in place. Maintain the extension pipe in a vertical position during backfilling. Slip the valve box frame over the extension pipe and adjust both to finish grade. Pour a 6-inch-thick by 2-foot-diameter concrete ring around the valve box frame. Concrete shall be Class C per Section 030500. In paved areas, top of concrete ring shall be 1 inch below finish grade of adjacent surfaces. Overlay the concrete ring with 1-inch compacted thickness of asphalt concrete pavement. Valve box frame and lid shall be flush with the finish surface of the pavement. Paint top side of valve box cover. Color of finish coat shall be yellow.

3.10 POLYETHYLENE FUSION WELDING INSPECTION

Butt fusion joints shall be visually inspected by comparing with manufacturer's visual joint appearance chart. Inspect other joints for proper fused connection. Replace unsatisfactory joints or joints needing improvement by cutting out defective joints or replacing fittings. Inspect each joint and reinspect corrections.

3.11 PRESSURE TESTING

A. Perform a pneumatic test per Section 400515 for flammable gas piping. Do not test until every joint has set and cooled at least eight hours at a temperature above 50°F. Perform testing before backfilling; however, place sufficient backfill material between fittings to hold pipe in place during tests. Systems which may be contaminated by gas shall first be purged. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from all sources of air during test period.

B. Maintain test pressure for at least eight hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes. Temperature shall be same as actual trench conditions. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature

change in accordance with the relationship PF + 14.7 = (P_1 + 14.7) (T_2 + 460)/(T_1 + 460), in which T and P represent Fahrenheit temperature and gauge pressure, respectively; subscripts 1 and 2 denote initial and final readings; and "PF" is the calculated final pressure.

C. If "PF" exceeds the measured final pressure (final gauge reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to all joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. Use a test gauge calibrated in 1-psi increments and readable to 1/2 psi in performing the tests.

D. If unacceptable fusion welds are observed during inspection and testing, remove a section of pipe containing the bad weld to a length of 18 inches on either side of the fusion weld. Then fusion weld a new spool piece in place of the removed section of pipe.

E. Under no circumstances shall a valve in a line be used as a bulkhead between gas in one section of the piping system and air in an adjacent section, unless two valves are installed in series with a valved telltale between these valves.

F. Following pneumatic testing, thoroughly purge gas lines with oil-free nitrogen gas such that no explosive mixtures will be present in the system during the filling process. Comply with NFPA 54, paragraph 8.3.

3.12 SYSTEM PURGING

After pressure tests and before testing a gas-contaminated line, purge line with nitrogen at junction with main line to remove all air or gas. Clear completed line by attaching a test pilot fixture and let gas flow until test pilot ignites. Procedures shall conform with ASME B31.8.

END OF SECTION

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SECTION 401458 STEEL PIPE FOR NATURAL GAS OR LPG SERVICE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of steel pipe and fittings for natural gas piping.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Painting and Coating: 099000.

B. Cold-Applied Wax Tape Coating: 099752.

C. Trenching, Backfilling, and Compacting: 312316.

D. General Piping Requirements: 400500.

E. Pressure Testing of Piping: 400515.

F. Manual Valves and Check Valves: 400520.

G. Equipment, Piping, Duct, and Valve Identification: 400775.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit list showing materials and dimensions of pipe and fittings with API and/or ASTM reference and grade. Show coating used on buried piping.

C. Submit certificates of welding rods used for field welding.

PART 2 - MATERIALS

2.01 PIPE

Material shall be seamless, API 5L, Grade B or ASTM A106, Grade B. A nondestructive electric test per the previously cited ASTM pipe specification may be substituted for the hydrostatic test. Minimum wall thickness for pipe having welded joints or connections shall be Schedule 80 per ASME B36.10. Minimum wall thickness for pipe having threaded connections shall be Schedule 80 per ASME B36.10.

2.02 FITTINGS

A. Fittings shall be butt-welded conforming to ASME B16.9. Material shall conform to ASTM A234, Grade WPB. Wall thickness shall be the same as the pipe as a minimum. Provide fittings at all bends. Do not field bend pipe.

B. Fittings 2 inches and smaller may be socket-welded in accordance with ASME B16.11, Class 3000.

2.03 JOINTS

Joints for pipe shall be butt-welded. Socket welds can be used on pipes smaller than 2 inches in diameter in accordance with ASME B31.8.

2.04 UNIONS

Unions shall comply with MSS SP-83, Class 3000, socket welded.

2.05 FLANGES

Provide weld-neck flanges, Class 150, per ASME B16.5 to connect to flanged valves or equipment. Flanges shall match the connecting flanges on the adjacent valve or piece of equipment. Flanges shall be flat faced.

2.06 BOLTS AND NUTS FOR FLANGES

See Section 400500.

2.07 GASKETS FOR FLANGES

Provide in accordance with ASME B31.8. Gasket material shall be nonasbestos.

2.08 CONNECTIONS BETWEEN METALLIC AND PLASTIC PIPING

Make connections between metallic and plastic piping with fittings conforming to ASTM D2513, F1973, or F2509.

PART 3 - EXECUTION

3.01 GENERAL

Ream, clean, and remove burrs from piping before making up joints.

3.02 WELDING

A. Beveled ends for butt-welding shall conform to ASME B31.8. Remove slag by chipping or grinding. Surfaces shall be clean of paint, oil, rust, scale, slag, and other material detrimental to welding.

B. Perform butt-welding and socket welding in conformance with ASME B31.8.

C. Qualification of field welding procedures shall be in accordance with Section 5 of API 1104. Welder qualification shall be in accordance with Section 6 of same standard.

D. The minimum number of passes for welded joints shall be as follows:

Steel Cylinder Thickness (inch)	**Minimum Number of Passes for Welds**
Less than 0.1875	1
0.1875 through 0.25	2
Greater than 0.25	3

Welds shall be full circumferential.

E. Use the SMAW method for welding. Materials shall comply with API 1104, Section 4.

F. Clean each layer of deposited weld metal prior to depositing the next layer of weld metal, including the final pass, by a grinding wheel.

G. Welding rod shall comply with API 1104.

H. Repair of weld defects shall comply with API 1104, Section 10.

I. Twenty percent of circumferential field welds shall be fully radiographed in accordance with API 1104, Section 11. Acceptance standards shall be in accordance with API 1104, Section 9.

3.03 PAINTING AND COATING

A. Coat buried piping per Section 099000, System No. 25.

B. Coat piping located above ground or in vaults and structures per Section 099000, System No. 10. Color of finish coat shall be OSHA Safety Yellow.

3.04 FIELD COATING OF TRANSITION FITTINGS TO POLYETHYLENE GAS PIPE

A. Coat per Section 099752 and the following:

B. Extend the primer a minimum of 3 inches onto the adjacent surfaces of the polyethylene gas pipe.

C. Apply the wax tape immediately after the primer application. Work the tape into the crevices around the transition fitting. Wrap the wax tape spirally around the pipe and across the fitting to the other pipe. Use a minimum overlap of 55% of the tape width.

3.05 INSTALLING EXPOSED PIPE

Install in accordance with ASME B31.8 and NFPA 54, Chapter 7.

3.06 INSTALLING BURIED PIPE

A. Install in accordance with Section 312316 and the following.

B. Pipe installed underground shall not deviate more than 1 inch from line or 1/4 inch from grade. Measure for grade at the pipe invert. Maintain a minimum 36-inch cover over the pipe (except at risers). Maintain a minimum 12-inch clearance between the pipe and underground structures.

C. Do not install gas piping closer than 12 inches to a waterline, drain line, sewer, or other pipe.

D. Material for pipe zone and pipe base shall be sand per Section 312316. Backfill material above pipe zone shall be native material per Section 312316.

E. If the pipe contains dirt, sand, or other foreign materials after it has been strung along the trench or right-of-way, swab each length prior to welding it into the pipeline. The swab may be a wire brush, cloth, or rubber pig. Visually inspect each length internally prior to use.

F. Provide plastic warning tape per Section 400775.

G. After the pipeline is complete, run a pipeline scraper or pig through the line twice. Pigging is not required for lines less than 2 inches in nominal size and for service laterals. Prior to the pigging operation, install a pig catcher on the end of the line. Fasten the catcher to the end of the pipeline in a manner which will prevent it from blowing off during the pigging operation. The pigging operation shall provide for controlled running of the pig. Move the pig by air pressure only. Do not use gas pressure in the pigging operation.

3.07 PIPELINE PRESSURE TESTING

A. Perform a pneumatic test per Section 400515 for flammable gas piping. Do not test until every joint has set and cooled at least eight hours at a temperature above 50°F. Perform testing before backfilling; however, place sufficient backfill material between fittings to hold pipe in place during tests. Systems which may be contaminated by gas shall first be purged. Make tests on entire system or on sections that can be isolated by valves. After pressurization, isolate entire piping system from all sources of air during test period.

B. Maintain test pressure for at least eight hours between times of first and last reading of pressure and temperature. Take first reading at least one hour after test pressure has been applied. Do not take test readings during rapid weather changes. Temperature shall be same as actual trench conditions. There shall be no reduction in the applied test pressure other than that due to a change in ambient temperature. Allow for ambient temperature

change in accordance with the relationship PF + 14.7 = (P_1 + 14.7) (T_2 + 460)/(T_1 + 460), in which T and P represent Fahrenheit temperature and gauge pressure, respectively; subscripts 1 and 2 denote initial and final readings; and "PF" is the calculated final pressure.

C. If "PF" exceeds the measured final pressure (final gauge reading) by 1/2 psi or more, isolate sections of the piping system, retest each section individually, and apply a solution of warm soapy water to all joints of each section for which a reduction in pressure occurs after allowing for ambient temperature change. Repair leaking joints and repeat test until no reduction in pressure occurs. Use a test gauge calibrated in 1-psi increments and readable to 1/2 psi in performing the tests.

D. If unacceptable welds are observed during inspection and testing, remove a section of pipe containing the bad weld to a length of 18 inches on either side of the weld. Then weld a new spool piece in place of the removed section of pipe. The closing welds shall be fully radiographed.

E. Under no circumstances shall a valve in a line be used as a bulkhead between gas in one section of the piping system and air in an adjacent section, unless two valves are installed in series with a valved telltale between these valves.

F. Following pneumatic testing, thoroughly purge gas lines with oil-free nitrogen gas such that no explosive mixtures will be present in the system during the filling process. Comply with NFPA 54, paragraph 8.3.

END OF SECTION

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SECTION 402040 DUCTILE-IRON PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes materials, testing, and installation of ductile-iron pipe and fittings 24 inches and smaller.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. Polyethylene Sheet Encasement (AWWA C105): 099754.

C. Fusion-Bonded Epoxy Linings and Coatings: 099761.

D. Trenching, Backfilling, and Compacting: 312316.

E. General Piping Requirements: 400500.

F. Pressure Testing of Force Main Piping: 400515.

G. Wall Flanges, Seep Rings, and Penetrations: 400762.

H. Flexible Pipe Couplings: 400722.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01330.

B. Provide an affidavit of compliance with standards referenced in this specification, e.g., AWWA C151. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in AWWA C153, Section 5.5 is met.

C. Provide the following information:

1. Wall thickness.

2. Show deflections at push-on and mechanical joints.

3. Submit joint and fitting details and manufacturer’s data sheets.

D. Submit calculations and test data proving that the proposed restrained joint arrangement can transmit the required forces with a minimum safety factor of 1.5.

E. Submit test report on physical properties of rubber compound used in the gaskets.

F. Submit drawing or manufacturer's data sheet showing flange facing, including design of facing serrations.

G. Submit weld procedure specification, procedure qualification record, and welder's qualifications prior to any welding to ductile-iron pipe.

PART 2 - MATERIALS

2.01 PIPE

Pipe shall be cast ductile (nodular) iron, conforming to AWWA C151.

2.02 PIPE WALL THICKNESS

A. Minimum wall thicknesses for pipe having grooved-end joints shall be as shown in the following table:

Pipe and Fitting Sizes (inches)	**Wall Thickness***
16 and smaller	Special Class 53
18	Special Class 54
20	Special Class 55
24	Special Class 56
*Special Class and Pressure Class per AWWA C151.	

B. Minimum wall thickness for pipe having push-on or restrained joints, plain ends, or cast flange ends shall be Class 350, unless otherwise shown in the drawings.

C. Minimum wall thickness for pipe having threaded flanges shall be Special Class 53 or Pressure Class 350.

D. Minimum pipe wall thickness required for corporation stops and tapped outlets shall be in accordance with Table A.1 of AWWA C151 for three full threads for design pressures up to 250 psi and four full threads for design pressures over 250 to 350 psi.

2.03 FITTINGS

A. Fittings 24 inches and smaller shall conform to AWWA C110 with a minimum pressure rating of 250 psi. Material shall be ductile iron. Flanges shall be flat faced.

B. Grooved-end fittings shall conform to AWWA C110 with grooved ends conforming to AWWA C606, radius cut rigid joints. Fitting material shall conform to ASTM A48, Class 30; ASTM A126, Class B; or ASTM A536, Grade 65-42-10. Wall thickness of

ductile-iron (ASTM A536) fittings shall conform to AWWA C110 or C153; wall thickness of cast-iron fittings shall conform to AWWA C110. Fittings and couplings shall be furnished by the same manufacturer.

C. Material for fittings with welded-on bosses shall have a Charpy notch impact value of minimum 10 ft-lbs under the conditions defined in AWWA C151. Test completed welds by the liquid penetrant method per ASTM E165.

2.04 FLANGES

A. Flanges shall be solid back, Class 125 per AWWA C115. Flanges on pipe shall be either cast or threaded. Material shall be ductile iron.

B. Flanged pipe and fittings shall be shop fabricated, not field fabricated. Threaded flanges shall comply with AWWA C115. Flanges shall be individually fitted and machine tightened in the shop, then machined flat and perpendicular to the pipe barrel. Flanges shall be backfaced parallel to the face of flange. Prior to assembly of the flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket.

2.05 PIPE LINING—AND FITTINGS

Line and coat pipe and fittings with fusion bonded epoxy per Section 099761.

2.06 GROOVED-END COUPLINGS

A. Grooved-end pipe couplings shall be ductile iron, ASTM A536 (Grade 65-45-12). Gaskets shall be Buna-N and shall conform to ASTM D2000.

B. Bolts in exposed service shall conform to ASTM A193, Grade B8, Class 2. Bolts in buried or submerged service shall be ASTM A193, Grade B8, Class 2.

C. Couplings for pipe 24 inches and smaller shall conform to AWWA C606 for flexible radius ductile-iron pipe, except where rigid radius couplings are required to connect to fittings. Couplings shall be Victaulic Style 31, Gustin-Bacon No. 500, or equal.

D. Grooved-end adapter flanges for piping 24 inches and smaller having an operating pressure of 150 psi and less shall be Victaulic Style 341 or 342 or equal. Flange dimensions shall conform to ASME B16.1, Class 125.

2.07 GASKETS FOR FLANGES

See Section 400500.

2.08 GASKETS FOR PUSH-ON AND RESTRAINED JOINTS

Synthetic rubber in accordance with AWWA C111.

2.09 BOLTS AND NUTS FOR FLANGES

See Section 400500.

2.10 JOINTS

A. Joints in aboveground or submerged piping or piping located in vaults and structures shall be grooved end or flanged.

B. Joints in buried piping shall be of the restrained push-on type per AWWA C111 except where flanged joints are required to connect to valves, meters, and other equipment.

C. Restrained joints for piping 6 inches and larger shall be American Cast Iron Pipe "Lok-Ring" or "Flex-Ring," U.S. Pipe "TR-Flex," or equal. Weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E165. Restrained joints for field closures shall be “Megalug” by EBAA Iron.

D. Restrained joints in 4-inch-diameter buried piping shall be American Cast Iron Pipe Company “Fast-Grip,” U.S. Pipe Field-lok gasket within Tyton joint pipe and fittings, or equal. Joint restraint shall be certified to four times rated pressure of 200 psi by Factory Mutual.

E. Where thrust restraint is called for in the drawings, provide pipe with restrained joints capable of transmitting 1.5 times the thrust, as calculated by the following equation:

$$T = 1.5 * (0.785 * P * D^2)$$

where:

P = Pressure class of pipe in psi.
D = Outside diameter of pipe in inches.
T = Thrust in pounds.

2.11 DUCTILE-IRON PIPE WELDMENTS

A. All welding to ductile-iron pipe, such as for bosses, joint restraint, and joint bond cables, shall be done at the place of manufacture of the pipe. Perform welding by skilled welders experienced in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

B. Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.

C. Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

PART 3 - EXECUTION

3.01 DELIVERY, UNLOADING, AND TEMPORARY STORAGE OF PIPE AT SITE

A. Use unloading and installation procedures that avoid cracking of the lining.

B. Deliver the pipe alongside the pipe laying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed and secure it from rolling.

C. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel. Field repair linings damaged by unloading or installation procedures.

3.02 SANITATION OF PIPE INTERIOR

A. During laying operations, do not place tools, clothing, or other materials in the pipe.

B. When pipe laying is not in progress, close the ends of the installed pipe by a child- and vermin-proof plug.

3.03 INSTALLING FLANGED PIPE AND FITTINGS

Install in accordance with Section 400500. Cut the bore of the gaskets such that the gaskets do not protrude into the pipe when the flange bolts are tightened.

3.04 INSTALLING GROOVED-END PIPE AND FITTINGS

See Section 400500.

3.05 INSTALLING BURIED PIPING

A. Install in accordance with AWWA C600, Section 312316, and as follows.

B. When installing piping in trenches, do not deviate more than 1 inch from line or 1/4 grade. Measure for grade at the pipe invert.

C. Assemble restrained joints per manufacturer's instructions.

3.06 JOINT DEFLECTIONS FOR BURIED PIPE

A. Do not exceed the following deflection angles for unrestrained buried pipe joints:

Pipe Size (inches)	Maximum Deflection (degrees)
	Push-On Joint
4	4
6	4
8	4
10	4
12	4
14	2 1/2
16	2 1/2
18	2 1/2
20	2 1/2
24	2 1/2

B. For restrained joints, do not exceed 80% of the manufacturer's recommended maximum deflections.

C. Assemble joints in accordance with AWWA C600 and the manufacturer's recommendations.

3.07 INSTALLING ABOVEGROUND OR EXPOSED PIPING

See Section 400500.

3.08 PAINTING AND COATING

A. Coat pipe located above ground, in vaults, and in structures with fusion-bonded epoxy per Section 099761.

B. Coat buried piping with fusion-bonded epoxy per Section 099761.

C. Coat submerged pipe with fusion-bonded epoxy per Section 099761.

D. Line and coat exposed grooved-end couplings with fusion-bonded epoxy per Section 099761

E. Line and coat submerged and buried grooved-end couplings with fusion-bonded epoxy per Section 099761**.**

3.09 POLYETHYLENE ENCASEMENT OF BURIED PIPE AND FITTINGS

Wrap buried pipe, fittings, grooved-end couplings, and joints with polyethylene per Section 099754.

3.10 FIELD HYDROSTATIC TESTING

Test pressures are shown in Section 400515. Test in accordance with Section 400515.

3.11 BURIED WARNING AND IDENTIFICATION TAPE

Provide detectable warning tape per Section 400775. Warning and identification shall read “CAUTION BURIED SEWER FORCE MAIN PIPING BELOW” or similar wording.

END OF SECTION

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SECTION 402076 STAINLESS STEEL PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and installation of stainless steel pipe and fittings 30 inches in diameter and smaller conforming to ASTM A312 and having a maximum design pressure of 150 psi.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. Polyethylene Tape Coating (AWWA C214): 099757.

C. Fusion-Bonded Epoxy Linings and Coatings: 099761.

D. Trenching, Backfilling, and Compacting: 312316.

E. General Piping Requirements: 400500.

F. Pressure Testing of Piping: 400515.

G. Manual, Check, and Process Valves: 400520.

H. Equipment, Piping, Duct, and Valve Identification: 400775.

I. General Requirements for Steel Piping: 402001.

1.03 SUBMITTALS

Submit shop drawings in accordance with Section 402001.

PART 2 - MATERIALS

2.01 PIPE

A. Pipe smaller than 3 inches shall conform to ASTM A312, Grade TP 316L. Pipe 3 inches and larger shall conform to ASTM A312, Grade TP 316L.

B. Pipe sizes and wall thicknesses shall conform to ASME B36.19 as follows:

Pipe Size	Wall Thickness
3 1/2 inches through 8 inches	Schedule 40S

2.02 FITTINGS

A. Fittings for aboveground or exposed pipe larger than 3 inches through 24 inches shall be flanged, conforming to ASTM A403, Class WP, same material and wall thickness as the pipe, conforming to ASME B16.9. Elbows shall be long radius.

2.03 PICKLING, PASSIVATING, AND FINAL CLEANING

Pipe and fittings shall be final cleaned, pickled, and passivated per ASTM A380. Passivation shall be the removal of exogenous (not inherent in the base metal) iron or iron compounds from the surface of the stainless steel by means of a chemical dissolution, by a treatment with an acid solution that will completely remove the surface contamination but will not significantly affect the stainless steel itself. After final cleaning, wet surfaces with water and inspect for rust spots after 24 hours. Reclean if there is any evidence of rusting.

2.04 QUALITY CONTROL

Include the "Hydrostatic Test" and "Flattening Test" requirements described in ASTM A999. A nondestructive electric test per ASTM A999 may be substituted for the hydrostatic test.

2.05 JOINTS

A. Joints shall be flanged.

B. See Section 402001 for additional requirements.

2.06 FLANGES

A. Provide weld-neck flanges (conforming to ASME B16.5) for piping 3 inches and smaller to connect to flanged valves, fittings, or equipment. Provide weld-neck or Van Stone flanges (per ASTM F2015) for piping larger than 3 inches. Flanges shall be Class 150 per ASME B16.5. Flanges shall match the connecting flanges on the adjacent fitting, valve, or piece of equipment. Flanges shall be flat face.

B. Material for weld-neck flanges shall conform to ASTM A182, Grade F316L.

2.07 BOLTS AND NUTS FOR FLANGES

See Section 400500.

2.08 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

See Section 400500.

2.09 GASKETS FOR FLANGES

See Section 400500.

2.10 PROTECTIVE END CAPS

Provide protective end caps on each piece of pipe or fabricated section, completely sealing the piece from contamination during shipment and storage. Provide the same type of seals on each fitting, or ship and store fittings in sealed boxes or containers.

2.11 OXYGEN INDICATOR FOR WELDING OPERATIONS

Use an oxygen indicator to determine the oxygen level in the purged atmosphere (rest oxygen) in the welding area. The oxygen indicator shall be of the zirconium cell type having a range of 1- to 100-ppm oxygen. Products: Intercon Enterprises Pro-2 or equal.

PART 3 - EXECUTION

3.01 SHIPPING, STORAGE, AND HANDLING

A. Ship, store, and handle piping (including both pipe and fittings) per AWWA C220, Section 6.2 and AWWA C226, Section 6.3 and the following.

B. When loading piping for shipment to the project site, use spacers and other protective devices to separate pipes to prevent damaging the surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the pipe surfaces after separation. Use padded chains or ribbon binders to secure the loaded pipe and minimize damage.

C. Cover piping 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.

D. Provide stulls, braces, and supports during shipping and storage such that out-of-roundness or deflection does not exceed 0.5% of the pipe diameter.

E. Handle piping with care during unloading, installation, and erection operations to minimize damage. Do not place or store pipe on the ground or on top of other work unless ground or work is covered with a protective covering or tarpaulin. Place pipe above the ground upon platforms, skids, or other supports.

F. Store piping at the site on pallets to prevent direct contact with ground or floor. Cover pipe during storage with protective coverings or tarpaulins to prevent deposition of rainwater, salt air, dirt, dust, and other contaminants.

G. Do not allow piping to contact carbon steel surfaces during storage, handling, or installation and erection at the site.

3.02 FABRICATION, ASSEMBLY, AND ERECTION

A. See Section 402001. Use an inert or shielding gas welding method. Do not use oxygen fuel welding. Purge the interior of the pipe with inert gas prior to the root pass. The oxygen content in the purged atmosphere in the welded area shall not exceed 30 ppm during welding operations. Use an oxygen indicator to verify oxygen levels during welding. Provide written documentation of the welding procedure before and during the oxygen purging process, showing the oxygen levels attained during the purging and welding operations.

B. Welded butt joints (both longitudinal and circumferential) shall comply with AWWA C220 and AWWA C226, Section 4. Do not use backing rings. Provide full penetration and smooth internal diameters for the root bead of welds. Grind the inside weld of socket welds flush with the pipe internal diameter. Welds shall be of smooth finish. Use anti-spatter compounds specifically formulated or designed for use with stainless steel. Do not allow heat tint to form in the heat-affected zone or remove heat tint completely from the heat-affected zone of the finished weld. The maximum depth of grinding or abrasive blasting to remove defects shall not exceed 10% of the wall thickness. Do not perform abrasive blasting with steel shot, grit, or sand.

C. No iron or steel surfaces shall come into contact with the stainless steel. This includes placing on steel tables, racks, pipe supports, etc. Do not use carbon steel wire brushes or grinders.

D. Welding electrodes shall comply with AWS A5.4. Bare wire shall comply with AWS A5.9. Use electrodes as follows:

Pipe Material	**Welding Electrode Material**
Type 304	E 308
Type 304L	E 347
Type 316	E 316
Type 316L	E 318

3.03 INSTALLING FLANGED PIPING

See Section 400500.

3.04 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

See Section 400500.

3.05 FIELD HYDROSTATIC TESTING

A. See Section 402001.

B. Do not allow test water to remain in the pipe for more than five days. Drain and dry the piping after completing the testing.

END OF SECTION

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SECTION 402097 HDPE PIPE, 20 INCHES AND SMALLER

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes materials and testing of PE3408 high-density, very high molecular weight polyethylene pipe and fittings of size 20 inches and smaller for use in direct burial piping having a hydrostatic design basis of 1,600 psi and having a maximum operating temperature of 74°F. Pipe diameter basis is IPS, with standard dimension ratio (SDR) and pressure class as shown in the drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Trenching, Backfilling, and Compacting: 312316.

B. Painting and Coating: 099000.

C. Leakage and Infiltration Testing: 330130

D. Polyethylene Sheet Encasement (AWWA C105): 099754.

E. General Piping Requirements: 400500.

F. Wall Flanges, Anchors, and Penetrations: 400762.

G. Manual, Check, and Process Valves: 400520.

H. Pressure Testing of Force Main Piping: 400515.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit materials list for review. Submit manufacturer's recommended method of installing buried pipe including methods for butt-fusing joints.

C. The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific product. Certification shall include a stress life curve per ASTM D2837.

D. Provide certification that the material is listed by the Plastics Pipe Institute in PPI TR-4 with a 73°F hydrostatic design stress rating of 800 psi and a 140°F hydrostatic design stress rating of 400 psi. The PPI listing shall be in the name of the pipe manufacturer and shall be based on ASTM D2837 and PPI TR-3 testing and validation of samples of the pipe manufacturer's production pipe.

E. 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 to these specifications.

F. Submit certified lab data to verify specified physical properties. Certify that tests are representative of pipe supplied for this project.

G. Submit affidavit of compliance with referenced standards (e.g., AWWA C901, C906, ASTM F714, etc.).

H. Submit recommended locations of flanged joints, unions, shop-fabricated fittings, and connections to other pipe materials. Submit detailed drawings of fittings.

I. Submit installation methods for pipes to be installed in casings

J. Submit qualification certificates for operators of heat fusion equipment.

PART 2 - MATERIALS

2.01 PIPE

A. Pipe 1/2 inch through 3 inches shall conform to AWWA C901 and the following restrictions.

B. Pipe and fittings 4 inches through 20 inches shall conform to AWWA C906 and the following requirements.

C. Pipe shall have a nominal IPS outside diameter.

D. The SDR and the pressure rating of pipe 1/2 inch through 3 inches shall be in accordance with Table 5 of AWWA C901. If no SDR is shown in the drawings, use an SDR of 17.

E. The minimum wall thickness (inches) for pipe 4 inches through 20 inches shall be in accordance with Table 5 of AWWA C906, for the SDR shown in the drawings. If no SDR is shown in the drawings, use an SDR of 17.

F. Pipe shall be light grey in color inside and outside.

G. 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.

H. Pipe shall have a minimum hydrostatic design basis (HDB) of 1,600 psi, as determined in accordance with ASTM D2837.

I. Pipe Material:

1. Materials used for the manufacture of polyethylene pipe and fittings shall be very high molecular weight, high-density ethylene/hexene copolymer PE 3408 polyethylene resin meeting the physical property and pipe performance requirements listed below.

Property	Specification	Units	Minimum Values
Material Designation	PPI/ASTM	---	PE4710
Material Classification	ASTM D1248	---	III C 5 P34
Cell Classification	ASTM D3350	---	345434C
Hardness	ASTM D2240	Shore "D"	64
Compressive Strength (Yield)	ASTM D695	psi	1,600
Tensile Strength @ Yield (Type IV Spec.)	ASTM D638 (2"/min)	psi	3,200
Elongation @ Yield	ASTM D638	%, min.	8
Tensile Strength @ Break (Type IV Spec.)	ASTM D638	psi	3,500 psi
Elongation @ Break	ASTM D638	%, min.	600
Modulus of Elasticity	ASTM D638	psi	110,000
ESCR:			
(Cond A,B,C: Mold. Slab)	ASTM D1693	Fo, Hrs	Fo>5,000
(Compressed Ring Pipe)	ASTM F1248	F50, Hrs	F50>1,000
Slow Crack Growth	Battelle Method	Days to Failure	Fo>32
Impact Strength (IZOD) (0.125-Inch Thick)	ASTM D256 (Method A)	in-lb/in Notch	42
Linear Thermal Expansion Coefficient	ASTM D696	in/in/°F	1.2 x 10-4
Thermal Conductivity	ASTM C177	BTU, in/ Ft2/hrs/°F	2.7
Brittleness Temp.	ASTM D746	°F	<-180°F
Vicat Soft. Temp.	ASTM D1525	°F	257
NSF Listing	Standard 14	---	"Listed"
*Standard deviation 0.01.			

2. The pipe shall be extruded from precompounded resin. In-plant blending of resin is unacceptable.

2.02 NIPPLES AND FLANGED STUB ENDS

Short nipples and stub ends shall be of the same material as the pipe.

2.03 FITTINGS

Minimum radius of fabricated elbows shall be 2.5 diameters. The fittings shall be fully pressure rated by the manufacturer to provide a working pressure equal to the pipe for 50 years of service at 73°F with an included 2:1 safety factor. Manufacture the fittings from the same resin type, grade, and cell classification as the pipe. Fittings shall be homogeneous throughout and free from cracks, holes, foreign inclusions, voids, or other injurious defects. The fittings shall be as uniform as practicable in color, opacity, density and other physical properties. The minimum "quick-burst" strength of the fittings shall not be less than that of the pipe with which the fitting is to be used.

2.04 JOINTS

A. Join sections of polyethylene pipe into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method performed in accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe manufacturer requirements of 500°F, alignment, and 150-psi interfacial fusion pressure.

B. Butt fusion joining shall result in a joint weld strength equal to or greater than the tensile strength of the pipe. Socket fusion shall not be used. Extrusion welding or hot gas welding of HDPE shall not be used. Flanges, unions, grooved-couplers, transition fittings, and some mechanical couplers may be used to connect HDPE pipe mechanically without butt fusion where shown in the drawings and at elbows and tees.

2.05 FLANGES

Flanges shall be steel, conforming to the dimensions of ASME B16.5, Class 150 and the details in the drawings.

2.06 BOLTS, NUTS, AND GASKETS FOR FLANGES

See Section 400500.

2.07 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

See Section 400500.

2.08 TRENCH BEDDING AND BACKFILL MATERIALS

See Section 312316.

PART 3 - EXECUTION

3.01 SHIPPING, STORAGE, AND HANDLING

A. Limit onsite pipe storage to a maximum of one week.

B. Transport pipe larger than 3 inches to the jobsite on padded bunks with nylon tie-down straps or padded bonding to protect the pipe. Protect the pipe from sharp objects. Anchor pipe securely to prevent slippage.

C. Store pipe larger than 3 inches on earth berms or timber cradles adjacent to the trench. Stack the heaviest series of pipe at the bottom. Do not stack pipe in excess of the following limits:

ALLOWABLE STACKING HEIGHTS FOR STORAGE OF HDPE PIPE		
Nominal Pipe Size (inches)	**Number of Rows High**	
	SDR Above 17	**SDR 17 and Below**
4	15	12
5	6	12
10	6	10
8	8	6
10	6	5
12	5	4
14	5	4
16	4	3
18	4	3
20	3	3

D. When the pipe is received, visually inspect to verify that the correct product was received. Check for damage that may have occurred during transit. Examine for fractures, kinking, deep gouges, or cuts. Remove pipe with gouges or cuts in excess of 10% of the pipe wall thickness.

E. Cover pipe 100% with protective coverings or tarpaulins to prevent deposition of road salts, diesel smoke, fuel residue, and other contaminants in transit.

F. Hook lifting equipment, such as cranes, extension boom cranes, and side boom tractors, to wide web choker slings that are secured around the load or to lifting lugs on the component. Use only wide web slings. Do not use wire rope slings and chains which can damage components. Use spreader bars when lifting pipe or components longer than 20 feet.

G. Unload large fabrications using a wide web choker sling and lifting equipment such as an extension boom crane, crane, or lifting boom. Do not use stub outs, outlets, or fittings as lifting points, and avoid placing slings where they will bear against outlets or fittings.

H. Protect the pipe from stones and sharp objects.

I. Store fittings in their original cartons.

3.02 HANDLING PIPE DURING INSTALLATION

A. Lift pipes with handling beams or wide belt slings near the middle of joints as recommended by the pipe manufacturer. Do not use cable slings, chains, or hooks.

B. Before installation, check pipe and fittings for cuts or scratches exceeding 10% of the pipe wall thickness, gouges, buckling, kinking, or splitting. Remove such defective pipe.

3.03 SANITATION OF PIPE INTERIOR

A. During fusion operations and laying operations, do not place tools, clothing, or other materials in the pipe.

B. When pipe laying is not in progress, including the noon hour, close the ends of the pipe by a vermin- and child-proof plug.

3.04 QUALIFICATION OF FUSION OPERATORS

Each operator performing fusion joining shall be qualified in the use of the manufacturer's recommended fusion procedure(s) by the following:

A. Appropriate training or experience in the use of the fusion procedure.

B. Making a sample joint according to the procedure that passes the following inspections and tests:

1. The joint shall be visually examined during and after joining and found to have the same appearance as a photograph or sample of an acceptable joint that was joined in accordance with the procedure; and

2. Test or examine the joint by one of the following methods:

a. Pressure and tensile test as described in 49 CFR 192.283;

b. Ultrasonic inspection and found to be free of flaws that would cause failure; or

c. Cut into at least three longitudinal straps, each of which is:

(a) Visually examined and found to be free of voids or unbonded areas on the cut surface of the joint, and

(b) Deformed by bending, torque, or impact and if failure occurs, it must not initiate in the joint area.

3. Each operator shall be requalified under the procedure, if, during any 12-month period he:

a. Does not make any joints under the procedure; or

b. Has three joints or three percent of the joints he has made, whichever is greater, that are found unacceptable by testing under 49 CFR 192.513.

3.05 HEAT FUSION

A. Comply with ASTM F2620, except as modified below.

B. Use fusion equipment specially designed for heat fusion of HDPE such as offered by McElroy Manufacturing, Inc., Tulsa, Oklahoma or equal. The equipment utilized shall be regulated for the different melt strength materials. Compatibility fusion techniques shall be used when polyethylenes of different melt indexes are fused together.

C. Maintain the proper temperature of the heater plate as recommended by the pipe manufacturer. Check it with a tempilstik or pyrometer for correct surface temperature.

D. Clean pipe ends inside and outside with a clean cotton cloth to remove dirt, water, grease, and other foreign materials.

E. Square (face) the pipe ends using facing tool of the fusion machine. Remove burrs, chips, and filings before joining pipe or fittings.

F. Check line-up of pipe ends in fusion machine to see that pipe ends meet squarely and completely over the entire surface to be fused. Make sure the clamps are tight so that the pipe does not slip during the fusion process.

G. Insert clean heater plate between aligned ends and bring ends firmly in contact with plate but do not apply pressure while achieving melt pattern. Allow pipe ends to heat and soften. Approximate softening depths are as follows:

Pipe Size (inches)	**Approximate Melt Bead (inches)**
2 and below	1/16
3 to 5	1/8
6 to 12	3/16
12 to 20	1/4 to 5/16

H. Carefully move the pipe ends away from the heater plate and remove the plate (if the softened material sticks to the heater plate, discontinue the joint, clean heater plate, resquare pipe ends, and start over).

I. Bring melted ends together rapidly. Do not slam. Apply enough pressure to form a double roll-back bead to the body of the pipe around the entire circumference of the pipe about 1/8- to 3/16-inch wide. Pressure is necessary to cause the heated material to flow together.

J. Allow the joint to cool and solidify properly. Remove the pipe from the clamps and inspect the joint appearance.

3.06 SIDEWALL FUSION

A. Accomplish side fusion procedure for HDPE in the field using 2- through 12-inch McElroy (or equal) fusion units and proper heater plate adapters. Where branch outlets are larger than 12 inches in outside diameter, accomplish sidewall fusion in a fitting fabrication shop.

B. Clean the pipe with a clean cotton cloth. Prepare surface of pipe (main) by roughing with 60 grit or coarser utility cloth.

C. Prepare the base of the branch by roughing with 60 grit or coarser utility cloth.

D. Align branch on the main and tighten clamp.

E. Check branch for square alignment.

F. Retract moveable clamp, roll in, and center heater plate with adapter between base of branch and main.

G. For all sizes, apply a strong, firm, continuous pressure until complete melt bead can be seen on main. Release pressure to light pressure. Continue heat soak cycle on branch and main. Watch base of branch for:

Main Sizes (inches)	**Heat Soak Cycle Fitting Base Bead**
1 1/4 and smaller	1/16-inch Melt Bead
2	1/8-inch Melt Bead
3 and Larger	1/8- to 3/16-inch Melt Bead

H. Retract moveable clamp and cleanly remove heater plate.

I. Bring melted surfaces together rapidly. Do not slam. Apply continuous progressive pressure until proper fusion bead is formed. Maintain pressure until joint has cooled.

3.07 COMPATIBILITY FUSION

A. Manufacturer of pipe shall provide technical personnel to instruct and demonstrate the fusion procedure for joining dissimilar HDPE materials.

B. Compatibility heat fusion and sidewall fusion shall be accomplished in the same manner as described above with the following exception:

> To achieve proper melt pattern, insert the heater plate and place a compatibility insulator between the heater plate and the lower melt material. After the higher melt achieves proper melt, then remove the insulator and bring the heater plate in contact with the lower melt material for proper melt. Continue heating both surfaces until proper melt develops. For manually operated fusion equipment, form a double roll-back bead as previously described in the fusion procedures.

3.08 PLACEMENT OF PIPE IN TRENCH

A. Control water in trench per Section 312316.

B. Lay pipes uphill if the grade exceeds 30%.

C. Install in accordance with ASTM F1668, except as modified herein.

D. Excavate to a minimum of 6 inches below the subgrade. Complete excavation to a uniform foundation free of protruding rocks. Complete stabilization of foundation, per Section 312316, then place material specified for the bedding in Section 312316 to bring the trench bottom to grade. Place and compact the bedding as detailed in the drawings. Trench bottom shall be continuous, smooth, and free from rocks.

E. Cut a depression to permit removal of the pipe handling slings. After the pipe has been butt-fused and the joints have set, snake the pipe into the trench per the pipe manufacturer's recommendations in order to allow for thermal expansion and contraction of the pipe.

F. Lower the fused pipe onto the bedding and install it to line and grade along its full length on firm bearing except at the sling depressions. Do not handle pipe at fabricated fittings. Tolerances on grade are 1/4 inch.

G. Consider pull-out forces caused by circumferential as well as longitudinal thermal contraction when flanged and mechanical joints are used. Make provisions for sealing as well as restraining to compensate for the axial loading due to expansion or contraction and/or pipe settlement.

H. When the pipe is laid in a rock cut or stony soil, excavate the trench at least 6 inches below pipe bottom grade and bring back to grade with compacted bedding. Remove boulders and large stones to avoid point contacts and to provide a uniform bed for the pipe.

I. Place a minimum 6-inch-thick layer of bedding material in the trench. Compact base to 90% relative compaction.

J. Backfill pipe zone immediately after pipe has been bedded and joined. Prevent movement of pipe while backfilling. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe or in between stiffening ribs. Backfill material placed under the haunches shall be shovel sliced. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling. Limit unbackfilled, installed pipe to five sections maximum. Avoid extended exposure to sun.

K. Add bedding and backfill material up to the top of the pipe in lifts not exceeding 6 inches at a time. Compact each lift to 90% relative compaction by mechanical or hand tamping. Do not use water flooding or jetting. Do not allow any void spaces beneath or around the pipe.

L. Add a 12-inch layer of bedding and backfill material above the top of the pipe in two 6-inch lifts. Compact each lift to 905% relative compaction.

M. Fill the remainder of the trench in maximum lifts of 12 inches. Compact each layer to 90% relative compaction. Material shall be as specified in Section 312316.

N. Compact by means of vibratory equipment or by hand tamping. Do not add successive layers unless the previous layer is compacted to the specified relative compaction. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.

O. Provide sufficient space along each side of the pipe and the trench wall to observe that the embedment material fills all spaces below pipe spring line under the pipe haunches. Do not allow pipe to float out of position.

3.09 INSTALLING FABRICATED FITTINGS

To avoid field damage, do not join large diameter (16-inch IPS and above) fabricated directional fittings, such as elbows, tees, wyes, and crosses, to more than one pipe before placement in the trench. Make the remaining outlet connections after placement in the trench with flanges, mechanical couplings, or electrofusion couplings. Perform butt fusion in the trench but place and remove the butt fusion machine in the trench such that the piping is not disturbed.

3.10 COLD-BENDING OF CURVED SEGMENTS

HDPE may be cold-bent to a minimum radius of no less than 30 times the pipe diameter as it is installed along curved alignment. The minimum bending radius that can be applied to the pipe without kinking it varies with the diameter and wall thickness of the pipe and shall not exceed the recommendations of the manufacturer. If adequate space is not available for the required radius, fuse a fitting of the required angle into the piping system to obtain the necessary change in direction.

3.11 STATIC ELECTRICITY DISCHARGING

A. Static electricity charges are generated on polyethylene pipe by friction, particularly during the handling of pipe in storage, shipping, and installation. The flow of air or gas containing dust or scale will also build up significant static charges, as will the flow of dry materials through the pipe. These charges are a safety hazard, particularly in areas where there is leaking gas or an explosive atmosphere.

B. Plastic pipe is a nonconductor of electricity and the static charge will remain in place until some grounding device comes close enough to allow it to discharge.

C. The discharge of these static electric charges is the responsibility of the Contractor.

D. Do not drag HDPE pipe over the ground, drop it onto the ground, or drop objects on it.

3.12 OPERATIONS INCIDENTAL TO JOINT COMPLETION

A. Install tracer tape per Section 400775.

B. Plan joint completion to accommodate temporary test bulkheads for hydrostatic testing.

3.13 FLANGED CONNECTIONS

A. Accomplish mechanical joining to other piping materials (fittings, valves, tanks, pumps, etc.) with factory-made flange adapters and steel or ductile-iron backup flanges. Use flanges to connect lengths of HDPE together when heat fusion is impractical.

B. Flange adapters shall be pressure rated the same as the pipe. Flange adapters shall be heat fused to the pipe as outlined in the heat fusion section.

C. Use gaskets between the polyethylene flange adapters when recommended by the HDPE pipe manufacturer. Apply sufficient torque evenly to the bolts to prevent leaks. After initial installation and tightening of flanged connections, allow the connections to set for a few hours. Then conduct a final tightening of the bolts.

D. Lubricate nuts and bolts with oil or graphite prior to installation.

E. Wrap buried flanges, bolts, and metal with the sheet polyethylene film or tape specified for the valves and equipment. Extend the wrap or tape over the flanges and bolts and secure it around the adjacent pipe circumference with tape.

F. Check operation of valves connected to molded stub end flange adapters. Insert polyethylene spacer if recommended by pipe manufacturer for clearance.

3.14 PLACEMENT OF PIPE IN CASINGS

A. Insert polyethylene pipe into existing pipelines in accordance with ASTM F585 and the following.

B. Fuse each section of pipe prior to insertion in casing or tunnel. Do not injure pipe by dragging or sliding on concrete or asphalt. Use pipeline casing insulators or dollies to move pipe through casing.

C. Block each section of pipe to prevent uplift and to ensure required line and grade. Do not encroach on specified minimum annular space between pipe and tunnel excavation. Do not obstruct between rails, where used, and between casing floor to permit concrete to fill all spaces.

D. Brace pipe during the placing of concrete backfill where casing is detailed as backfilled in the drawings. Do not fuse braces to pipe. Limit diameter variations to 1% of the nominal diameter.

3.15 LEAKAGE & INFILTRATION TESTING

See Section 330130.

END OF SECTION

DSECTION 405000 PROCESS CONTROL AND INSTRUMENTATION SYSTEM (PCIS) GENERAL REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section of the specifications includes materials, testing, and installation of process control and instrumentation system as specified herein and indicated on the drawings.

B. These specifications shall not be interpreted as permission or direction to violate any governing code or ordinance. Equipment, materials, and workmanship shall comply with the latest revisions of the following codes and standards:

1. Instrumentation: ISA - The International Society of Automation.

2. Wiring: National Electrical Code (NEC), ISA S5.3 and S5.4.

3. Control Panels: NEMA Standards Publication 250-2003.

4. Control Logic: NFPA 79.

5. Piping: ANSI B31.3 (instrumentation piping).

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Programmable Logic Control System: 405040.

B. Instrument Equipment: 405020

C. SCADA Software: 405060

D. Control Panels: 405080.

1.03 SCOPE OF WORK

A. The work involves furnishing all hardware and software, programming, installation, labor, material, equipment, and engineering in strict compliance with the contract documents for the City of San Luis Obispo – Calle Joaquin Lift Station Replacement Project.

1.04 SUBMITTALS

A. Detailed System Drawings and Data:

1. The submittal shall consist of six sets of detailed drawings and data prepared and organized by the Contractor. All drawings, schematics, layouts, and diagrams shall be done on 11" x 17" sheets utilizing AutoCAD.

2. Drawings shall contain only relevant simplified details using symbol approach. Photographic images of components depicting irrelevant details (screws, holes, logos, etc.) are not allowed.

3. Drawings prints shall not contain details and texts smaller than 3/64”.

B. Two sets of submittals will be returned to the Contractor.

C. Submit these drawings and data as a complete package at the same time.

D. Submittals shall be in three-ring hardcover binders and arranged for convenient use including tab sheets, all indexed, and cross referenced with a separate index for each item.

E. Provide manufacturers cut sheets and manuals for all hardware to be provided.

F. Provide an Instrument Index.

G. Provide ISA type instrumentation data sheets for each component, together with a technical product brochure or bulletin. The data sheets, as a minimum, shall show:

1. Instrument tag designation.

2. Component name.

3. Manufacturer's model number.

4. Calibrated range.

5. Instrument location.

6. Input and output characteristics.

7. Scale range and units (if any) and multiplier (if any).

8. Requirements for electric supply.

H. Group the data sheets together in the submittal by type. Provide individual data sheets for each instrument with one brochure or bulletin to cover all identical uses of that component.

I. The detailed construction drawing submittal shall include, as a minimum, the following types of drawings and diagrams required for the construction of this project:

1. Legend, Symbols, and Index.

2. System Block Diagrams.

3. Power Distribution Diagrams.

4. Instrument Control Panel Layouts/Construction Drawings/Details. The drawings shall include the following:

    a. Dimensions

    b. Location of all components

    c. Identification of all components

    d. Bill of Materials

    e. Conduit entry area.

5. PLC/RTU Rack Elevation Drawing for each PLC/RTU.

6. Internal Panel Wiring Diagrams.

7. Digital I/O Module Wiring Diagrams.

8. Analog I/O Module Wiring Diagrams.

9. Detailed NFPA 79-style Ladder Diagrams (for discrete wiring) to meet the following minimum requirements:

    a. Each subassembly shall be shown as a rectangle in the diagram with all external terminals identified. Terminals unknown at the time of the submittal shall be left blank, to be filled later. Single contacts internal to the subassemblies shall be shown in the rectangle connected to their terminal points.

    b. Where the internal wiring diagrams of subassemblies are furnished on separate sheets, they shall be shown as a rectangle in the schematic diagram with all external points identified and cross-referenced to the separate sheets of the control circuit. Coils and contacts internal to the subassemblies shall be shown in the rectangle connected to their terminal points.

    c. Show unique rung numbers on left side of each rung. A cross-referencing system shall be used in conjunction with each relay coil so that associated contacts may be readily located on the diagram. The contacts shall be referenced to coils as well, so that associated coils may be readily located on the diagram. Where a relay contact appears on a sheet separate from the one on which the coil is shown, the purpose of the contact shall be described on the same sheet. Spare contacts shall be shown.

d. Limit, pressure, float, flow, temperature sensitive, and similar switch symbols shall be shown on the schematic (ladder) diagram with all utilities turned off (electric power, air, gas, oil, water, lubrication, etc.) and with the equipment at its normal starting position. If the equipment is shown in a specific position, the position shall be identified.

e. Contacts of multiple contact devices, e.g., selector switches, shall be shown on the line of the schematic diagram where they are connected in a circuit. A mechanical connection between the multiple contacts shall be indicated by a dotted line or arrow. This does not apply to control relays, starters, or contactors. Additional charts or diagrams may be used to indicate the position of multiple contact devices such as drum, cam, and selector switches.

f. The purpose or function of all switches shall be shown adjacent to the symbols. The purpose or function of controls such as relays, starters, contactors, solenoids, subassemblies, and timers on the diagram shall be shown adjacent to their respective symbols. The number of positions of the solenoid valve shall be shown adjacent to the valve solenoid symbol.

10. Detailed Loop Interconnection Wiring Diagrams (per ISA S5.3 and S5.4) for the entire system showing all control equipment, instrumentation, electrical equipment, components, wiring, routing, boxes (pull, junction, and terminal junction), terminations, wire tags, and wire colors. The diagrams shall show the detailed interconnection of all electrical equipment, instrumentation, panels, enclosures, components and the like provided under this contract.

11. Arrangement and construction drawings for consoles, control panels, and for other special panels for field installation. These drawings shall include dimensions, location of all components, identification of all components, bill of materials, detailed schematics of all internal wiring, preparation and finish data, nameplates, and the like. These drawings also shall include enough other details to define the style and overall appearance of the assembly; include a finish sample for all panel surfaces.

12. Installation, mounting, and anchoring details for all field instruments and panel mounted components.

13. An instrument list including all instruments provided under this project.

14. An I/O List for each PLC/RTU in the project.

J. Detailed System Software Submittal: The submittal shall consist of six sets of the software system descriptions and diagrams. Two sets of submittals will be returned to the contractor. The software submittal can be made as a separate package to be inserted in the original submittal. The following items must be submitted at least eight weeks prior to the factory witness test orientation:

1. Detailed PLC/RTU software logic diagram printouts for each PLC/RTU. Logic diagrams shall be fully annotated such that an individual unfamiliar with the diagram format can fully understand the process control logic presented.

2. An updated I/O List for each PLC/RTU in the project.

3. Narrative control descriptions for each analog and discrete control loop. Loop descriptions shall describe how each control loop will operate, the PLC control logic, SCS control and monitoring capabilities and in general a job specific description of each control loop in the system.

4. Sample color printouts of each Operator Interface display, report, and log for the supervisory control system (SCS) software.

5. PLC/RTU software logic program files and OIT software program files shall be submitted in addition to diagrams.

K. Complete detailed bills of material: Detailed bill of material for all components shall be provided including complete manufacturers name and model number, quantity to be provided, and cross references to data sheet sections.

L. Operation, Maintenance, and Repair Manuals (OMM):

1. The organization of the initial submittal required above shall be compatible to eventual inclusion as one volume of the operation, maintenance, and repair manuals.

2. Operation manuals shall be prepared and submitted to the Owner's Representative for preliminary review in six copies. When the Owner's Representative is satisfied that these are complete and properly prepared, six final sets shall be delivered to the Owner's Representative.

3. The complete OMM shall contain the following:

a. All the information included in the preliminary equipment submittal, the detailed installation submittal, and the additional information required herein, all bound in hard-cover binders and arranged for convenient use including tab sheets, all indexed and cross referenced with a separate index for each item.

b. All final “as-built” drawings with the AutoCAD electronic files.

c. Electronic files for all PLCs, Operator Interfaces, programming.

d. Calibration and maintenance instructions.

e. Trouble-shooting instructions.

f. Instructions for ordering replacement parts.

1.05 QUALIFICATIONS AND RESPONSIBILITY OF CONTRACTOR

A. The Contractor shall furnish and install all proposed hardware as shown on the drawings and as specified herein. The PLC system installation and wiring connections to peripheral equipment and instruments shall be the responsibility of the system supplier using qualified personnel possessing the necessary equipment and having experience in making similar installations. Evidence of such qualification, as well as notification of the system supplier assuming unit responsibility, shall be furnished to the Owner in writing for approval prior to commencement of the work.

B. Qualification Evidence: The qualification evidence shall include the following:

1. The contractor shall be Certified by Control System Integrators Association (CSIA)

2. Verification that the system supplier shall have had a minimum of five years' experience with the installation and programming of industrial control systems similar in type to those to be installed in this project.

3. A list of completed similar installations including name, address, and telephone number of the owner, name of project, and date of completion.

4. The name and qualifications of supervisory personnel to be directly responsible for the programming and installation of the control system.

C. Under this section, the Contractor shall furnish the following:

1. Instrumentation equipment (Section 405020).

2. PLC, HMI, and UPS (Section 405040).

3. Data Radio (Section 405050)

4. Control cabinets (Section 405080).

5. Spare parts per Sections 405020, 405040, 405050, and 405080.

6. Special tools and test equipment required by the supplier.

7. Installation, integration and testing.

8. Documentation.

9. Operator training.

10. Warranty (one year).

11. Shipping and receiving.

D. All calibration and final checkout of the process control and instrumentation system shall be witnessed by the Owner's Representative to determine if the system complies with the contract documents.

E. The Contractor shall be responsible for coordinating and interfacing with equipment supplied under these contract documents, which are an integral part of the system. Interfacing shall be incorporated in the detailed systems drawings and data section of the contract documents.

F. The system supplier shall be experienced in the design, programming, and service of this type of equipment. In the event of a dispute as to the acceptability of the system supplier, the Owner's Representative shall make the final determination.

1.06 GUARANTEE

A. The Contractor shall repair or replace defective components, rectify malfunctions, correct faulty workmanship, all at no additional cost to the Owner during the warranty period.

B. To fulfill this obligation, the Contractor shall utilize qualified technical service personnel. Services shall be performed within five calendar days after notification by the Owner's Representative.

1.07 MEASUREMENT AND PAYMENT

A. Payment for the work in this section shall be included as part of the lump-sum bid amount stated in the Proposal.

PART 2 - MATERIALS

2.01 DESIGNATIONS OF COMPONENTS

A. In these specifications and on the plans, all systems, and other elements are represented schematically and are designated by numbers, as derived from criteria in ISA standards. The nomenclature and numbers designated herein and on the plans shall be employed exclusively throughout shop drawings, data sheets, and the like. Any other symbols, designations, and nomenclature unique to a manufacturer's standard methods shall not replace those prescribed above, as used herein, and on the plans.

2.02 INSTRUMENT TAGGING

A. Attach a stainless-steel tag to the instrument at the factory. Permanently mark the stainless-steel tag with the instrument tag number and the instrument calibration range. The manufacturer's standard metal nameplate as a minimum shall denote model number,

serial number, operating electrical voltage and amperage (when applicable), and date of manufacture.

2.03 INSTRUMENT SYSTEM POWER

A. Power provided for the instrument system at the facility shall be 120-volt a-c, single phase, 60 Hz.

B. Where d-c power supplies are not furnished integral with any one instrument system loop, then provide separate solid-state power supplies. All 24vdc instrumentation should be on a common power supply, but on separate fused circuits.

2.04 MATCHING STYLE, APPEARANCE, AND TYPE

A. All display instruments of each type shall represent the same outward appearance, having the same physical size and shape and the same size and style of numbers and pointers.

PART 3 - EXECUTION

3.01 UNIFORMITY OF COMPONENTS

A. Components, which perform the same or similar functions, shall, to the greatest degree possible, be of the same or similar type, the same manufacture, the same grade of construction, the same size, and the same appearance.

3.02 MOUNTING OF EQUIPMENT AND ACCESSORIES

A. Mount equipment in accordance with the installation detail drawings as prepared by the Contractor and reviewed by the Owner’s Representative. Mount equipment so that they are rigidly supported, level and plumb, and in such a manner as to provide accessibility; protection from damage; isolation from heat, shock, and vibration; and freedom from interference with other equipment, piping, and electrical work. Do not install consoles, cabinets, and panels until heavy construction work adjacent to computer and telemetry equipment has been completed to the extent that there shall be no damage to the equipment.

B. Locate devices, including accessories, where they shall be accessible from grade, except as shown otherwise.

C. Mount local equipment in cabinets or existing panels as specified. Mount associated I/O terminals on a common panel or rack; mounting panels and rack shall be baked enamel.

D. Coordinate the installation of the electrical service to components related to the system to assure a compatible and functionally correct system. All accessories shall be coordinated and installation supervised by the Contractor.

E. Test the completed system after installation to assure that all components are operating with the specified range and all interlocks are functioning properly.

F. Tubing Valves and Fittings: All instrument tubing manifolds shall be Type 316 stainless steel, unless otherwise specified elsewhere in these specifications. Tubing runs to transmitters shall be installed with a positive slope in one direction. Fittings and valves shall be Type 316 stainless steel. Block/bleed valves shall be as manufactured by Hex Valve Series HB59, or equal.

3.03 CALIBRATION

A. Each instrument requiring factory calibration shall be furnished with calibration data. The calibration data shall be factory certified.

B. Calibrate systems after installation in conformance with the component manufacturer's instructions. This shall provide that those components having adjustable features are set carefully for the specific conditions and applications of this installation and that the components and/or systems are within the specified limits of accuracy. Defective elements, which cannot achieve proper calibration or accuracy, either individually or within a system, shall be replaced. Accomplish this calibration work by a technical field representative of the single instrument supplier. He shall certify in writing to the Owner’s Representative that all calibrations have been made and that all systems are ready to operate.

3.04 FACTORY TESTING

A. The fully configured SCADA system shall be successfully submitted to a factory acceptance test before shipment to the jobsite. Instrument Control Panel(s) shall be fully assembled and wired.

B. Factory testing shall take place at the PCIS Integrator’s facility located in California.

C. The factory test will be for one (1) day. Allow additional time for setup, breakdown and pre-testing.

D. Prior to factory system testing, submit a written detailed test procedure for review by the Owner. Notify the Owner in writing four weeks in advance of the scheduled testing.

E. Factory witness tests shall demonstrate that the system will perform each operation required for all specified conditions, including both normal and emergency operations and conditions. Provide a certification and log of all tests to the Owner for review and comment.

F. Check panel wiring against approved submittal drawings. Record any changes made during testing of the equipment on the record drawings.

G. The system shall be exercised through operational tests, under factory-simulated conditions to demonstrate that the system is fully configured to perform all control,

logic, monitoring, reporting, logging, archiving and communications functions as specified and that the system is ready for field installation. All test equipment required to simulate actual field conditions shall be provided by the control system integrator.

H. The factory witness test shall take as long as necessary to demonstrate to the Owner and the Owner's Representative that the system performs each operation.

I. A return visit to the Contractor's facility for re-testing will be at the total expense of the Contractor.

3.05 FIELD TESTING

A. Exercise systems through field tests in the presence of the Owner in order to demonstrate achievement of the specified performance.

B. Coordinate field tests dependent upon completion of work specified elsewhere. Schedule tests among all parties involved so that the tests may proceed without delays or disruption by uncompleted work.

3.06 5-DAY ACCEPTANCE TEST

A. When systems are assessed to have been successfully carried through a complete operational test and the Owner concurs in this assessment, a date to start the system acceptance test involving the Owner's operating personnel will be agreed upon.

B. Recheck the systems at this time to verify proper operation, and make final adjustments. The system testing shall consist of five (5) consecutive days (Monday – Friday) of continuous testing utilizing the Owner's day shift working hours. The Contractor shall be on call ready to respond to system failures within two hours after day shift working hours and on weekends. The Owner's representative will determine the severity of the problem to the best of his ability and contact the Contractor for disposition. This arrangement will in no way relieve the system supplier of responding within 2 hours and resolving the problem in a mutually agreed upon time frame not greater than 48 hours.

C. The acceptance tests shall have a success factor of 95% system uptime. If the system should fail below the 95% factor, correct the system problems. System start-up shall start over again from day one. This will continue until the system functions for five consecutive days with a 95% uptime success factor.

3.07 OPERATOR TRAINING

A. Provide the Owner's operating personnel and/or the Owner's Representative with three (3) days of formal instruction in the functions and operations of each system provided under this contract.

B. Provide the training sessions at the Owner's facilities and on the equipment furnished under this contract. The education and instruction of operating personnel shall be by a qualified instructor familiar with the requirements for this project. Each training session

shall be for eight hours of formal instruction. Session dates shall be directed by the Owner. There will be three (3) nonconsecutive one-day training sessions, which shall not coincide with any system testing or start-up activities.

END OF SECTION

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SECTION 405010 PROCESS CONTROL AND INSTRUMENTATION SYSTEM LOOP DESCRIPTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The descriptions, together with the detail drawings, instrumentation diagrams, comprise the functional design criteria of the Process Instrumentation and Control System (PCIS). The process and instrumentation diagrams (P&IDs) represent the basic concept of the PCIS requirements, whereas the descriptions supplement the instrumentation diagrams.

B. Owner shall furnish PCIS with functional sample standard Lift Station PLC and OIT program. PCIS shall make necessary modifications to supplied programs.

C. The PCIS Supplier shall utilize the descriptions and P&IDs as the basic criteria for the design of the instrumentation schematics, control software, preparation of data sheets, wiring diagrams, piping layouts, assembly drawings, and other requirements set forth in these specifications.

D. The PCIS will provide an integrated control and reporting system. The function of this system is to monitor, control, report, and safeguard the system. The PCIS system will be based on remote terminal units, linked to a an existing SCADA computer and peripherals, with selected monitoring and alarm functions displayed in the control room.

E. Status-to-Command Disagreement (STCD): Provide a STCD alarm for all equipment controlled with the control system. The STCD alarm shall be initiated if a piece of equipment is commanded to start/stop or open/close by a PLC and the appropriate run or position status is not reported back within a time interval. STCD shall be pinned out when Utility Power is unavailable, and ATS is not switched to Emergency while generator is running.

F. Provide high-high, high, low, low-low, rate of change and instrument fail alarms for all analog points in the system. If a particular alarm is used by ladder logic, or requires to be displayed at local Operator Interface, that alarm shall be implemented at the PLC.

G. All software switches shall be implemented with associated time delays. Time delay value shall be pre-programmed initially to 10 seconds, unless specified otherwise.

H. All flow values and motors elapsed running time shall be totalized and stored at the PLC. Resetting of those totals shall be coordinated with Owner's Representative during submittal stage.

I. All scaling of analog signals shall be implemented at the PLCs. Each PLC shall interface with an Operator Interface and with PLC network/SCADA System using data in engineering units.

J. At each PLC the processor shall monitor the internal operation of the PLC and communication system for failures. If a failure is detected, a dry contact closure shall close and illuminate the "PLC Fail Light" at an ICP.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. PCIS General Requirements: 405000.

B. Instrumentation Equipment: 405020.

C. Programmable Logic Controller and Operator Interface: 405040.

D. Instrument Control Panel (ICP): 405080.

PART 2 - LOOP DESCRIPTIONS

2.01 LOOP 011, LIFT PUMPS BACKUP MODE MONITORING

PLC shall monitor signals originated at the MCC while pumps operate in Backup Mode. The backup mode will be initiated any time a high high level (LSHH-011) is activated by the MCC common controls.

2.02 LOOP 021, LIFT STATION WET WELL LEVEL MONITORING

A. Calle Joaquin Lift Station Wet Well level shall be monitored by two submersible level transmitters LT-021A and LT-021B.

B. An operator shall be able to select a "duty" level transmitter, which will be used for Lift Pump Controls (see Para 2.03A below).

C. Upon the duty transmitter failure, the PLC shall send a failure alarm. the PLC shall automatically switch the duty level transducer if the backup is available..

D. A differential level (DL) shall be calculated. When the DL remains above an operator selectable set point for an operator selectable time interval (measured in minutes), a "High Differential Level" alarm shall be generated, indicated some abnormalities with a level system.

2.03 LOOPS 100, 111, AND 121, LIFT PUMP CONTROLS

A. When the Wet Well level, measured by the "duty" transmitter (see Para 2.02B above) remains above an operator selectable high level set point for an operator selectable time interval (measured in hundreds of seconds), a pump step up demand is generated and lead pump shall start.

B. When the Wet Well level, measured by the "duty" transmitter (see Para 2.02B above) remains below an operator selectable low level set point for an operator selectable time

interval (measured in hundreds of seconds), a pump step down demand is generated and lead pump shall stop.

C. Sequence of Operation

1. There shall be two modes for sequence selection: “Fixed Sequence” and “Run Time Alternation”.

2. Fixed Sequence Selection

a. Pump sequence shall be determined by software hand switch (HS-100A) position: Lead (P1) - Lag (P2) or Lead (P2) – Lag (P1).

b. Sequence Rotation

(1) Sequence of operation shall be rotated after the pump(s) stop.

(2) If sequence is changed outside of normal rotation, as specified in Paragraph 2.03F.4 below, no rotation for the next cycle shall occur.

c. Sequence Indication

(1) Current sequence (P1, P2) shall always be displayed.

(2) Indication shall also include “PUMP AVAILABLE” status (see Para 2.03D.1 below).

(3) Provide an indication on the screen “PUMP SEQUENCE FOR NEXT CYCLE”.

3. Run Time Alternation

a. Pump sequence shall be determined based on current pump run times (RT), as follows:

(1) The pump with the lowest RT becomes a lead one.

(2) The pump with the second lowest RT becomes a lag one.

b. Sequence Rotation

(1) Sequence of operation shall be rotated after all pumps stop.

(2) If sequence is changed outside of normal rotation, as specified in Paragraph 2.03F.4 below, no rotation for the next cycle shall occur.

c. Sequence Indication

(1) Sequence shall be indicated as specified in Para 2.03C.2.c above.

D. Pump Control Logic

1. Pump is treated as not available when at least one of the following conditions is present:

   a. Pump is not in AUTO at the SCS.

   b. Pump READY signal from the MCC is not detected.

   c. Pump STCD is detected.

   d. Pump FAIL signal from the MCC is detected.

2. Pumps will be operated based on Wet Well Level (low level L1 to highest level L4):

   Level L1 - Stop Lead Pump
   Level L2 - Stop Lag Pump
   Level L3 - Start Lead Pump
   Level L4 - Start Lag Pump

3. If, while Lead pump is running, a stop command is detected, Lead Pump stop timer shall be started, if the Scour Mode for the cycle is set. (See Paragraph 2.03E below). Otherwise, pump shall stop immediately.

4. Lead pump shall stop after the stop timer delay is expired.

E. Scour Mode

1. In Scour Mode a lead pump remains operating for an operator selectable time interval (set in seconds).

2. An operator shall be able to select at the SCS number of cycles between the scour modes.

3. Number of cycles remaining before scour mode shall be displayed at SCS.

F. Pumps Transitions

1. Next pump in sequence shall substitute a non-available pump.

2. If a running pump becomes non-available, an alarm shall be generated and the next in sequence available pump shall start.

3. When all available pumps are running and a demand exists for non-available pump, a "DEMAND FOR NON-AVAILABLE PUMP" alarm signal shall be generated and transmitted to the SCS for alarm indication and logging.

4. Changing the pump sequence "on the fly" is not allowed. New sequence shall take effect after pumps stop.

5. When a non-available pump becomes available, it shall take its place in the sequence. The pump transition, if required, shall be implemented as described in Para 2.03F.4 above.

2.04 LOOP 141, LIFT STATION FLOW

A. Lift station flow shall be monitored by a magnetic type flowmeter FE/FIT-141.

B. PLC shall totalize the accumulated flow pulses generated by the flowmeter.

C. Flowmeter fail alarm shall be reported to SCS. Flowmeter metering vault flood switch alarm shall be monitored and reported to SCS.

2.05 LOOP 995, 997, AND 999 INTRUSION ALARMS

A. PLC shall monitor intrusion alarms at Instrument Control Panel, metering vault and valve vault hatch.

2.06 LOOP 151 AND 161 ATS AND GENERATOR

A. PLC shall monitor following status and alarms (Refer to DWG. N-003.) generated by ATS and Generator.

1. ATS in Normal Position

2. ATS in Emergency Position

3. ATS Loss of Power

4. Generator Running

5. Generator Fail

6. Generator in Auto

7. UPS on Battery

8. UPS Fail

PART 3 - EXECUTION

See Section 405000.

END OF SECTION

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SECTION 405020 INSTRUMENTATION EQUIPMENT

PART 1 - GENERAL

1.01 DESIGNATIONS OF COMPONENTS

In these specifications and on the plans, all systems, meters, instruments, and other elements are represented schematically and are designated by numbers, as derived from criteria in ISA standards. The nomenclature and numbers designated herein and on the plans shall be employed exclusively throughout shop drawings, data sheets, and the like. Any other symbols, designations, and nomenclature unique to a manufacturer's standard methods shall not replace those prescribed above, as used herein, and on the plans.

1.02 SIGNAL CHARACTERISTICS

Wherever possible and feasible, components shall be of electronic solid-state design and systems shall utilize the same signal characteristics throughout each and all of the several systems; transmission signals shall be 4 mA to 20 mA. The combined power supply and transmitter loops shall, when tested with appropriate precision resistors, present a voltage signal of 1- to 5-volt DC. Signal isolators shall be provided where required.

PART 2 - MATERIALS

2.01 LEVEL TRANSMITTER--SUBMERSIBLE

A. The submersible all-titanium pressure transmitter shall provide an electrical 2-wire d-c current signal proportional to the pressure applied to the unit's diaphragm-sensing element. The pressure sensing element shall be diffused silicon semiconductor with a process media operating temperature range of –4 °F to 140 °F. Provide the level transmitter with the following features:

1. Waterproof cable with internal vent to atmosphere rated for transmitter suspension up to 300 feet.

2. Conduit adapter.

3. Cable strain relief.

4. Internally adjustable span.

5. A separate suspension cable for transmitters suspended over 20 feet.

6. Sensor termination enclosure with desiccant module.

7. Flush Teflon-coated elastomeric diaphragm.

B. Accuracy of the level transmitter shall be ±0.25% of calibrated span.

C. The level transmitter shall be that manufactured by Siemens/Evoqua Mod A1000i, no substitution is allowed.

D. The breather assembly kit and sensor termination enclosure shall be that manufactured by Siemens Model No. W3T4801 and W3T4804, no substitution is allowed.

LEVEL TRANSMITTER--SUBMERSIBLE	
GENERAL	
Tag No.	LT-021A & LT-021B
P&ID No.	N-003
Service	Wet Well Level
Quantity	2
TRANSMITTER	
Location	Wet Well
Diaphragm Material	Titanium
Output Signal	4 mA - 20 mA
Output Signal to	PLC
Range	0-40 ft
Mounting Detail	N-004, Detail 3
Cable Length	40 ft.
SERVICE CONDITIONS	
Process Media	Wastewater
Specific Gravity	1.0
Oper. Press. (psig)	N/A
Temp. (°F)	40 to 80
Power	24 V dc

END OF SECTION

SECTION 405040 PROGRAMMABLE LOGIC CONTROLLER AND OPERATOR INTERFACE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes requirements for materials, testing, and installation of a control system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Process Control and Instrumentation System (PCIS) General Requirements: 405000.

1.03 SUBMITTALS

Submit shop drawings in accordance with Section 405000.

PART 2 - MATERIALS

2.01 DESIGNATIONS OF COMPONENTS

In these specifications and on the plans, all systems, and other elements are represented schematically and are designated by numbers, as derived from criteria in ISA standards. The nomenclature and numbers designated herein and on the plans shall be employed exclusively throughout shop drawings, data sheets, and the like. Any other symbols, designations, and nomenclature unique to a manufacturer's standard methods shall not replace those prescribed above, as used herein, and on the plans.

2.02 PROGRAMMABLE LOGIC CONTROL SYSTEM

A. A fully integrated programmable logic control system shall be furnished as specified in this section. The programmable logic control system hardware shall be intelligent process control units with analog and discrete I/O for process interface.

B. The a-c power of the control system will be 120-volt +/-10% a-c, 60 hertz, single phase derived from line power. The system shall be designed to operate satisfactorily from 0 °C to 60 °C ambient temperature for the PLC.

2.03 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. The PLC shall be a 32-bit programmable logic controller microprocessor-based stand-alone device. It shall be a process and logic controller designed for industrial environments. It shall be capable of a mix of logic, timing, counting, computation, library of preprogrammed subroutines, and PID loop control capabilities necessary for the unit process application. The PLC shall utilize a "prepackaged"/"preprogrammed"

approach to functionality to allow its use by personnel who have no formal training in digital equipment, digital communications, or software programming.

B. The PLC shall come complete with central processor, memory, power supply, interconnecting cables, and discrete and analog I/O interfaces.

C. The logic and variable memory shall be read/write RAM. All RAM shall have integral supercapacitor that will maintain in nonvolatile storage for a minimum of six months upon a utility power failure. The logic and variable memory shall have a sufficient ladder logic location for programming all specified functions plus 25% spare memory.

D. The PLC shall have the following features:

1. Logic Control: The PLC shall be capable of performing the same functions as conventional logic systems including on delay timers, off delay timers, counters, and drum sequencers.

2. Compare Function: The PLC shall perform the compare function that compares two integers or floating point numbers for less than, equal to, greater than, and not equal to. The programmed function shall energize when true and de-energize it when false.

3. Move Function: The PLC function shall move an integer or floating point value from one memory location to another memory location when an internal permissive is enabled.

4. Math Function: The PLC shall be capable of performing addition, subtraction, multiplication, and division on integer or floating point numbers.

5. Analog Controllers: The PLC processor shall perform all the functions of the conventional three-mode (PID) analog controller. The controller shall perform proportional only control, proportional plus reset, and proportional plus reset plus derivative and integral only control. The controller shall be the conventional three-mode controller.

6. The PLC shall be able to generate PID loops with a minimum sample time of 1.0 second. PID tuning constants shall have the following adjustable range:

Proportional Gain	0.0% to 99.99%
Reset Time	0.01 to 999.99 minutes
Derivative Time	0.00 to 999.99 minutes

7. Time-of-Day Clock: The PLC shall have an internal time-of-day clock/calendar running independently of the CPU.

8. PLC System Alarm: The PLC processor shall monitor the internal operation of the PLC system for failures. If a failure is detected, the system shall shut down and

freeze all inputs and outputs in their last states until the error is cleared. As a minimum, the following failures shall cause the PLC to shut down:

a. Memory failure.

b. Memory parity error.

c. I/O cycle failure.

d. Operating system error.

E. Input/Output:

1. The PLC discrete input modules shall be 24-volt DC and have noise filters or use other techniques to reject short-time constant noise and 60-Hz pickup. Allen-Bradley 1769-IQ16 to match other sites.

2. The PLC discrete output modules shall be 24-volt DC solid-state drivers suitable for operating control relays. Each discrete output module shall include fuses and fuse blown indicators. Allen-Bradley 1769-OB16 to match other sites.

3. The PLC analog inputs shall be suitable for accepting 4 mA to 20 mA from either 2- or 4-wire transmitters. The input power shall be from an external 24-volt DC power supply. The analog to digital converter shall have a 12-bit minimum resolution with an overall accuracy of 0.5% at 60 °C. Allen-Bradley 1769-IF8I to match other sites.

4. Discrete PLC I/O modules shall have individual LED status lights for each I/O point.

5. All discrete and analog modules shall have terminal blocks for termination of the I/O wires.

6. Individual I/O points shall be capable of withstanding low energy common mode transients to 1,500 volts.

F. Spare I/O

1. Provide the following minimum spare I/O:

a. Analog Inputs: One complete module or 33%, whichever is less.

b. Discrete Inputs: One complete module or 33%, whichever is less.

c. Discrete Output: One complete module or 33%, whichever is less for each type.

2. Pre-wired Spare I/O: Provide PLCs with pre-wired spare I/O for future plant expansion:

G. The PLC shall be Allen-Bradley CompactLogix L33ER, no substitution is allowed.

2.04 PLC SOFTWARE

A. All PLC programming shall be done using a standard Windows-based package developed for this purpose.

B. All programming, monitoring, searching, and editing shall be accomplished with the PLC programming software. The programming software shall be usable while on-line, off-line, and shall have the ability to emulate/run the PLC program using the programming unit. The PLC program shall display multiples of series and parallel contacts, coils, timers, counters, and mathematical function blocks. The software shall be able to monitor the status of all inputs, outputs, timers, counters, and coils. It shall have the capability to disable/force all inputs, outputs, and coils to simulate the elements of the ladder logic by means of color change. The software shall include a search capability to locate any address or element and its program location. PLC status information, such as error indication and amount of memory remaining shall be shown on the display screen.

C. The programming package shall be Studio 5000 v32 by Allen-Bradley.

2.05 OPERATOR INTERFACE (OI)

A. Provide, program, test, fully configure, and place into operation Operator Interface as indicated herein.

B. The operator interface shall be a panel mounted electronic assembly that allows bi-directional communication with a programmable logic controller.

C. The OI shall be a TFT-type and have touch screen capability. The unit shall employ flash memory for storing the application specific symbols and data. The unit shall be capable of handling up to 160 touch areas per screen display and a minimum of 50 screens. Each touch area shall provide audible feedback to the operator.

D. The unit shall meet the following requirements:

1. Display View: 15-in diagonal, minimum

2. Resolution: 800 x 600 pixel, minimum

3. Brightness: 300 nits, minimum

E. Screens shall be configured using an off-line PC based software package that operates in the Windows environment. Configuration software shall be provided.

F. Each display screen shall consist of graphic representations of legend plates, push buttons, pilot lights, numeric data displays, numeric data entry buttons, bar graphs, time displays, text displays, selector switches, illuminated push buttons, counter/timer

numeric preset and increment/decrement buttons. Graphics can be created using any software that produces standard BMP files. Applications shall be downloaded to the operator interface device and stored in flash memory.

G. The unit shall be capable of displaying text messages that can be triggered by the status or values of bits or numeric variables in the programmable logic controller. In addition, the unit shall be capable of accepting and displaying text messages that are stored in programmable controller as ASCII strings.

H. Graphics: The operator shall monitor and control the system using a number of pre-configured graphic displays, which represent the particular equipment and processes being controlled. Minimum of five screens shall be programmed for each process unit shown on a single P&ID. Graphic displays shall be provided illustrating a process flow using symbols to represent equipment with process flow direction lines connecting the symbols. Symbols shall be used for pumps, motors, valves, and primary elements. Adjacent to each discrete graphic symbol, the description shall be included. Adjacent to each analog graphic symbol, the point description, current value, and engineering units shall be displayed. Alarm messages shall flash. All process lines, structures, and equipment shall be identified with the proper nomenclature. The process and instrumentation diagrams (P&IDs) provided under these specifications shall be used to help generate graphics displays.

I. The OI shall communicate with the programmable logic controller in a fashion, as determined by the PLC manufacturer. A communication driver shall be provided with the editing software.

J. All cables for communication between the unit and the PLC shall be provided along with a cable for serially interfacing the device with a personal computer.

K. OI shall be PanelView Plus 7 model 2711P-T15C21D8S by Allen-Bradley, No or equal.

2.06 ETHERNET SWITCH

A. Ethernet switch shall be DIN-rail mountable. Ethernet switch shall be in full compliance with standards set forth by IEEE 802.3. Switch shall have five Ethernet ports, as minimum. LEDs on each port shall indicate link data rate and activity status. A power LED shall indicate that power is applied to the.

B. Ethernet Switch shall meet the following specific requirements:

1. Operation: Minimum10/100 Mbps, Full and Half Duplex, Auto-Negotiation

2. Switching Properties: Store & Forward

3. Minimum Number of MAC addresses: 1024

4. Minimum of 64K of message memory

5. Interface: RJ-45 10/100BaseTX ports

6. MDIX Auto Cable Sensing

7. Operating Temperature: -20 °C to 60 °C

8. Operating Humidity: 10% to 95% (non condensing)

9. MTBF: 100,000 hours minimum

C. The Ethernet switch shall be TrendNet TrendNet TI-G62, Allen Bradley Stratix 2000 1783-US8TG2GX, Allen Bradley Stratix 2000 1783-US5T, Moxa EDS-G205, or equal. .

2.07 UPS

A. Provide a UPS to protect the PLCs, instruments, and communication system from line disturbance, subcycle power losses, brownouts, blackouts, or general power outages. In normal operation the UPS shall supply filtered and regulated AC power to the load. Upon failure of the commercial AC power the critical load shall continue to be supplied by the inverter, which shall obtain its power from the battery.

B. There shall be no interruption of the output waveform to the critical load upon failure or restoration of the commercial AC source. Upon restoration of the commercial source, the inverter/charger shall recharge the battery.

C. The UPS shall have a built-in battery test feature to periodically test the battery with actual load connected. During the test the load power shall be derived from the inverter. There shall be no power interruption to the load, if the battery test fails.

D. The UPS shall be complete with the following features:

1. Power indication;

2. “UPS on Battery” discrete output;

3. Inverter circuit breaker protection.

4. Automatic bypass upon inverter failure

5. Ethernet Web/SNMP monitoring

E. The UPS system shall meet the following requirements:

1. Input/output voltage: 120-volt AC, single phase, 60 Hz.

2. Output harmonic distortion: 5% maximum at full load.

3. Frequency stability: +/-0.5%.

4. Voltage regulation for line and load: +/-3%.

5. Overload capacity: 125% for 10 minutes.

6. Battery lifetime: 3 years at ambient temperature 40 °C.

7. Operating Temperature: 0 °C to 40 °C.

8. Batteries: Internal

9. Output rating: 700 VA.

10. Battery Backup Time: 9 minutes (at full rated load).

F. UPS shall be Eaton 9SX-700 with optional Network-M2 interface card. No or equal.

2.08 SPARE PARTS

The Contractor shall furnish to the Owner all necessary spare parts of components required to maintain the system. Prior to final acceptance of work, the Contractor shall provide a spare parts listing of all necessary spare parts and quantities for review by the Owner's Representative. The spare parts shall include the following minimum requirements:

Part Description	Quantity
Power Supply	1 each
CPU and Memory Module	1 each
Analog Input Module	1 of each type
Discrete Input Module	1 of each type
Discrete Output Module	1 of each type

The Contractor shall deliver to the Owner all the required spare parts upon final acceptance of the work. The spare parts shall not be used as replacement parts during the guarantee period.

PART 3 - EXECUTION

Refer to Section 405000.

END OF SECTION

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SECTION 405050 DATA RADIO SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes requirements for materials, testing, and installation of Data Radio System.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. PCIS General Requirements: 405000.

B. Programmable Logic Control System: 405040.

C. Control Panels: 405080.

PART 2 - MATERIALS

2.01 DATA RADIO

A. Provide a GE MDS Orbit Model MCR with Unlicensed High Performance 900 MHz, Cellular 4GY LTE NAM/EMEA, and 2 ethernet options..

B. City shall configure radio with City standard MDS radio programming, and shall be responsible for ensuring communication. Contractor is responsible for ensuring adequate radio signal strength and other RF parameters affected by the physical installation.

2.02 TRANSMISSION LINES AND ASSOCIATED DEVICES

A. Transmission Line (Coaxial Cable) and Connectors:

1. One-Half-Inch Foam Dielectric Heliax Cable from the ICP to the antenna. Manufacturer/catalog number Andrew/LDF4-50A.

2. One-Quarter-Inch Superflexible Foam Dielectric Heliax Cable: Equipment connection only, 36-inch lengths. Manufacturer/catalog number Andrew/FSJ1-50A.

A. YAGI ANTENNAS

1. Yagi Antenna shall be six element, fabricated of 6061-T6 aluminum rod and seamless drawn pipe. Aluminum materials shall be gold anodized for maximum reliability and corrosion resistance. Hardware of fastenings shall be stainless steel. Heavy aluminum alloy mounting casting allows installation for either vertical or horizontal polarization.

2. Internal balun, coax feed, and connectors shall be sealed in foam potting system to prevent moisture penetration. Following specifications apply:

    a. Frequency range to match radio frequency i.e. 900-928 MHz.

    b. Gain (over dipole): 10 dBi.

    c. VSWR: 1.5:1 maximum.

    d. Impedance: 50 Ω.

    e. Front-to-Back Ratio: 20 dB minimum.

    f. Maximum Power Input: 200 W.

    g. Polarization: Vertical or horizontal with 36 degree bean width.

    h. Termination: Type N female.

    i. Mounting: Maximum 2.375-inch O.D. pipe.

3. Manufacturer/Model: Bluewave Marathon BMYD890K or equal.

PART 3 - EXECUTION

Refer to Section 405000.

END OF SECTION

SECTION 405060 SCADA SOFTWARE

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes requirements for modifications of an existing Supervisory Control and Data Acquisition (SCADA) system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. PCIS General Requirements: 405000.

B. PLC Hardware and Software: 405040.

1.03 SUBMITTALS

Submit shop drawings in accordance with Section 405000.

1.04 DESIGNATIONS OF COMPONENTS

In these specifications and on the plans, all systems and other elements designated by numbers, as derived from criteria in ISA standards. The nomenclature and numbers designated herein and, on the plans, shall be employed exclusively throughout shop drawings, data sheets, and the like. Any other symbols, designations, and nomenclature unique to a manufacturer's standard methods shall not replace those prescribed above, as used herein, and on the plans.

PART 2 - MATERIALS

2.01 SCS GENERAL SOFTWARE BY GE INTELLUTION

Existing SCADA software is iFix by GE Intellution.

2.02 MODIFICATIONS

Owner shall add new screens for Calle Joaquin Lift Station to existing SCADA HMI. Screen developed for Calle Joaquin Lift Station features shall match Laguna-3 Lift Station screens with modification suitable for this project. Contractor shall be responsible for providing data tags and PLC program to City representative. Functional testing shall be performed on local OIT touch screen. SCADA will be designed to mirror local OIT touch screen functionality by City.

PART 3 - EXECUTION

Refer to Section 405000.

END OF SECTION

SECTION 405080 INSTRUMENT CONTROL PANEL (ICP)

PART 1 - GENERAL

1.01 DESCRIPTION

This section includes requirements for materials, testing, and installation of the cabinets and consoles to be provided by the system contractor under Section 405000.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Process Control and Instrumentation System (PCIS) General Requirements: 405000.

1.03 SUBMITTALS

Submit shop drawings in accordance with Section 405000.

PART 2 - MATERIALS

2.01 INSTRUMENT CONTROL PANEL – MCC ELEVATION

A. The panel shall be a floor-mounted NEMA 4 enclosure and shall be constructed from 14-gage formed steel throughout. Access door shall have door bars on inside surface and continuous hinges. All exposed edges and welds on the enclosure shall be ground smooth. No penetration through the cabinet door or exterior with rivets, screws, bolts, or back of panel nuts shall be allowed. The enclosure shall provide protection against dirt, dust, oil, and water. The interior shall be provided with a formed 12-gage subpanel for attaching surface-mounted components. All components shall be attached with screws, and the subpanel shall be threaded.

B. Rivets or back of panel nuts, screws, or bolts shall not be allowed. No panel penetration is allowed, except for the conduit entry.

C. Provide a LED lamp in the panel. Each interior shall be equipped with a 120 V, 20 A duplex utility outlet and a dedicated single-pole, 20 A, 120 V circuit breaker protecting the outlet and the lamp. The utility outlet and the lamp shall be powered by utility power.

D. Power distribution system shall include a UPS to be powered from a designated "UTILITY POWER FOR UPS" receptacle. The power distribution system shall be connected to the UPS output by a cord with a plug matching the UPS outlet. Provisions shall be made to allow the UPS to be bypassed, i.e. power distribution system to be powered from the utility power by the power cord connected to the "UTILITY POWER FOR UPS" receptacle. The receptacle shall be protected by a designated circuit breaker.

E. A folding shelf at least 18 inch wide and a documentation pocket shall be provided at the panel. The shelf shall be secured to the door bars in a way to allow vertical adjustment of the shelf location.

F. Refer to instrument drawings for enclosure minimum size and installation details.

G. Temperature Control:

1. Contractor shall provide temperature control features, to maintain internal cabinet temperature within the limits required by the equipment installed in the cabinet.

2. Submit cooling system sizing calculations, as part of the enclosure submittal. For each panel submit a spread sheet to list heat loss and temperature limit for each component.

3. Assume ambient temperature of 112°F.

4. Adjustable Panel High Temperature switch shall be provided to PLC. Hoffman ADLTEMP (shared with panel heater) or ATEMNO is City standard.

2.02 PANEL CONTROL CIRCUIT DEVICES AND COMPONENTS

A. General: All components, except those on the front panels, shall be mounted behind on fixed or swing-out panels; terminal blocks for field connections shall be mounted on fixed channels located near the bottom of the sections but clear of the conduit entry area. Fixed panels shall be located so as not to prevent access within the cabinets to other components, wiring, and terminal blocks on fixed panels or front panels.

B. All electrical devices within the panel shall be identified by tag number, machine printed on a label visible from the panel interior. Labels shall be made of durable plastic tape with an adhesive backing. The labels shall have rounded corners and shall be consistent in size throughout the panel.

C. Control Relays:

1. Control relays shall have 120-volt AC or 24-volt DC coils, except as noted; contacts shall be rated for the various circuit applications shown on the drawings. Control relays shall be 10-ampere, multiple-contact, 300-volt, plug-in type with dust cover and sockets. The relays shall be equipped with the following features:

a. Retaining clip.

b. Test button lockable in "ON" position.

c. Mechanical flag for contact status indication.

d. Pilot light for coil power indication.

2. If additional contacts are required, they shall be ganged.

3. The relays shall be Releco General Purpose Relays, Allen-Bradley Bulletin 700-HA, IDEC series RU, Telemecanique RXM relay (Zelio Plug-in), or equal. All control relays shall be products of one manufacturer.

D. Circuit Breakers: Circuit breakers shall be single-pole, 120-volt, 15-ampere rating.

E. Feed-Through Terminal Blocks: Feed-through terminal blocks shall be modular DIN rail mounted with plastic insulating housings and screw secured cage clamp wire termination and shall be rated 20 amperes at 300 volts. Current carrying parts shall be made of at least an 85% copper alloy, nickel-plated for maximum conductivity and resistance to corrosion. Terminal blocks shall provide a secure oxide-film free connection to the wire without the use of spades, ring tongues, or ferrules. Terminals blocks shall have captive screws and a built-in vibration resistance mechanism, which locks the screw connection in place after the wire has been terminated. A bridge bar for cross connection shall be provided. A test adapter for a banana jack shall be provided. The test adapter shall provide a positive test connection to the terminal block and shall lock into place for hands free operation. White marking strips, fastened securely to the molded sections shall be provided and wire (terminal) numbers or circuit identifications shall be marked thereon with permanent marking fluid. Feed-through terminal blocks shall be Phoenix Contact Type UK 4, Allen-Bradley Series 1492-W, ABB (Entrelec) Series M4/6.NC, Sprecher+Schuh Cat. No. V7-W4, or equal.

F. Fuse Terminal Blocks: Fuse terminal blocks shall be the same profile, but different color as the feed through terminal blocks, and shall have blown fuse light indicator. Fuse terminal blocks shall be Phoenix Contact Type UK 4-TG, or equal.

G. Disconnect Terminal Blocks: Disconnect terminal blocks shall be of knife disconnect type. The blocks shall have a universal foot for mounting on DIN rail and a width of the feed through block. Disconnect terminal blocks shall be Phoenix Contact Type UK 5-MTK-P/P, or equal.

H. DC Power Supplies: Provide DC power supplies as required for analog loops and DC circuits. Each power supply shall be enclosed and include internal short-circuit protection. Current requirements shall not exceed 75% of manufacturer maximum rating.

I. Receptacles: Duplex receptacles shall be molded composition, ivory, specification grade, with finder groove face. Duplex receptacles for 120-volt, single-phase, 3-wire service to be rated 20 amperes, 125 volts, back or side wired, NEMA Type 5-20R. Duplex receptacles shall be Arrow-Hart No. 5352I, Bryant No. BRY5362-I, Hubbell No. CR5362-I, or equal.

J. Indicating Lights: Indicating light shall be push-to-test transformer type with LED.

2.03 PANEL CONTROL CIRCUIT WIRING

A. Wire Type and Size: Instrumentation signal cables shall be of the type used for process control with shielded pairs or triads with polyvinyl jacket and overall shield over the multiple pairs or triads. The instrumentation cable shall be rated 300 volts at 90 °C or

better. The size of the instrumentation cable shall be AWG No. 18 with seven strands minimum, unless otherwise specified elsewhere. All instrumentation cables shall meet all the requirements of IPCEA S-61-402 and shall be UL listed.

B. 120-volt AC wiring within the panel shall be AWG No. 14 THHN. Main power (120-volt AC) to the panels shall be wired using color coded AWG No. 12. AC power to all system power supplies. Wires shall be color coded in accordance with the following table:

Black	L1 (hot)
White	L2 (neutral)
Red	AC control circuits
Blue	DC circuits
White with Blue Stripe	DC Return Voltage
Yellow	Interlock control circuits wired from an external power source
Green	Equipment ground

C. All interfacing between the cabinets and the field shall be accomplished at a terminal strip (TB-1). No internal panel wiring shall be connected to terminals on the "field side" of TB-1. Likewise, no field wiring shall be connected to terminals on the "panel side" of TB-1.

D. All intentionally grounded, grounding, and bonding conductors shall be sized by NEC Article 250 as required.

E. Wires carrying voltage from external devices and one wire from an analog loop shall be terminated at the disconnect terminal block.

F. Only one wire shall be terminated at each side of a terminal block. A bridge bar shall be used for cross connection.

G. Wiring run from components on a swing-out panel to other components on a fixed panel shall be made up in tied bundles. These shall be tied with nylon wire ties and shall be secured to panels at both sides of the "hinge loop" so that conductors are not strained at terminals.

H. Wiring run to control devices on the front panels shall be tied together at short intervals and secured to the inside face of the panel using Panduit adhesive mounts with Eastman No. 910 adhesive.

I. Wiring to rear terminals on panel-mount instruments shall be run in plastic wireways secured to horizontal brackets run above or below the instruments in about the same plane as the rear of the instruments.

J. Conformance to the above wiring installation requirements shall be reflected by details shown on the shop drawings for the Engineer's review.

K. Signal conditioners and control interface relays shall be provided wherever proper instrument interfacing dictates use of these components. Each auxiliary device shall be assigned a tag number and shall appear on the panel shop drawings.

L. Wire Marking:

1. Each signal and circuit conductor connected to a given electrical point shall be designated by a single unique number which shall be shown on all shop drawings. These numbers shall be marked on all conductors at every terminal.

2. For field distribution of a common potential, wire number to each field device shall consist of a common (group) number and individual number, ex. if a wire connected to a “hot” potential on a panel side of a terminal block has tag “5”, then field wires should be tagged “5-1”, 5-2”, etc.

3. The markers shall be permanent sleeve type with machine printed black markings. Markers shall be Thomas & Betts Series EZS, Tyco Series RPS, or equal.

M. Terminal Marking: Each terminal shall be identified by a single unique number. Hand-written labels shall not be allowed. The match between the terminal identification and the wire identification is not required.

N. All electrical devices within the panel shall be identified by tag number, machine printed on a label visible from the panel interior. Labels shall be laminated plastic with an adhesive backing. The labels shall be consistent in size throughout the panel.

2.04 SPARE PARTS

A. The Contractor shall furnish to the Owner all necessary spare parts of components required to maintain the system. Prior to final acceptance of work, the Contractor shall provide a spare parts listing of all necessary spare parts and quantities for review by the Owner's Representative. The spare parts shall include, but not be limited to, the following minimum requirements:

MINIMUM SPARE PARTS LIST	
Part Description	**Quantity**
1. Power supply	1 each type
2. Relays	2 each type

B. The Contractor shall deliver to the Owner all the required spare parts upon final acceptance of the work. The spare parts shall not be used as replacement parts during the guarantee period.

PART 3 - EXECUTION

Refer to Section 405000.

END OF SECTION

SECTION 409115 MAGNETIC FLOWMETERS

PART 1 - GENERAL

1.01 DESCRIPTION

This section describes requirements for magnetic flowmeters.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Painting and Coating: 099000.

B. Pressure Testing of Piping: 400515.

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions and Section 013300.

B. Submit manufacturer's catalog data and detail drawings showing dimensions, pressure rating, coatings, and meter parts and describe by material of construction specifications (such as AISI, ASTM, SAE, or CDA) and grade or type

C. Furnish manufacturer’s application performance guarantee with submittals.

D. Show meter laying lengths.

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. The meter flow tube and transmitter shall be by the same manufacturer.

B. The magnetic flowmeter and transmitter shall be manufactured by one of the following:

1. McCrometer, Hemet, California:

Magnetic Flowmeter: Model Ultramag

2. ABB Instrumentation, Rochester, New York:

Magnetic Flowmeter with Transmitter: Model **Watermaster**.

3. Endress+Hauser, Greenwood, Indiana:

a. Magnetic Flowmeter: Model Promag W.

b. Transmitter: Model Promag 50.

C. The manufacturer shall have a minimum of five years' experience in the manufacture of bipolar d-c magnetic flowmeters.

2.02 METER DESIGN

A. The magnetic flowmeter shall be an obstructionless pipeline-mounted instrument to magnetically measure the flow of the process media. The output signal shall not be affected by changes in fluid viscosity or density and shall have zero point stability and auto zeroing functions. Provide the magnetic flowmeter with the following features:

1. Drip- and splash-proof sensor, capable of withstanding temporary submersion of up to 30 feet of water for 48 hours.

2. Integral terminal box with watertight cable seals.

3. Interconnecting cables.

B. Provide stainless steel grounding rings and grounding straps per manufacturer’s requirements.

2.03 MATERIALS OF CONSTRUCTION--FLANGELESS METERS

A. The flow tube shall be Type 304 stainless steel with carbon steel grooved ends.

B. Liner and electrodes shall be as indicated in the subsection on "Service Conditions."

2.04 MATERIALS OF CONSTRUCTION--FLANGED METERS

A. The flow tube shall be Type 304 stainless steel with carbon steel flanges.

B. Liner and electrodes shall be as indicated in the subsection on "Service Conditions."

2.05 INDICATOR/TOTALIZER

The indicator/totalizer shall accept the process flow signal from the magnetic flowmeter and convert its electrical output signals directly proportional to the instantaneous metered flow rate. The housing shall be suitable for field mounting.

2.06 TRANSMITTER

A. The transmitter shall be microprocessor based with flow rate indicator in engineering units, forward, reversed, and net flow totalizer, all in user-selectable engineering units. The display shall also be capable of indicating alarm status and velocity of fluid. The transmitter shall be mounted as indicated in the instrument list.

B. The preamplifier input impedance shall be a minimum of 10E+11 ohms.

C. Power Requirements: 117-volt ac, ±10%, 60 hertz.

D. Totalized flow and programmed configuration shall be maintained in memory for up to 10 years.

2.07 INTERCONNECTING CABLE

The interconnecting cable between the sensor and the transmitter shall be furnished by the magnetic flowmeter manufacturer.

2.08 PERFORMANCE

The overall system's performance shall be as follows:

A. Accuracy: 0.5% of flow rate with minimum fluid velocity of 1 fps.

B. Repeatability: ±0.1% of flow rate.

C. The accuracy of each meter shall be verified by calibration in a flow laboratory traceable to the U.S. National Institute of Standards and Technology.

D. Adjustable full-scale range.

E. Outputs: Bidirectional, isolated 4- to 20-mA d-c and either 24-volt d-c scaled pulse.

F. Minimum Conductivity: 5 micromho/centimeter.

G. Power Consumption: 20 watts maximum.

H. Temperature Limits, Ambient: -20°F to +140°F.

I. Temperature Limits, Process: Elastomers +160°F, Teflons +300°F, ceramic 350°F.

J. Field Selectable Low Flow Cutoff: 0% to 10%.

K. The flowmeter shall have a positive zero return (PZR) input controlled by an external dry contact.

L. Environmental Rating: NEMA 4X, for both sensor and electronics whether remote or sensor mounted.

M. The meter shall have empty pipe detection.

N. A common alarm discrete output (a dry contact or a transistor switch) shall be provided for remote indication of fault conditions.

PART 3 - EXECUTION

3.01 REPLACEMENT SPOOL

Furnish a grooved end or flanged ductile-iron spool with gaskets for each magnetic flowmeter. The spool shall be the same length as the meter.

END OF SECTION

SECTION 412215 DAVIT CRANE

PART 1 - GENERAL

1.01 EXPERIENCE

Manufacturer shall have a minimum of 5 years' experience producing substantially similar equipment.

1.02 SUBMITTALS

Submit shop drawings and samples per Section 013300.

PART 2 - MATERIALS

2.01 DAVIT CRANE

A. Manufacturer: davit crane shall be as manufactured by Thern, Inc., Series 5FT25 or approved equal.

B. Design Factor: designed with an ultimate design factor greater than 3:1 for all components including the lifting winch and base.

C. Lift Capacity: davit crane shall have a lift capacity of 1,500 pounds, with the boom fully extended, at 90 degrees from vertical.

D. Hook Reach: boom shall have a maximum hook reach of at least 120 inches measured from mast center to hook center when the boom is horizontal.

E. Hook Height: hook height shall be adjustable by moving the boom up or down between horizontal and 45 degrees from vertical, with a minimum of 64 inches between the lowest position and the highest position at 150 inches.

F. Boom Angle: boom angle shall be fixed or adjustable with a hand operated screw jack acting to raise or lower the boom between horizontal and 45 degrees from vertical.

G. Boom Sheave: wire rope shall pass over a sheave at the end of the boom. Sheave shall have a needle bearing.

H. Clearance: minimum height of the boom shall be 72 inches between mounting surface and the underside of the boom.

I. Rotation: mast and boom shall rotate 360 degrees in the base on roller and tapered roller bearings, with a rotational handle attached to mast to facilitate rotation. Owner shall have the ability to set limits on rotation to avoid hitting fixed obstructions.

J. Fastening Pins: crane components shall be fastened together using solid steel pins.

K. Winch Location: lifting winches shall be located such that the center point of the drive shaft is no more than 18 inches in front of the centerline of the mast.

L. Nametag: davit crane shall be labeled with a non-corrosive metal identification plate labeled or imprinted with the manufacturer's name, model number, serial number, capacity rating, and other essential information.

2.02 CRANE FINISH

A. Epoxy Finish

Crane shall have a 3 step epoxy finish consisting of a primer, an epoxy coat, and a top coat of polyurethane.

2.03 LIFTING WINCH

A. Electric winch shall be provided that is 1.5 hp, 115 V, single-phase, 60 Hz.

B. Automatic internal load brake

C. 6-foot NEMA 4 pendant control and an 8-foot power cord with grounded plug

D. Line Speed range from 9 – 16 fpm

E. Frame construction of mild steel

F. Gear reducer construction of cast aluminum

G. Pressure plate with corrosion-resistant trivalent zinc finish

H. Red Enamel finish

I. Stainless Steel fasteners to mount winch to crane

2.04 WIRE ROPE

A. Wire Rope: wire rope construction shall be 304 stainless steel cable at least 38 feet in length.

B. Hooks: latch type hooks shall be used and shall be either non-rotating eye type or swivel type to allow 360 degree rotation under all load conditions. Hooks shall be heat treated drop forged type 304/316 stainless steel.

END OF SECTION

SECTION 432132 RAW SEWAGE PUMPS

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of submersible raw wastewater pumps designed to operate in a wet well under submerged and partially submerged conditions.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with Section 013300.

B. Submit dimensional drawings, including pumps, bases, and motors.

C. Submit weight of pump and motor unit.

D. Submit manufacturer's catalog data and detail drawings showing all pump parts and describe by material of construction, specification (such as AISI, ASTM, SAE, or CDA), and grade or type.

E. Submit manufacturer’s data on linings and coatings.

F. Submit pump curves from manufacturer's catalog data on which the specified operating points are marked. Show efficiency, brake horsepower, and NPSH required for the selected pump curve for each specified operating point. Show maximum operating speed.

G. Show impeller diameter, eye area, sphere size, and number of vanes.

H. Submit setting drawings. Show anchor bolt layout and anchor bolt dimensions.

I. Submit the manufacturer’s method for factory performance testing and sample pump test sheet for reporting performance test results. Submit at least two weeks before the tests. The test form shall contain the data presented in the sample form in Appendix H of ANSI/HI 14.6.

1. Submit manufacturer’s certified performance test curve and pump test sheet for each pump. Submit at least two weeks prior to shipping the units from the factory.

2. Submit a manufacturer’s hydrostatic test certificate per ANSI/HI 11.6.6.11 and a report on hydrostatic tests for each pump per ANSI/HI 11.6.6.12. Submit at least two weeks prior to shipping the units from the factory.

3. Submit Operations and Maintenance Manuals.

1.03 QUALITY ASSURANCE

A. All pumping equipment furnished under this Section shall be of a design and manufacture that has been used in similar applications and it shall be demonstrated to the satisfaction of the Owner that the quality is equal to systems made by the manufacturer specifically named herein. Manufacturers shall provide evidence of at least five (5) installations in which similarly sized systems have provided satisfactory performance for a minimum of five (5) years in a similar application.

B. To insure a consistent high standard of quality, the manufacturer of this pumping equipment shall comply with the requirements of the ISO 9001 Quality and such compliance shall be verified by an independent certification agency approved by the International Organization for Standardization. Documentation shall be submitted for approval showing compliance with this requirement, and the equipment will not be released for shipment until approved.

C. Screw centrifugal pump, complete with motor, basin, controls, and all other specified accessories and appurtenances shall be furnished by the pump manufacturer to insure compatibility and integrity of the individual components, and provide the specified warranty for all components. The pump manufacturer shall accept unit responsibility for each pump complete assembly.

D. The screw centrifugal pumps specified in this section shall be furnished by and be the product of one manufacturer.

1.04 MANUFACTURER'S SERVICES

A. Provide equipment manufacturer's services at the jobsite for the minimum labor days listed below, travel time excluded:

B. One labor day for Field Testing.

C. One labor day for Operational Testing per Section “COMMISSIONING AND STARTUP”.

D. One labor day to instruct the Owner's personnel in the operation and maintenance of the pumps.

PART 2 - MATERIALS

1.01 PUMP DESIGN

A. The Contractor shall assign unit responsibility to the pump supplier for the complete pump system, including motors and cooling system control assembly.

B. The pump, with its appurtenances and electric cable, shall be capable of continuous submergence under water without loss of watertight integrity to a minimum depth of 65 feet.

C. Design the casing to withstand a hydrostatic test of at least 150% of the pump discharge pressure (suction pressure plus pump differential pressure) at shutoff.

D. Pump curve shall be continuously rising and shall be free of dips and valleys from the design point to the shutoff head. The shutoff head shall be at least 110% of the head that occurs at the highest guarantee total head.

E. Pumps shall be Prerostal pumping systems, specifically designed to pump raw, unscreened sewage, biosolids, or other media containing solids and/or rags and other fibrous materials without clogging.

F. Each Prerostal pumping system shall be capable of automatically matching the discharge rate of the pumping system to the influent flow of the system, without the use of modulating valves or variable speed drives.

G. Each Prerostal pumping system shall be of self-cleaning design and shall be capable of capturing, entraining, and pumping floatables and other debris.

H. Each Prerostal pumping system shall consist of a Hidrostal clog-free screw centrifugal pump, motor, suction bell, Prerostal basin, and level controller as specified herein.

1.02 PUMPS

A. Design

1. The basic design shall be a single passage, clog free pump, utilizing a screw centrifugal impeller. The overall pump design shall combine high efficiency, low required NPSH, a large solid passage, and the ability to handle rags or other fibrous material without plugging.

2. The hydraulic design of the impeller shall combine the action of a positive displacement screw with the action of a single vane centrifugal impeller to provide a single, non bifurcated flowstream with only gradual changes in flow direction.

a. The leading edge of the impeller vane shall blend into the impeller body in such a way that any rag or other fibrous material caught on the leading edge and folded over both sides of the vane will be unfolded and released as the textile follows the flowstream through the pump.

b. The impeller flange or impeller shall contain a spiral groove on the rear face so that any solids in the pumped media are discharged from the space between the backplate and the rear of the impeller.

3. In order to maintain optimum running clearances along the entire length of the impeller to maintain design hydraulic efficiencies, the geometry of the impeller and suction liner shall be conical, so any axial adjustment of the suction liner will cause the clearance between the impeller and suction liner to change uniformly along the entire length of the impeller. Designs incorporating curved, or combination

curved/conical impeller and suction liner are not acceptable because in such designs clearances cannot be adjusted uniformly over the full length of the impeller.

4. Suction and discharge flanges shall be drilled to meet ANSI 125 lb. bolting.

B. Materials of Construction

1. The pump volute, backplate, suction cover, and impeller flange shall be of closed grained cast iron, ASTM A48-CL30.

2. Suction liner materials of construction shall cast iron.

a. For pumps with a regulable liner, the suction piece shall be externally adjustable to compensate for wear by means of three stainless steel regulating screws so the necessary running clearances between the liner and impeller can be maintained for optimum hydraulic efficiency.

b. For pumps with a shimmed liner, the suction piece or impeller shall be externally adjustable to compensate for wear by means of shims so the necessary running clearances between the liner and impeller can be maintained for optimum hydraulic efficiency.

c. Pumps without a separate suction liner and cover are not considered equal or acceptable.

3. Impeller materials of construction shall be ductile iron. All impellers shall be dynamically balanced.

4. All materials shall conform to the following specifications.

a. Cast iron: ASTM A48-CL30

b. Ductile Iron: ASTM A536 72

1.03 MOTOR

A. Design

1. Motor to be manufactured by the same manufacture as the pump.

2. Motors shall be of the explosion-proof design, approved by Factory Mutual for uses in Division 1, Class I, Groups C&D, hazardous locations.

3. The motors shall be of the immersible type, suitable for full-load, continuous operation either completely dry or fully submerged in the pumped liquid of up to 65 foot depths. Motors shall be of the "air-filled" type, to optimize efficiency, with stator and rotor housed in a watertight chamber containing only air. Motors of the "oil-filled" type, with stator and rotor immersed in oil or motors which circulate the

pumped media through internal cooling media channels, ports, or jackets are not equal or acceptable.

4. Motors shall incorporate a separate heat-exchanger circuit, with a shaft-mounted cooling pump circulating oil from a jacket surrounding the stator housing to a heat-exchanger surface cast into the pump backplate. The circulating oil shall transfer excess motor heat directly to the pumped media inside the pump volute, without the need of submergence. The circulating oil shall provide adequate motor cooling at any continuous power output up to and including rated powers in an ambient temperature of up to 40 C. Alternately, motors shall dissipate heat directly by convection from the exposed stator housing to surrounding ambient air, without the need of submergence. The motor surface shall be sized for adequate motor cooling at any continuous power output up to and including rated power in an ambient temperature of up to 40 C.

5. Motor stator windings and leads shall be Class H wire, insulated with moisture-resistant Class F insulation for operation at temperatures up to 115 degrees Celsius. The complete system shall be considered a Class F insulation system.

6. Motors shall have the stator varnish applied by the "vacuum-pressure impregnation" method to ensure thorough and complete varnish penetration. The stator shall be heat-shrink fitted into the stator housing.

7. Motor cable-entry sealing assembly shall consist of the following five components to ensure a positive, redundantly watertight seal:

    a. The sealing components shall be mechanically isolated from cable strains by a two-piece restraining clamp, which will securely grip the cable above the moisture-sealing components and bear any mechanical forces applied to the cable.

    b. The cable moisture seal shall consist of an elastomer grommet, prevented from extruding past the cable by stainless-steel retaining washers on either side. The grommet shall be compressed tightly against the cable outside diameter (and the entry assembly inner diameter) by a screwed follower gland.

    c. Each individual conductor shall be interrupted by a solid-copper isolation dam to prevent wicking of moisture through the conductor strands.

    d. The cable insulation shall be sealed by an epoxy poured into the cable entry and totally encapsulating the stripped-back insulation and the individual copper dams. This poured epoxy seal shall also function as a redundant seal for the cable outside diameter.

    e. The cable free end shall be sealed from moisture-entry during shipping, storage, and prior to connection to the control panel by a plastic sleeve securely clamped over the cable end.

f. Motors which use only a compressed grommet gland, or only a poured epoxy seal, without benefit of redundancy of both types together are not considered equal or acceptable.

8. Shaft sealing shall be by independently-mounted, tandem mechanical seals contained in an oil chamber that is formed as an intrinsic part of the motor frame and allows the seals to be completely submerged in and lubricated by the oil bath.

a. The mechanical seal nearest the bearing shall utilize carbon/ceramic faces (except for U and T size motors [as referenced by the third digit of the motor code] which shall utilize tungsten carbide/silicon carbide faces) and shall isolate the seal cooling oil from the motor frame.

b. The mechanical seal nearest the impeller shall be a rubber bellows-type construction (except for U and T size motors, which shall be a stainless steel bellows-type construction) with the bellows designed to prevent contaminants from contacting the stainless-steel spring which loads the seal face. The seal faces shall be a solid tungsten carbide rotating face running against a solid silicon carbide stationary face. Seals with both faces of similar materials, or seals with bonded, soldered, or converted face surfaces are not equal or acceptable.

c. The mechanical seal nearest the impeller shall be contained in a seal chamber formed by the impeller flange and a recess cast into the motor frame. To prevent debris from entering the chamber and to prolong the mechanical seal life, a flush port shall be provided so an optional external water flush can be supplied directly into the seal chamber.

d. The mechanical seal nearest the impeller shall be isolated from contaminants in the pumped media by a labyrinth-fit between the backside of the impeller and the backplate, as well as by pump-out grooves cast into the impeller back shroud and into the backplate, to minimize debris reaching the shaft seal.

9. The thrust bearings shall be designed to take the full axial load of the impeller.

10. Motors shall be immersible, 3 phase, 60 cycle, 20 HP, 1724 RPM, 240 Volts.

B. Protection Devices. The motor shall be provided with the protection devices listed below.

1. Thermostats (N/C Klixon type): Three normally closed thermal sensors embedded in the stator windings, wired in series, will open a protective circuit if winding temperature exceeds rated operating temperature. These sensors automatically reset when winding temperature has cooled to a safe operating temperature. Thermostats shall not be used on VFD operation.

2. For Motors Equipped with Bearing Temperature Protection: One normally closed thermal sensor is provided in close contact to the thrust bearings of the motor. The

sensor will be wired to shut down the motor if bearing temperature exceeds rated operating temperature.

3. For Motors Equipped with a Dry Chamber Float Switch: The motor shall be equipped with a normally closed float switch in the dry portion of the motor, to shut down the motor in the event that water should enter the dry portion of the motor

4. All motors shall be fitted with a conductivity probe to monitor the moisture content of the oil in the chamber between the outer and the inner mechanical seals. The probe shall be wired to a separate protective circuit, which, when connected to a conductivity-sensitive relay in the control panel, will trip an alarm if moisture content of the oil indicates a failure of the outer mechanical seal.

1.04 DISCHARGE CONNECTIONS.

The pump shall be automatically connected to the discharge connection elbow when lowered into place and shall be easily removed for inspection or service. Sealing of the pumping unit to the discharge elbow shall be accomplished by a simple linear downward motion of the pump. The pump unit shall be guided by one 316 stainless steel guide rail. The rail shall be fixed onto the discharge elbow hub and held in place by a 316 stainless steel, compression fit upper bracket. No portion of pump shall bear directly on the floor of the sump.

1.05 SUCTION BELL

A stainless steel suction bellmouth shall be provided to prevent premature vortexing of the liquid column, thereby extending the Prerostal range.

1.06 MOUNTING

The manufacturer shall provide a heavy duty cast iron or fabricated steel fast out fixture, which shall be permanently mounted to the Prerostal basin in the wet well as shown by the plans and specifications.

A. The fixture shall cantilever the entire pump and motor from the volute discharge flange, providing an unobstructed area under the pump; supports from underside of pump volute or pump suction to sump floor (which could collect textiles and impede flow to pump) will not be acceptable.

B. The fixture shall include a 90 degree cast iron schedule 80 elbow to connect to vertical piping, and shall provide mounts for two stainless steel rails, which will guide the pump into position.

C. The pump shall be supported by a positive metal to metal interlocking flange, which is additionally sealed by a leak proof nitrile rubber ring pressed against the fixture flange by the weight of the pump.

1.07 PREROSTAL BASIN

A. The Prerostal system manufacturer shall provide a Prerostal basin with Prerostal frame for installation by the Contractor. The Prerostal basin shall be a rectangular fiberglass basin with a galvanized steel frame. After being located in the wet well, the basin shall be secured to the wet well floor and the Contractor should use traditional forming methods to frame out the structure and grout. Coordinate with the wet well manufacturer to form the bottom of the wet well to conform to the prerostal basin requirements.

B. The Prerostal system manufacturer shall be responsible for the design geometry and shall certify the installed basin(s) will allow the Prerostal system to meet the specified pumping criteria.

C. The Prerostal basin shall be self-cleaning and shall capture, entrain, and remove floatables and other debris from the wet well.

D. The prefabricated basin shall be constructed of a minimum thickness 3/8” reinforced fiberglass. The coating shall be a gel coat of 9-12 mils.

E. Prerostal system baffles

When required, pump system baffles shall be provided to insure equal distribution of flow to all pumps.

a. Baffle Design.

(1) Baffles should have vertical openings of 3" on 12" centers or as shown on the drawings.

(2) Baffles should be mounted 4-8 inches above forebay floor, and a minimum of 12 inches horizontally from the Prerostal weir wall. Settled solids shall flow freely into the Prerostal basin.

(3) Construction of baffle shall be per the plans and furnished by the contractor.

b. Baffle Material. Construction shall be hot-dipped galvanized structural steel shapes and bar stock, concrete, and/or redwood planks.

1.08 POWER SUPPLY

Power supply will be 240 volts, 60 hertz, 3 phase.

1.09 VIBRATION AND RESIDUAL UNBALANCE

A. The maximum vibration level shall not exceed that shown in Figure 9.6.4.2.5.1a in ANSI/HI 9.6.4-2009.

B. Maximum residual unbalance in impellers shall not exceed that shown in Figure B.2 in ANSI/HI 9.6.4-2009.

1.10 MOTOR CABLES

Pump motor power cables installed shall be made of a Hypalon or Protolon synthetic rubber-jacketed, Type SPC multi conductor cable, suitable for submersible pump applications and heavy mechanical stresses. The power cable shall also be sized according to NEC and ICEA standards and also meet with P-MSHA approval or equivalent. Use a separate Hypalon or Protolon synthetic rubber-jacketed, Type SPC cable for temperature and moisture pilot protection signals. The total length of each cable shall be a minimum of 85 feet.

1.11 ANCHOR BOLTS, NUTS, AND WASHERS

A. Anchor bolts, nuts, and washers for pumps installed in wet wells shall be stainless steel of material grades as recommended by the manufacturer.

1.12 SPARE PARTS

A. Provide the Owner with a package of spare parts as recommended by the manufacturer for each model or size of pump:

B. Pack spare parts in a wooden box; label with the manufacturer’s name and local representative’s name, address, and telephone number; and attach list of materials contained within.

PART 3 - EXECUTION

1.01 SERVICE CONDITIONS

A. Pump hydraulic performance conditions and design data shall be as shown below.

B. Pump Tag Numbers: 1 and 2

Liquid pumped	Raw Unscreened Sewage
Altitude	111 feet above mean sea level
Fluid temperature range	35°F to 110°F

Pump Data

Guarantee Rate of Flow (gpm)	Guarantee Total Head (feet)	Minimum Pump Efficiency
500	60	68%
675	51	75%
712	49	75%

Maximum pump speed	1,725 rpm
Minimum NPSH available	59.68 feet
Suction Diameter	6-inch
Discharge Diameter	6-inch
Motor horsepower (minimum)	15 hp
Manufacturers and models	HIDROSTAL PREROSTAL SYTEM E5K - LM
The pump manufacturer is sole-sourced and no equal shall be accepted. Contact information for the manufacturer's representative is: Flo-Systems, Inc. Elmo Dagondon elmod@flo-systems.net Flo-Systems.net 760-715-5282	

C. The specified impeller shall be capable of passing a 3-inch diameter sphere.

D. The pumps shall be designed for continuous operation and will be operated continuously under normal service over the entire Prerostal range, as specified.

E. The Prerostal pumping system shall be designed such that the wet well will be cleaned each time that the liquid level reaches the "off level" of the pumps.

1.02 FACTORY PERFORMANCE TESTING

A. Each pumping unit shall be subjected to a non witnessed certified factory performance test. Conduct tests in accordance with ANSI/HI 14.6, using the actual job driver. The performance test acceptance shall be Grade 1B per ANSI/HI 14.6 and shall include test parameters for power and efficiency.

B. No motor overload above nameplate rating will be allowed.

C. Perform a hydrostatic test on pump pressure-containing components per ANSI/HI 11.6.

1.03 PAINTING AND COATING

A. Coat submerged or immersed pumps and motors per Section “PAINTING AND COATING”, System No. 1. Apply the specified coatings at the place of manufacture.

B. Line volute and interior wetted surfaces per Section “PAINTING AND COATING”, System No. 1. Do not coat impeller unless recommended by the pump manufacture for raw sewage applications.

1.04 SHIPMENT AND STORAGE

A. Prepare equipment for shipment including blocking of the rotor when necessary. Identify blocked rotors by means of corrosion-resistant tags attached with stainless steel wire. The preparation shall make the equipment suitable for six months of outdoor storage from the time of shipment, with no disassembly required before operation, except for inspection of bearings and seals.

B. Identify the equipment with item and serial numbers. Material shipped separately shall be identified with securely affixed, corrosion-resistant metal tags indicating the item and serial number of the equipment for which it is intended. In addition, ship crated equipment with duplicate packing lists, one inside and one on the outside of the shipping container.

C. Pack and ship one copy of the manufacturer’s standard installation instructions with the equipment. Provide the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the jobsite and before start-up.

D. Store and protect pumps per API 686 (first edition), Chapter 3, paragraphs 1.4 through 1.9, 1.15, 1.16, 1.20, and 1.21 and as described below.

E. Coat exterior machined surfaces with a rust preventative.

F. The interior of the equipment shall be clean and free from scale, welding spatter, and foreign objects.

G. Provide flanged openings with metal closures at least 3/16-inch thick, with elastomer gaskets and at least four full-diameter bolts. Provide closures at the place of pump manufacture prior to shipping. For studded openings, use all the nuts needed for the intended service to secure closures.

H. Provide threaded openings with steel caps or solid-shank steel plugs. Do not use nonmetallic (such as plastic) plugs or caps. Provide caps or plugs at the place of pump manufacture prior to shipping.

I. Clearly identify lifting points and lifting lugs on the equipment or equipment package. Identify the recommended lifting arrangement on boxed equipment.

J. Wrap exposed shafts and shaft couplings with waterproof, moldable waxed cloth or volatile-corrosion-inhibitor paper. Seal the seams with oil-proof adhesive tape.

K. If electric motors are stored or installed outside or in areas subject to temperatures below 40°F or are exposed to the weather prior to permanent installation, provide the manufacturer's recommended procedures for extended storage. Provide temporary covers over the motor electrical components. Provide temporary conduits, wiring, and electrical supply to space heaters. Inspect electrical contacts before start up.

1.05 INSTALLING TENSIONING SYSTEM

A. Attach cable bracket to the lip of the equipment opening. Use drilled epoxy stainless steel bolts.

B. Attach the flange discharge elbow to the floor of the wet well using drilled epoxy stainless steel anchor bolts.

C. Install the guide cable/rail per manufacturer's recommendations.

D. Provide and attach the stainless steel lift chain or cable.

1.06 FIELD TESTING

Bump motor to ensure that motor has been connected for proper rotation.

END OF SECTION