Port of Brownsville
1000 Foust Road
Brownsville, TX 78521

CONTRACT DOCUMENTS & TECHNICAL SPECIFICATIONS

FOR

FISHING HARBOR WASTEWATER TREATMENT PLANT IMPROVEMENTS

VOLUME 1 OF 1

This document is released for bidding under the authority of Daniel Christodoss, Phd, PE, TBPE Registration No. 86016. Per meeting with BND on 01/02/2025, BND will include front end documents and send it to RRP for final QA/QC.

Prepared By:

R.R.P. CONSULTING ENGINEERS, L.L.C.

Texas Registered Engineering Firm F-4440

5400 N. 10th St. McAllen TX 78504

Phone: 956-926-5000

January 2025

Port of Brownsville will be responsible for Power Supply, WWTP Hookup, Securing Permit from TCEQ, and for any contamination secondary or primary present on the surface or subsurface of the Fishing Harbor WWTP or its Vicinity

STATE OF TEXAS
Daniel Christodoss, PhD
86016
LICENSED PROFESSIONAL ENGINEER

01-06-2025

DOCUMENT 00001

TITLE SHEET

PROJECT MANUAL
FOR

PORT OF BROWNSVILLE
PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT

PROJECT MANAGER

_____

Signature

_____ _____

Date

DEPUTY PROJECT MANAGER

_____

Signature

_____ _____

Date

WASTEWATER TREATMENT PLANT

_____

Signature

_____ _____

Date

STRUCTURAL

_____

Signature

_____ _____

Date

ELECTRICAL & ELECTRONIC CONTROLS

_____

Signature

_____ _____

Date

Document 00003

TABLE OF CONTENTS (not complete - front end documents pending from BND)

PORT OF BROWNSVILLE
PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT
RRP No. TX 2307

CONTRACT FORMS

AGREEMENT FORMS (not complete - front end documents pending from BND)

BONDS AND CERTIFICATES (not complete - front end documents pending from BND)

CONDITIONS OF THE CONTRACT (not complete - front end documents pending from BND)

GENERAL

SUPPLEMENTARY CONDITIONS (not complete - front end documents pending from BND)

ADDENDA

SPECIFICATIONS (not complete - front end documents pending from BND)

DIVISION 1 - GENERAL REQUIREMENTS

VOLUME-II

DIVISION 2 - SITE WORK

Document 00310

FORM OF PROPOSAL

To:

Project No.: TX2307

Project: PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT.

Bidder:

_____

[Print or type full name of proprietorship, partnership, corporation, or joint venture]

1.0 OFFER

Having examined the place of the Work and all matters referred to in the Bid Documents, and the Contract Documents prepared by or approved by the Engineer for the named Project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Total Bid Price of:

_____
_____(Dollars)

[Print or type in words, Bidder's Total Bid Price]

($_____
___)

[Print or type in figures, Bidder's Total Bid Price]

Stipulated Price (Lump Sum) Contract. If the Bid is for a Stipulated Price Contract, the Total Bid Price is the total Stipulated Price offered, including Cash Allowances and Alternate Bids, if any. If there are Cash Allowances, the Total Bid Price includes the Total Cash Allowances amount. If there are Alternate Bids, the Total Bid Price is tabulated in Document 00407 - Schedule of Alternates.

Unit Price or Combination Stipulated Price and Unit Price Contract. If the Bid is for a Unit Price Contract or a combination of Stipulated Price and Unit Price Contract, the Total Bid Price, including Cash Allowances, if any, is tabulated in: Document 00405 - Schedule of Unit Price Work for a Project with no Alternate Bids, or Document 00407 - Schedule of Alternates for a Project with Alternate Bids.

Cash Allowances. All Cash Allowances, totaled in Document 00405 - Schedule of Unit Price Work and described in the Bid Documents are included in the Total Bid Price.

Changes in Contract Price Due to Variations in Actual Quantities. For items quoted in Document 00405 - Schedule of Unit Price Work, the Total Bid Price is based in whole or in part on the Unit Price multiplied by the quantity for each of the items listed. The Contract Price is subject to change due to variation in the actual quantities of each item in the completed Work in accordance with the Contract Documents.

Alternate Bids. Alternate Bid work, as listed in Document 00407 - Schedule of Alternates and described in the Bid Documents, will be performed for an amount added or deducted to the Total Bid Price for each Alternate Bid that is accepted by the Owner. The Owner may accept or reject any or all Alternate Bids.

Security Deposit. Included herewith is a Security Deposit in the amount of 5 percent of the Total Bid Price, including Cash Allowances and Alternate Bids.

Period for Bid Acceptance. This offer shall be open to acceptance and is irrevocable for 90 days from the Bid date. That period may be extended by mutual written agreement of the Owner and the Bidder. After 90 days, the Bidder may withdraw without penalty if no mutual agreement can be reached.

2.0 CONTRACT TIME

If this offer is accepted, Substantial Completion of the Work will be achieved within the time stated in Document 00020 - Notice to Bidders. The Date of Commencement will be established by the Notice to Proceed.

3.0 ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted therein have been considered and all costs relating thereto are included in the Bid Price:

Addendum No._____dated _____

Addendum No._____dated _____

Addendum No._____dated _____

Addendum No._____dated _____

Addendum No._____dated _____

Addendum No._____dated _____

4.0 SUPPLEMENTS TO THIS BID:

The following Supplements are attached as an integral part of this Bid:

[X] Document 00405 - Schedule of Unit Price Work, if applicable
[X] Document 00407 - Schedule of Alternates, if applicable
[X] Document 00411 – Bid Bond (*Form supplied by Bidder*)
[X] Document 00420 – Statement of Bidder's Qualifications
[X] Document 00423 – Certification to Bidder's Experience & Qualifications
[X] Document 00425 – Equipment & Material Suppliers List
[X] Document 00427 – Non-Collusion Affidavit

5.0 SIGNATURES:

Bidder:_____
[Please print or type the full name of your proprietorship, partnership, corporation, or joint venture.*)

By:_____
[Signature]**

[Date]

Name:_____
[Please print or type name]

[Title]

Address:_____
[Mailing]

_____
[Street, if different]

Telephone:_____
[Print or type telephone number]

* *If the Bid is a joint venture, add additional Bid form signature sheets for each member of the joint venture.*

** *The undersigned, as bidder, certifies that the only person or parties interested in this proposal as principals are those named herein; that the Bidder has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the Contract for the Project.*

Note: This document constitutes a government record, as defined by § 37.01 of the Texas Penal Code. Submission of a false government record is punishable as provided In § 37.10 of the Texas Penal Code.

END OF DOCUMENT

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Document 00405

SCHEDULE OF UNIT PRICE WORK

This Document, constitutes an integral part of Document 00310 - Form of Proposal.
When a Contract is awarded, this Document becomes an integral part of Document 00500 - Form of Agreement Between the Owner and Contractor.

SECTION A – WORK, EQUIPMENT, FACILITIES, LABOR AND MATERIALS

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
1	Construct Wastewater Lift Station Structure, Including but not Limited to 10-foot Diameter Precast Concrete Wet Well and Valve Pad/valve box shown on drawings. Complete in place as specified or approved equal including spreading of spoils as directed by Engineer	EA	1		
2	Furnish and Install Wastewater Lift Station Piping, Including but not Limited to Piping, Valves, Fittings and Gauges (Complete in place)	EA	1		
3	Furnish and Install Three (3) 350 gpm at 65 feet of head, 10-HP Submersible Wastewater Pumps (Manufactured by Gorman-Rupp, Goulds, Franklin, Pentair, FloWise, Ebara, Weil, Grundfos and Flygt or Approved Equal), Bases, Stainless Steel Guide Rails, Power Cable, Cable Hangers, Safety Grate, Stainless Steel Brackets and Ancillary Equipment (Complete in Place)	LS	1		
4	8-Inch DR-18, AWWA C-900 PVC Force Main (Including but not Limited to all Fittings and Valves; furnish and install, complete in place)	LF	200		
5	30-Inch DR-18, AWWA C-900 PVC Sanitary Sewer (All Depths, Including Removal/Installation of Plug and Clamp,	LF	300		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
	Including Connection to Lift Station Wet Well; furnish and install, complete in place)				
6	Application of Protective Coating to Include Wet Well Concrete Walls and all Interior and Exterior Piping, Valves and Fittings (complete in place)	LS	1		
7	Furnish and Install Wastewater Lift Station Electrical System, Including but not Limited to Control Panel with PLC Accommodations, Conduit, Wiring, Electrical Services, and all Ancillary Equipment (complete in place)	LS	1		
8	Site Work Including but not Limited to Site Stripping and Grading (including use of spoils from wet well and basin excavation for grading) (Complete in Place Including all Required Components and Appurtenances; as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	AC	2		
9	Headworks Including but not Limited to Screen, Screenings Collection and all Appurtenances. (Complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
10	Sludge Holding/Rapid Mix Basin, Treatment Train # 1,2 & 3, Screw Press and accessories, MCC Control and Blower and all buildings Complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
11	UV Disinfection Unit and new outfall system Complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
12	Installation of a Packaged Non-potable water system with all Pumps, Pressure Tanks, Controls, Piping, Valves, Fittings, and Hose Bibs Complete in Place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
13	Basin Drainage System Including Sludge Draw Off Station with Drain, Basin Piping, Fitting and Valves Complete in Place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
14	Basin Walkways, Stairs, and Handrails as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
15	Various Flow Metering Equipment and Recorders Complete in Place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
16	Excavation as Indicated on Approved Construction Drawings; On-Site Disposal, Contractor to Haul, Place, Grade, and	LS	1		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
	Compact Spoil and Fill to the Proposed Grades in Maximum 8-Inch Lifts (loose measure) and compact to 95% SPD, +/- 2% of Optimum Moisture				
17	Construction of Miscellaneous Concrete Pads and Components Including but not Limited to Control Building Foundation, Stair Landings, Blower Pad, NPW Pump Pads, Concrete Swale, Dumpster Pad with Drain, Sidewalks, Removable Bollards, etc as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
18	Fiberglass Bleach Building Including all HVAC, Doors, Louvers, and Appurtenances (furnish and install, complete in place) as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
19	Wastewater Treatment Plant Drainage and Outfall Including but not Limited to 6-Foot Diameter Manhole, 30-inch HDPE Effluent Piping, 30-Inch PVC Culvert Piping and Rip-Rap (furnish and install, complete in place) as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
20	Extra Depth for Lift Station Manhole (Over 8-foot Deep) as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	VF	20		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
21	20-Foot Wide 2-way Crushed Concrete All Weather Access Drive with 8-Inch Subgrade, Excavation and Backfill, (complete in place) as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	SY	5000		
21	Two-stage digester and Thickener Complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
22	Maintenance building with adjacent site work and connecting piping and electrical work to provide one complete 0.5 MGD WWTP complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
23	Sludge dewatering basin complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
24	All equipment interconnecting yard piping complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
25	All Wastewater Treatment Plant Equipment Interconnecting Yard Electrical System (All Electrical Work, Including but not Limited to the Incoming Service Structure, Main Breaker, Transformer, Panelboards,	EA	1		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
	Lighting, Installation of all Vendor Supplied Control Panels and Instrumentation, Conduit, and Wire, as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)				
26	Emergency 1000 KW Diesel Generator, (Including, but not Limited to 2000 Gallon double Wall Fuel Tank with 5000 Gallon concrete containment Pad, Automatic Transfer Switch, Fuel, Concrete Foundation Pad, Sound Attenuating Enclosure, Stairs and Walkway for access, complete in place) as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
27	Provide, Install, and Remove a Rental Generator, Including Fuel Costs, to Operate the Proposed Facilities for 30 Calendar Days	LS	1		
28	Allowance for Control Systems Programming	LS	1		
29	Allowance for Arc Flash Hazard Analysis	LS	1		
30	All protective coatings and site work complete in place as per the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	EA	1		
31	Drainage Swales Including Hydro mulch Seeding (Inclusive of Watering, Fertilizing, Mowing, Overseeding and Maintenance, Until a full Stand of Live Bermuda Grass has been Established and All Governing Agencies have Inspected and Finally Accepted the Subject Project Into the One-Year Maintenance Period	LF	2500		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
32	Well Point De-Watering to complete all work as shown on the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LF	350		
33	Crushed Stone Foundation with Filter Fabric Wrap to complete all work as shown on the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LF	350		
34	Crushed Stone Foundation and Embedment with Filter Fabric Wrap to complete all work as shown on the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LF	350		
35	Trench Safety System for On-Site Piping, Drainage Facilities, and Foundation Construction. (All Depths, furnish and install, complete in place)	LF	500		
36	Bronze Plaque for Maintenance Building	EA	1		
37	Construction Materials and Testing	LS	1		
38	Petroleum Product and other contaminated areas soil and ground/surfacewater (40 CFR parts 262 through 265, 268, and parts 270, 271, and 124 of this chapter) testing, personal protective equipment, and disposal per regulations)	CY	900		
39	Soil Treatment for Foundations with Lime-Fly Ash (FS)	CY	3,600		
40	Structural Fill	CY	1,000		
41	Mobilization, Performance and Payment Bonds and Insurance	LS	1		
42	Final Site Clean Up and Grading (Including Hydro Mulch Seeding, Inclusive of	LS	1		

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES (1)	TOTAL IN FIGURES
	Waterings, Fertilizing, Mowing, Over-Seeding and Maintenance Until a Strand of Bermuda Grass has been Established and all Approving Agencies have Inspected and Accepted the Project After the One-Year Maintenance Period has been Successfully Satisfied)				
43	Reinforced Filter Fabric Fence with Steel Fence Posts (installation around perimeter and maintenance)	LF	2000		
44	Inlet Protection Barrier for Stage 1 Inlet	EA	8		
45	Stabilized Construction Access/Exit	LS	1		
46	Concrete Truck Washout Structure (installation, maintenance and removal)	LS	1		
47	Storm Water Pollution Prevention Plan Compliance (including SWPPP implementation, performing project site inspections, completing inspection reports, filing notices, posting permits, certificates and notices, installation of new control measures, maintenance of existing control measures, etc.)	LS	1		
	SUB-TOTAL SECTION A				

SECTION B – CASH ALLOWANCES

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES(1)	TOTAL IN FIGURES
1	Assist BND in Power Pole Relocation and Upgrades as well as equipment hook ups	CA	1	$250,000	$250,000
2	Automatic Standby Dual Fuel Generator furnish and install to run the entire 0.5 MGD WWTP in case of power outage complete with reinforced concrete pad to be 3 feet above 500 year storm frequency Flood Elevation	CA	1	$300,000	$300,000

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES(1)	TOTAL IN FIGURES
3	Corrosion proofing all material and equipment susceptible to corrosion and exposed to moisture and water using 416L Stainless Steel and Waterproofing all conduits and wires and elevating all electrical equipment with reinforced concrete pad designed by Texas PE to be 3 feet above 500 year storm frequency Flood Elevation	CA	1	$200,000	$200,000
4	Compliance with AREMA, Federal, State, City and all applicable codes and regulations	CA	1	$150,000	$150,000
	SUB-TOTAL SECTION B				

SECTION C – ALTERNATES TABLE

ITEM NO.	ITEM DESCRIPTION	UNIT	UNIT QTY.	UNIT PRICE IN FIGURES(1)	TOTAL IN FIGURES
1	Chlorine Disinfection System to complete all work as shown on the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
2	Sludge Drying Beds as shown on the Approved Construction Drawings and Details, Contract Documents, General Notes, General and Special Conditions, Technical Specifications and any Addendum)	LS	1		
	SUB-TOTAL SECTION C				

BID SUMMARY

SECTION A – WORK, EQUIPMENT, FACILITIES, LABOR AND MATERIALS $_____

SECTION B – CASH ALLOWANCES $_____

TOTAL BID (SECTION A + SECTION B): *$_____*

Submit security deposit of 5% of Total Bid

Project Name: PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT.

Project No. TX 2307 Bidder's Signature: _____

Company: _____ Name (print or type): _____

Date: _____ Title: _____

END OF DOCUMENT

DOCUMENT 00420

STATEMENT OF BIDDER'S QUALIFICATIONS

BIDDER: **PROJECT NAME:**

	PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT.

1.0 ORGANIZATION

1.1 How many years has your organization been in business as a Contractor?

1.2 How many years has your organization been in business under its present business name?

1.2.1 Under what other or former names has your organization operated?

1.3 If your organization is a corporation, answer the following:

1.3.1 Date of incorporation: _____

1.3.2 State of incorporation: _____

1.3.3 President's name: _____

1.3.4 Vice-president's name(s): _____

_____

1.3.5 Secretary's name: _____

1.3.6 Treasurer's name: _____

1.4 If your organization is a partnership, answer the following:

1.4.1 Date of organization: _____

1.4.2 Type of partnership (if applicable): _____

1.4.3 Name(s) of general partner(s): _____

1.5 If your organization is individually owned, answer the following:

1.5.1 Date of organization: _____

1.5.2 Name of owner: _____

1.6 If the form of your organization is other than those listed above, describe it and name the principals:

2.0 LICENSING

2.1 List jurisdictions and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable. Indicate name, license number and expiration date for Master Plumber or other trade required under the Instructions to Bidders section of this Bid.

2.2 List jurisdictions in which your organization's partnership or trade name is filed.

3.0 EXPERIENCE

3.1 List the categories of work that your organization normally performs with its own forces.

3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)

3.2.1 Has your organization ever failed to complete any work awarded to it?

3.2.2 Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers?

3.2.3 Has your organization filed any law suits or requested arbitration with regard to construction contracts within the last five years?

3.3 Within the last five years, has any officer or principal of your organization ever been an officer or principal of another organization when it failed to complete a construction contract? (If the answer is yes, please attach details.)

3.4 On a separate sheet, list major construction projects your organization has in progress, giving the name of project, owner, architect, contract amount, percent complete and scheduled completion date.

3.4.1 State total worth of work in progress and under contract:

3.5 On a separate sheet, list the major projects your organization has completed in the past five years, giving the name of project, owner, architect, contract amount, date of completion and percentage of the cost of the work performed with your own forces.

3.5.1 State annual amount of construction work performed each year during the past five years:

3.6 On a separate sheet, list the construction experience and present commitments of the key individuals of your organization. Submit resumes of Key Personnel (as defined in the Instructions to Bidders. Bidder hereby certifies that the Resident Superintendent has the authority to act on behalf of the Contractor at all times. No substitution shall be made without the written authorization of the Owner and the Engineer based upon acceptance of the qualifications of the proposed substitute.

3.7 Provide form 00423 "Certification of Bidder's Qualifications" as evidence that the Bidder meets the minimum criteria called out in the Instructions to Bidders.

4.0 REFERENCES

4.1 Trade References (3):

4.2 Bank References (2):

4.3 Surety:

Name and telephone number of Bonding Company: _____

Name, telephone and address of Agent: _____

_____

_____

5.0 FINANCING

5.1 Financial Statement

5.1.1 Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

a. Cash Flow Statement

b. Notes to Financial Statement

c. Auditor Statement

d. Comparison Statements, if available

5.1.2 Name and address of firm preparing attached financial statement, and date thereof:

5.1.3 Is the attached financial statement for the identical organization named on page one?

5.1.4 If not, explain the relationship and financial responsibility of the organization

whose financial statement is provided (e.g., parent-subsidiary).

5.2 Will the organization whose financial statement is attached act as guarantor of the contract for construction?

6.0 SIGNATURE

6.1 To be executed by a principal of the firm authorized to certify the foregoing information:

_____, being duly sworn, deposes and says that the information provided herein is true and sufficiently complete so as not to be misleading.

6.2 Dated at _____ this _____ day of _____, 20___.

Name of Organization: _____

By: _____

Printed Name: _____

Title: _____

END OF DOCUMENT

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DOCUMENT 00423

CERTIFICATE OF BIDDER'S EXPERIENCE & QUALIFICATIONS

The undersigned bidder certifies that he is, at the time of bidding, and shall be, throughout the period of the contract, licensed by the State of Texas to do the type of work required under terms of the contract documents. Bidder further certifies that he is skilled and regularly engaged in the general class and type of work called for in the contract documents.

The bidder represents that he is competent, knowledgeable and has special skills on the nature, extent and inherent conditions of the work to be performed. Bidder further acknowledges that there are certain peculiar and inherent conditions existent in the construction of the particular facilities which may create, during the construction program, unusual or peculiar unsafe conditions hazardous to persons and property. Bidder expressly acknowledges that he is aware of such peculiar risks and that he has the skill and experience to foresee and to adopt protective measures to adequately and safely perform the construction work with respect to such hazards.

Signed this _____ day of _____, 20___.

_____
Name of Bidder

_____
Contractor's License No. and State

_____
Signature of Bidder

_____
Title of Signatory

END OF SECTION

DOCUMENT 00425

EQUIPMENT & MATERIAL SUPPLIERS LIST

PURPOSE: To assist the Owner in determining the ability of each Bidder to properly fulfill the requirements of this proposed contract, the Bidder shall complete the following items. All questions must be answered, and the data given must be clear and comprehensive. If necessary, questions may be answered on separate attached sheets as specified by 00420 Statement of Bidder's Qualifications. If, while evaluating the bids, the Owner discovers that answers to these questions are false or misleading then the Owner reserves the right to reject the bid based on non-responsiveness. **This statement must be notarized.**

The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the Owner in verification of the recitals comprising this Statement of Bidder's Qualifications.

A. EQUIPMENT AVAILABLE FOR THIS CONTRACT: The Bidder shall provide below a list of equipment available for use on this contract:

EQUIPMENT	OWN	RENT/LEASE (Supplier & Phone #)

B. MATERIALS AND MAJOR EQUIPMENT: The Bidder shall provide below a list of manufacturers and suppliers of major equipment and materials proposed on this contract:

ITEM	MANUFACTURER OR SUPPLIER

BIDDER

Executed this: _____ Day of: _____ , 20

By: _____

BIDDER

Title: _____

NOTARY PUBLIC

State of Texas

County of:

Subscribed and sworn to before me this: _____

_____

NOTARY PUBLIC

END OF SECTION

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DOCUMENT 00427

NON-COLLUSION AFFIDAVIT

State of _____ §

County of _____ §

_____, being duly sworn, deposes and says that:

(1) He (she) is _____ of _____ _____, the Bidder submitting the attached Proposal

(2) He (she) is fully informed respecting the preparation and contents of the attached Bid and any and all appurtenances thereof

(3) Such Bid is genuine and is not a collusive Bid

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with another Bidder, firm or person to submit a collusive Bid in connection with the Contract for which the attached bid has been submitted or to refrain from bidding in connection with such contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix an overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Owner or any other person interested in the proposed contract; and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including

this affidavit.

_____

_____

(Title)

Subscribed and sworn to me this _____ day of _____, 20__.

By: _____

Notary Public in and for _____

County, Texas

My commission expires _____

END OF SECTION

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Document 00900

ADDENDUM NO. 1

Date of Addendum:_____

PROJECT NAME: **PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT.**

PROJECT NO**: TX 2307** EDAP NO:

BID DATE:_____. (There is no change to the Bid Date.)

FROM: RRP Consulting Engineers LLC.
5400 North 10th Street
McAllen, Texas 78504

TO: **Prospective Bidders**

This Addendum and its Attachments forms a part of the Bidding Documents and will be incorporated into Contract Documents, as applicable. Insofar as the original Project Manual and Drawings are inconsistent, this Addendum governs. Acknowledge receipt of the Addendum by inserting its number in Document 00310 - Form of Proposal. **FAILURE TO DO SO MAY SUBJECT BIDDER TO DISQUALIFICATION.**

CHANGES TO PROJECT MANUAL

BIDDING REQUIREMENTS

CONTRACT FORMS

_____

CONDITIONS OF THE CONTRACT

_____

SPECIFICATIONS

_____

CHANGES TO DRAWINGS

CLARIFICATIONS

MINUTES OF PRE-BID CONFERENCE

ATTACHMENTS

END OF ADDENDUM NO.**1**

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Section 01110

SUMMARY OF WORK

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Summary of the Work including work by Owner, Owner furnished products, Work sequence, future Work, Contractor use of Premises, and Owner occupancy.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of the contract is for the construction of the, Phase One of the New Fishing Harbor 0.5 MGD Wastewater Treatment Plant

1.03 CASH ALLOWANCES

A. $575,000

1.04 ALTERNATES

A. None

1.05 OWNER FURNISHED PRODUCTS

A. The Owner will furnish no products.

1.06 OWNER FURNISHED UTILITIES

A. The Owner will furnish no utilities.

1.07 WORK SEQUENCE

A. Work sequence will be the responsibility of the Contractor using good construction practices.

B. Coordination of the Work: Refer to Section 01312 – Coordination and Meetings.

1.08 CONTRACTOR USE OF PREMISES

A. Comply with procedures for access to the site and Contractor's use of rights-of-way as specified in Section 01145 - Use of Premises.

B. Construction Operations: Limited to Owner's rights-of-way provided by Owner.

C. Utility Outages and Shutdown: Provide notification to the Owner and private utility companies (when applicable) a minimum of 48 hours, excluding weekends and holidays, in advance of required utility shutdown. Coordinate all work as required.

1.09 WARRANTY

A. Comply with warranty requirements in accordance with Document 00700 - General Conditions.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

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Section 01145

USE OF PREMISES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Section includes general use of the site including properties inside and outside of rights-of-way, work affecting road, ramps, streets and driveways and notification to adjacent occupants.

1.02 RIGHTS-OF-WAY

A. Confine access and operations and storage areas to rights-of-way provided by Owner as stipulated in Document 00700 - General Conditions; trespassing on abutting lands or other lands in the area is not allowed.

B. Contractor may make arrangements, at Contractor's cost, for temporary use of private properties, in which case Contractor and Contractor's surety shall indemnify and hold harmless the Owner against claims or demands arising from such use of properties outside of rights-of-way.

C. Provide written proof of arrangement upon request by Resident Project Representative or Engineer.

D. Restrict total length which materials may be distributed along the route of the construction at any one time to 1,000 linear feet unless otherwise approved in writing by Resident Project Representative.

1.03 PROPERTIES OUTSIDE OF RIGHTS-OF-WAY

A. Altering the condition of properties adjacent to and along rights-of-way will not be permitted.

B. Contractor’s responsibility to assure access to all private property has been obtained prior to beginning work in said property.

C. Means, methods, techniques, sequences, or procedures which will result in damage to properties or improvements in the vicinity outside of rights-of-way will not be permitted.

D. Any damage to properties outside of rights-of-way shall be repaired or replaced to the satisfaction of the Resident Project Representative and at no cost to the Owner.

E. Plan all work outside of rights-of-way in advance to assure no delay to scheduled work due to lack of entry, access, or easement to properties is experienced.

1.04 USE OF SITE

A. Obtain approvals of governing authorities prior to impeding or closing public roads or streets. Do not close more than two consecutive intersections at one time.

B. Notify Resident Project Representative at least 48 hours prior to closing a street for a street crossing. Permission for street closures is required in advance and are the responsibility of the Contractor.

C. Maintain access for emergency vehicles including access to fire hydrants.

D. Avoid obstructing drainage ditches or inlets; when obstruction is unavoidable due to requirements of the Work, provide grading and temporary drainage structures, and appropriate SW3P to maintain unimpeded flow; at no separate payment.

E. Locate and protect private lawn sprinkler systems which may exist on rights-of-ways within the site. Repair or replace damaged systems to condition equal to or better than that existing at start of Work at no separate payment.

F. Perform daily clean-up of dirt outside the construction zone, and debris, scrap materials, and other disposable items. Keep streets, driveways, and sidewalks clean of dirt, debris and scrap materials. Do not leave buildings, roads, streets or other construction areas unclean overnight. Provide water truck and sweeper for cleanup and dust control at no cost to owner.

1.05 NOTIFICATION TO ADJACENT OCCUPANTS

A. Notify individual occupants in areas to be affected by the Work of the proposed construction and time schedule. Notification shall be not less than 72 hours or more than 2 weeks prior to work being performed within 200 feet of the homes or businesses.

B. Include in the notification the names and telephone numbers of two company representatives for resident contact, who will be available on 24-hour call. Include precautions which will be taken to protect private property and identify potential access or utility inconvenience or disruption.

C. Consideration shall be given to the ethnicity of the neighborhood where English is not the dominant language. Notice shall be in an understandable language.

1.06 PUBLIC, TEMPORARY, AND CONSTRUCTION ROADS AND RAMPS

A. Construct and maintain temporary detours, ramps, and roads to provide for normal public traffic flow when use of public roads or streets is closed by necessities of the Work.

B. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment or large or heavy trucks or equipment.

1.07 EXCAVATION IN STREETS AND DRIVEWAYS

A. Avoid needless hindering or inconveniencing public travel on a street or any intersecting alley or street for more than two blocks at any one time.

B. Remove surplus materials and debris and open each block for public use as work in that block is complete.

C. Acceptance of any portion of the Work will not be based on return of street to public use.

D. Avoid obstructing driveways or entrances to private property.

E. Provide temporary crossing or complete the excavation and backfill in one continuous operation to minimize the duration of obstruction when excavation is required across drives or entrances.

1.08 TRAFFIC CONTROL

A. Provide traffic control plan, traffic control, flagmen, signals, control devices, lights, traffic signals, barricades and signs in accordance with the State of Texas Manual on Uniform Traffic Control Devices.

B. Move, replace, maintain, clean all traffic control devices

1.09 SURFACE RESTORATION

A. Restore site to condition existing before construction to satisfaction of Resident Project Representative.

B. Repair paved area per the requirements of Section 02951 - Pavement Repair and Resurfacing.

C. Repair turf areas which become damaged, level with bank run sand conforming to Section 02317 - Excavation and Backfill for Utilities, or topsoil conforming to Section 02911 - Topsoil, as approved by the Resident Project Representative and re-sod in accordance with Section 02922 - Sodding. Water and level newly sodded areas with adjoining turf using steel wheel rollers appropriate for sodding. Do not use spot sodding or sprigging.

D. Fences. Locate and protect fences which may exist on rights-of-way. Remove, relocate, repair or replace fences when requested at no additional cost to owner.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

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SECTION 01150

PROJECT PROCEDURAL DEFINITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section defines and explains certain terms to minimize potential misunderstandings between the Owner, the Owner's Resident Project Representative, Contractor, and Engineer.

1.02 TERMS, DEFINITIONS, AND EXPLANATIONS

A. Drawing/Plan Clarification: An answer from the Resident Project Representative or Engineer, in response to an inquiry from the Contractor, intended to make some requirement(s) of the Drawings or Plans clearly understood. Drawing/Plan clarifications may be sketches, drawings, or in narrative form and will not change any requirements of the Drawings or Plans. Responses to Contractor inquires shall be outlined in Section 01151.

B. Notice of Defects: A notice issued by the Engineer documenting that the work or some portion thereof has not been performed in accordance with the requirements of the Contract Documents. Payment shall not be made on any portion of the work for which a Notice of Defect has been issued and the work not corrected to the satisfaction of the Engineer. Upon receipt of a Notice of Defect, the Contractor shall provide a written Response to Notice of Defect within ten (10) working days after receipt of the Notice. The Contractor's response shall be in accordance with Article 13 of the General Conditions.

If the Contractor disputes issuance of the Notice of Defect, the Resident Project Representative has ten (10) working days in which to respond by either:

1. withdrawing the Notice of Defect, or

2. directing the Contractor to correct the work. Such a determination by the Resident Project Representative shall be final and conclusive of the matter.

If directed to correct the work, the Contractor shall do so within ten (10) working days after receipt of such direction from the Resident Project Representative, or any other time as may be agreed to with the Resident Project Representative.

C. Project Communications: Routine written communications between the Owner, Engineer, and the Contractor shall be in letter or field memo format. Such communications shall not be identified as Requests for Information or Request for Technical Instructions, nor shall they substitute for any other written requirement pursuant to the provisions of these Contract Documents.

D. Request for Information/Request for Technical Instructions: A request from the Contractor to the Resident Project Representative or Engineer, seeking an interpretation or a clarification of some requirement of the Contract Documents. The Contractor shall clearly and concisely set forth the

issue for which it seeks clarification or interpretation and why a response is needed from the Resident

Project Representative or Engineer. The Contractor shall, in the written request, set forth its interpretation or understanding of the Contract's requirements along with reasons why it has reached such an understanding. Responses from the Resident Project Representative or Engineer will not change any requirements of the Contract Documents.
Responses to Contractor inquiries shall be as outlined in Section 01151-RFI'S.

E. Substitution/Or-Equal Submittals: A written request from the Contractor to substitute a material, article, device, product, fixture, form, type of construction, or process called for in the Contract Documents with another item that shall be substantially equal in all respects to that so indicated or supplied.

F. Schedule Submittals: When required, the Contractor shall submit schedules, schedule updates, schedule revisions, time impact analysis, etc., for review and acceptance.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

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SECTION 01151

REQUESTS FOR INFORMATION / REQUESTS FOR TECHNICAL INSTRUCTIONS (RFI'S/RFTI'S)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Section includes mandatory procedures and sets forth policies to be followed in requesting technical information or clarification.

1.03 PROCEDURES AND POLICIES

G. If the Contractor or Subcontractor, at any tier, determines that some portions of the Drawings, Specifications, or other Contract Documents require clarification or interpretation by the Owner or Engineer, the Contractor shall submit a Request for Information or a Request for Technical Instructions in writing to the Resident Project Representative. RFI's/RFTI's may only be submitted by the Contractor. The Contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed. In the RFI/RFTI, the Contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

H. The Owner acknowledges that this is a complex project, and its successful completion will be a cooperative effort between all parties. The Owner does not intend to limit or restrict communications between any of the parties.

I. The Resident Project Representative will review all RFI's/RFTI's to determine whether they are Requests for Information or Request for Technical Instructions within the meaning of this term. If the Resident Project Representative determines that the document is not an RFI/RFTI, it will be returned to the Contractor, unreviewed as to content, for resubmittal in the proper manner.

J. Responses to Requests for Information/Request for Technical Instructions shall be issued within ten (10) working days of receipt of the request from the Contractor unless the Resident Project Representative or Engineer determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Resident Project Representative or Engineer, they will, within ten (10) working days of the receipt of the request, notify the Contractor of the anticipated response time. If the Contractor submits a Request for Information /Request for Technical Instructions on an activity within ten (10) working days or less of float on the current project schedule, the Contractor shall not be entitled to any time extension due to the time it takes the Resident Project Representative or Engineer to respond to the request provided that the Resident Project Representative or Engineer responds within ten (10) working days set forth above.

K. Responses from the Resident Project Representative or Engineer will not change any requirement of the Contract Documents. In the event the Contractor believes that a response to a Request for Information / Request for Technical Instructions will cause a change to the requirements of the Contract Document, the Contractor shall immediately give written notice to the Engineer stating that the Contractor considers that the response warrants a Change Order.

Failure to give such written notice within ten (10) working days shall waive the Contractor's right to seek additional time or cost under the General Conditions.

L. Contractor shall maintain log of RFI'S submitted and dates to include response received from Engineer. The contractor shall not allow outstanding RFI'S to exceed 10 working day response period without notifying Engineer.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

Section 01255

CHANGE ORDER PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Procedures for processing Change Orders, including:

1. Assignment of a responsible individual for approval and communication of changes in the Work.

2. Documentation of change in Contract Price and Contract Time.

3. Change procedures, using proposals and construction contract modifications, work change directive, stipulated price change order, unit price change order, time and materials change order.

4. Execution of Change Orders.

5. Correlation of Contractor submittals.

1.02 REFERENCES

A. Rental Rate Blue Book for Construction Equipment (Data Quest Blue Book). Rental Rate is defined as the full, unadjusted base rental rate for the appropriate item of construction equipment.

1.03 RESPONSIBLE INDIVIDUAL

A. The contractor shall provide a letter indicating the name and address of the individual authorized to execute change documents, and who shall also be responsible for informing others in the Contractor's employ and Subcontractors of changes to the Work. The information shall be provided at the Pre-construction Conference.

B. The responsible individual shall agree upon the scope of the work and the basis of payment for the change order before beginning the work.

1.04 DOCUMENTATION OF CHANGE IN CONTRACT PRICE AND CONTRACT TIME

A. The contractor shall maintain detailed records of changes in the Work. Provide full information required for identification and evaluation of proposed changes, and to substantiate costs of changes in the Work.

B. The contractor shall document each proposal for a change in cost or time with sufficient data to allow evaluation of the proposal.

C. Proposals shall include, as a minimum, the following information as applicable:

1. Quantities of items in the original Document 00405 - Schedule of Unit Price Work with additions, reductions, deletions, and substitutions.

2. Payment will not be made for anticipated profits on work that is eliminated.

3. When Work items were not included in the Schedule of Unit Price Work, Contractor shall provide unit prices for the new items, with supporting information as required by the Engineer. The supporting information shall include as a minimum a complete copy of the attached Cost or Price Summary (CWTAP-101) and justification of overhead.

4. Justification for any change in Contract Time.

4. Additional data upon request.

D. For changes in the Work performed on a time-and-material basis, the following additional information may be required:

1. Quantities and description of products and equipment.

2. Taxes, insurance and bonds.

3. Overhead and profit.

4. Dates and times work was performed, and by whom.

5. Time records and certified copies of applicable payrolls.

6. Invoices and receipts for products, rented equipment, and subcontracts, similarly documented.

E. For changes in the work performed on a time-and-materials basis, rental equipment will be paid as follows:

1. Rented equipment will be paid by actual invoice cost for the duration of time required to complete the extra work without markup for overhead and profit. If the extra work comprises only a portion of the rental invoice where the equipment would otherwise be on the site, the Contractor shall compute the hourly equipment rate by dividing the actual monthly invoice by 176. (One day equals 8 hours and one week equals 40 hours.)

2. Operating costs shall not exceed the estimated operating costs given in the Blue Book for the item of equipment. Overhead and profit will be allowed on operating cost.

F. For changes in the work performed on a time-and-materials basis using Contractor-owned equipment, use Blue Book rates as follows:

1. Contractor-owned equipment will be paid at the Blue Book Rental Rate for the duration of time required to complete the extra work without markup for overhead and profit. The Rental Rate utilized shall be the lowest cost combination of hourly, daily, weekly or monthly rates. Use 150 percent of the Rental Rate for double shifts (one extra shift per day) and 200 percent of the Rental Rate for more than two shifts per day. Standby rates shall be 50 percent of the appropriate Rental Rate shown in the Blue Book. No other rate adjustments shall apply.

2. Operating costs shall not exceed the estimated operating costs given in the Blue Book for the item of equipment. Overhead and profit will be allowed on operating cost. Operating costs will not be allowed for equipment on standby.

1.05 CHANGE PROCEDURES

A. Changes to Contract Price or Contract Time can only be made by issuance of a Change Order. Issuance of a Work Change Directive will be formalized into a Change Order. All changes will be in accordance with the requirements of Document 00700 - General Conditions.

B. The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Price or Contract Time as authorized by the General Conditions by issuing supplemental instructions.

C. Contractors may request clarification of Drawings, Specifications or Contract Documents or other information by using a Request for Information. Response by the Engineer to a Request for Information does not authorize the Contractor to perform tasks outside the scope of the Work. All changes must be authorized as described in this section.

D. Change Orders for work not specified in Section 00405 – Schedule of Unit Price Work – shall be accompanied with a “Cost and Price Summary” Form (CWTAP – 101) plus justification of overhead rate.

1.06 PROPOSALS AND CONTRACT MODIFICATIONS

A. The Engineer may issue a Request for Proposal, which includes a detailed description of a proposed change with supplementary or revised Drawings and Specifications. The Engineer may also request a proposal in response to a Request for Information. The contractor shall prepare and submit a proposal within 7 days or as specified in the request.

B. The Contractor may propose an unsolicited change by submitting a proposal to the Engineer describing the proposed change and its full effect on the Work, with a statement describing the reason for the change and the effect on the Contract Price and Contract Time including full documentation.

1.07 WORK CHANGE DIRECTIVE

A. Engineers may issue a signed Work Change Directive instructing the Contractor to proceed with a change in the Work. A Work Change Directive will subsequently be incorporated in a Change Order.

B. The document will describe changes in the Work and will designate a method of determining any change in Contract Price or Contract Time.

C. The contractor shall proceed promptly to execute the changes in the Work in accordance with the Work Change Directive.

1.08 STIPULATED PRICE CHANGE ORDER

A. A stipulated price Change Order will be based on an accepted proposal including the Contractor's lump sum price quotation with Schedule of Values.

1.09 UNIT PRICE CHANGE ORDER

A. Where Unit Prices for the affected items of Work are included in Document 00405 - Schedule of Unit Price Work, the unit price Change Order will be based on the unit prices.

B. Where unit prices of Work are not pre-determined in Document 00405 - Schedule of Unit Price Work, the Work Change Directive or accepted proposal will describe the work and specify the unit prices to be used.

1.10 TIME-AND-MATERIAL CHANGE ORDER

A. Contractor shall provide an itemized account and supporting data after completion of change.

B. Engineer will determine the change allowable in Contract Price and Contract Time as provided in Document 00700 - General Conditions.

C. Contractor shall maintain detailed records of work done on time-and-material basis as specified in paragraph 1.04, Documentation of Change in Contract Price and Contract Time.

D. The contractor shall provide full information required for evaluation of changes and shall substantiate costs for changes in the Work.

1.11 EXECUTION OF CHANGE DOCUMENTATION

A. Engineers will issue Change Orders, Work Change Directives, or accepted proposals for signatures of parties as described in Document 00700 - General Conditions.

1.12 CORRELATION OF CONTRACTOR SUBMITTALS

A. For Stipulated Price Contracts, the Contractor shall promptly revise the Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item.

B. For Unit Price Contracts, the next monthly estimate of work after acceptance of a Change Order will be revised to include any new items not previously included and the appropriate unit rates.

C. The contractor shall promptly revise progress schedules to reflect any change in Contract Time and shall revise schedules to adjust time for other items of work affected by the change and resubmit for review.

D. The contractor shall promptly enter changes to the on-site and record copies of the Drawings, Specifications or Contract Documents as required in Section 01785 - Project Record Documents.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

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Section 01270

MEASUREMENT AND PAYMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected products.

1.02 AUTHORITY

A. Measurement methods delineated in Specification sections are intended to complement the criteria of this section. In the event of conflict, the requirements of the Specification section shall govern.

B. Resident Project Representative will take all measurements and compute quantities accordingly.

C. Contractor shall assist by providing necessary equipment, workers, and survey personnel as required by Resident Project Representative.

1.03 UNIT QUANTITIES SPECIFIED

A. Quantity and measurement estimates stated in the Agreement are for contract purposes only. Quantities and measurements supplied or placed in the Work and verified by Resident Project Representative shall determine payment as stated in Article 9 of the General Conditions.

B. If the actual Work requires greater or lesser quantities than those quantities indicated in the Bid Form, provide the required quantities at the unit prices contracted, except as otherwise stated in Article 9 of the General Conditions.

C. Lump Sum

D. Plan Quantity

1.04 MEASUREMENT OF QUANTITIES

A. Measurement by Weight: Reinforcing steel, rolled or formed steel or other metal shapes will be measured by CRSI or AISC Manual of Steel Construction weights. Welded assemblies will be measured by CRSI or AISC Manual of Steel Construction or scale weights.

B. Measurement by Volume:

1. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.

2. Excavation and Embankment Materials: Measured by cubic dimension using the average end area method.

C. Measurement by Area: Measured by square dimension using mean length and width or radius.

D. Linear Measurement: Measured by linear dimension, at the item centerline.

E. Stipulated Price Measurement: By unit designated in the agreement.

F. Other: (Including but not limited to, each and lump sum). Items measured by weight, volume, area, or lineal means or combination, as appropriate, as a completed item or unit of the Work.

1.05 PAYMENT

A. Payment Includes: Full compensation for all required supervision, labor, products, tools, equipment, plant, transportation, services, and incidentals; and erection, application or installation of an item of the Work; and Contractor's overhead and profit.

B. Total compensation for the required Unit Price Work shall be included in Unit Price bid in Document 00405 - Schedule of Unit Price Work.

C. Interim payments for stored materials will be made only for materials to be incorporated under items covered in unit prices, unless disallowed in Supplementary Conditions.

D. Progress payments will be based on the Resident Project Representative's observations and evaluations of quantities incorporated in the Work multiplied by the unit price.

E. Final payment for Work governed by unit prices will be made based on the actual measurements and quantities determined by Engineer multiplied by the unit price for Work which is incorporated in or made necessary by the Work.

1.06 NONPAYMENT FOR REJECTED PRODUCTS

A. Payment will not be made for any of the following:

1. Products wasted or disposed of in a manner that is not acceptable to Resident Project Representative.
2. Products determined as nonconforming before or after placement.
3. Products not completely unloaded from transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on hand after completion of the Work, unless specified otherwise.
6. Loading, hauling, and disposing of rejected products.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

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Section 01292

SCHEDULE OF VALUES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Preparation and submittal of a Schedule of Values for stipulated price contracts or for major lump sum items on unit price contracts for which the Contractor requests progress payments.

1.02 DEFINITION

A. The Schedule of Values is an itemized list that establishes the value of each part of the Work for a stipulated price contract and for major lump sum items in a unit price contract. The Schedule of Values is used as the basis for preparing applications for payments. Quantities and unit prices may be included in the schedule when designated by the Engineer.

B. A major lump sum item is a lump sum item in the Schedule of Unit Price Work which qualifies as Major Unit Price Work as defined in Document 00700 - General Conditions.

C. Schedule of values shall be submitted by Contractor initializing lift station lump sum work as a basis for determining percent complete.

1.03 PREPARATION

A. For stipulated price contracts, subdivide the Schedule of Values into logical portions of the Work, such as major work items or work in contiguous geographic areas. Use Section 01326 - Construction Schedule (Bar Chart) to guide the subdivision of work items. The items in the Schedule of Values will correlate directly with the tasks enumerated in the Construction Schedule. Then organize each portion using the Table of Contents of this Project Manual as an outline for listing the value of work by Sections. A pro rata share of mobilization, bonds, and insurance may be listed as separate items for each portion of the work.

B. For unit price contracts, items should include a proportional share of Contractor's overhead and profit so that the total of all items will equal the Contract Price.

C. For lump sum equipment items where submittal of operation/maintenance data and testing are required, include a separate item for equipment operation and maintenance data submittal valued at 5 percent of the lump sum amount for each equipment item and a separate item for testing and adjusting valued at 5 percent of the lump sum amount for each equipment item.

D. Round off figures for each listed item to the nearest $100.00 except for the value of one item, if necessary, to make the total of all items in the Schedule of Values equal the Contract Price for stipulated price contracts or the lump sum amount in the Schedule of Unit Price Work.

E. Type the schedule of values on 8-1/2-inch by 11-inch white bond paper.

1.04 SUBMITTAL

A. Submit within 30 days of Notice to Proceed, or at the pre-construction meeting, whichever occurs sooner.

B. Revise the Schedule of Values and resubmit for items affected by contract modifications, change orders, and work change directives. After the changes are reviewed without exception by the Engineer, make the submittal at least 10 days prior to submitting the next application for progress payment.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

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Section 01312

COORDINATION AND MEETINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Section includes general coordination including preconstruction conference, site mobilization conference, and progress meetings.

1.02 RELATED DOCUMENTS

A. Coordination is required throughout the documents. Refer to all of the Contract Documents and coordinate as necessary.

1.03 ENGINEER AND REPRESENTATIVES

A. The Engineer may act directly or through designated representatives as defined in the General Conditions and as identified by name at the preconstruction conference.

1.04 CONTRACTOR COORDINATION

A. Coordinate scheduling, submittals, and Work of the various Specifications sections to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify that utility requirement characteristics of operating equipment are compatible with existing or planned utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. Conceal pipes, ducts, and wiring within the construction in finished areas, except as otherwise indicated. Coordinate locations of fixtures and outlets with finish elements.

E. Coordinate completion and clean up of Work for Substantial Completion and for portions of Work designated for Owner's partial occupancy.

F. Coordinate access to site for correction of nonconforming Work to minimize disruption of Owner's activities where Owner is in partial occupancy.

G. Contractor should be prepared to discuss coordination scheduling submittals, methods, and project status at all monthly project meetings.

1.05 PRECONSTRUCTION CONFERENCE

A. Engineer will schedule a preconstruction conference.

B. Attendance Required: Owner's Representatives, Engineer's Representatives, Resident Project Representative, Funding Agency Representatives, Contractor, and major Subcontractors.

C. Agenda:

1. Distribution of Contract Documents.
2. Designation of personnel representing the parties in Contract, and the Engineer.
3. Review of insurance.
4. Discussion formats proposed by the Contractor for schedule of values (if any), and construction schedule.
5. Procedures and processing of shop drawings and other submittals, substitutions, pay estimates or applications for payment, Requests for Information, Request for Proposal, Change Orders, and Contract closeout.
6. Scheduling of the Work and coordination with other contractors and utility service providers.
7. Review of Subcontractors.
8. Appropriate agenda items listed for Site Mobilization Conference, paragraph 1.06C, when preconstruction conference and site mobilization conference are combined.
9. Procedures for testing and responsibility for non-compliance or failed tests, review of test results.
10. Procedures for maintaining recorded documents.
11. Other items as may be deemed appropriate.

1.06 SITE MOBILIZATION CONFERENCE

A. When required by the Contract Documents, Engineer will schedule a conference at the Project site prior to Contractor occupancy.

B. Attendance Required: Engineer representatives, Resident Project Representative, Special Consultants, Contractor's Superintendent, and major Subcontractors.

C. Agenda:

1. Use of premises by Owner and Contractor.
2. Safety and first aid procedures.
3. Construction controls provided by Owner.
4. Survey Plan
5. Traffic Control Plan

6. SW3P Compliance
7. Temporary utilities.
8. Security and housekeeping procedures.
9. Field office requirements.
10. DBE/MBE
11. EEO
12. Davis Bacon

1.07 PROGRESS MEETINGS

A. Project meetings shall generally be held at the Project field office or other location as designated by the Engineer. Meetings shall generally be held at monthly intervals, or more frequent intervals if directed by an Engineer.

B. Attendance Required: Job superintendent, major Subcontractors and Suppliers, Owner's Representatives, Engineer's Representatives, Funding Agency Representatives (if any), and Resident Project Representative as appropriate to agenda topics for each meeting.

C. Engineer or his representative will plan for meetings and recording minutes.

D. Engineer or his representative will prepare the agenda and preside over meetings.

E. Contractor shall provide required information and be prepared to discuss each agenda item.

F. Agenda:

1. Review minutes of previous meetings.
2. Review of Record Documents.
3. Review of Work progress schedule submittal, and pay estimates, payroll and compliance submittals.
4. Field observations, problems, and decisions.
5. Identification of problems which may impede planned progress.
6. Review of submittals schedule and status of submittals.
7. Review of RFI and RFP status.
8. Change order status.
9. Review of off-site fabrication and delivery schedules.

10. Maintenance of progress schedule
11. Corrective measures to regain projected schedules.
12. Planned progress during succeeding work period.
13. Coordination of projected progress.
14. Maintenance of quality and work standards.
15. Effect of proposed changes on progress schedule and coordination.
16. Other items relating to Work.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

FORM OF AGREEMENT FOR ENGINEERING/ARCHITECTURAL CONSTRUCTION

THIS AGREEMENT, made this ____ day of _____ 20____ by and between

PORT OF BROWNSVILLE, herein called "Owner", acting herein through its_____, and
(Title of Authorized Official)

_____

STRIKE OUT INAPPLICABLE TERMS (a corporation) (a partnership) (an individual doing business as _____

of _____. County of _____, and State of _____ hereinafter called "Contractor."

It is understood ENGINEER/ARCHITECT representing OWNER shall be

RRP CONSULTING ENGINEERS LLC. -

WITNESSETH, That the Contractor and the Owner, for the consideration hereinafter named, agree as follows:

ARTICLE I - SCOPE OF THE WORK.

The Contractor hereby agrees to furnish all of the materials and all of the equipment and labor necessary and to perform all of the work shown on the drawings and described in the specifications for the project entitled PHASE ONE OF THE NEW FISHING HARBOR WASTEWATER TREATMENT PLANT for the contract amount of :
$ _____

(a) Drawings prepared for same by RRP Consulting Engineers LLC.

(b) Specifications consisting of: _____.

1. "Standard General Specifications" issued by the PORT OF BROWNSVILLE and as issued in the contract documents.

2. "Special Conditions" as prepared by _____ dated _____.

3. The "General Conditions for Engineering/Architectural Construction".

4. Addenda

_____ DATED _____
_____ DATED _____

ARTICLE II - TIME OF COMPLETION/LIQUIDATED DAMAGES.

"If the contractor fails to complete this contract in the working days specified, the time charge will be made for each working day thereafter". The Contractor further agrees to pay, as liquidated damages, the sum of $ 300.00 for each consecutive calendar day thereafter.

The time set forth in the proposal for the completion of the work is an essential element of the contract. For each working day in addition to the working days herein before stated as extended by the Owner, the amount per day given in the following schedule will be deducted from the money due or to become due to the Contractor not as a penalty, but as added expense for Engineering/Architectural supervision.

FOR AMOUNT OF CONTRACT			..... COST PER DAY
$ 5,000.00	to	$ 25,000.00	... ..$100.00
$ 25,001.00	to	$ 100,000.00	... . $200.00
$ 100,001.00	to	$ 500,000.00	... ...$500.00
$ 500,001.00	and	over	..... $1,000.00

ARTICLE III - THE CONTRACT SUM.

A. The Owner shall pay the Contractor for the performance of the work the amounts determined for the total number of each of the following units of work completed at the unit price stated thereafter. The total number of units contained in this schedule is approximate only, and the final payment shall be made for the actual number of units that are incorporated in or made necessary by the work covered by the contract.

B. When and where applicable the original contract price may be increased or decreased as contemplated to complete construction as called for in the plans and specifications and in accordance with Texas Local Government Code Chapter 252 (Formerly Article 2368a V.T.C.S. Section 2a).

C. Changes in the work made under Section 18 of the General Conditions, and not included in Article I, that cannot be classified as coming under any of the Contract units may be done at mutually agreed-upon unit price, or under the provisions of Article V "Extra Work".

ARTICLE IV - PROGRESS PAYMENTS

The owner shall make payments on account of the Contract as follows:

A. On not later than the first day of every month the Contractor shall present to the Engineer/Architect an invoice covering the total quantities under each item of work that has been completed from the start of the job to and including the last day of the preceding month, and the value of the work so completed determined in accordance with the schedule of unit prices for such items together with such supporting evidence as may be required by the Engineer/Architect.

B. Measurements of units for payment shall be made in accordance with the Special Conditions of the contract.

a) On not later than the 30th of the month, the Owner shall pay to the Contractor 90 Percent of the amount of the invoice-less previous payments made. The 10 percent retained percentage may be held by the Owner until the value of the work completed at the end of any month equals 50 percent of the total amount of the Contract after which, if the Engineer/Architect finds that satisfactory progress is being made he shall recommend that all of the remaining monthly payments be paid in full. Payments for work under, Subcontracts of the General Contractor, shall be subject to the above conditions applying to the General Contract after the work under a Subcontract has been 50 percent completed.

b) Final payment of all money due on the contract shall be made within 30 days of completion and acceptance of the work.

c) If the Owner fails to make payment as herein provided, or as provided in Article V (d), in addition to those remedies available to the Contractor under Section 23 of the General Conditions, there shall be added to each such payment daily interest at the rate of 6 percent per annum commencing on the first day after said payment is due and continuing until the payment is delivered or mailed to the Contractor.

ARTICLE V - EXTRA WORK

If the Engineer/Architect orders, in writing, the performance of any work not covered by the Drawings or included in the Specifications, and for which no items in the contract are provided, and for which no unit price or lump sum basis can be agreed upon, then such extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

A. The contractor shall be reimbursed for all reasonable and necessary costs incurred in doing the work and shall receive an additional payment of 10% of all such costs to

cover his indirect overhead costs.

B. The "Cost of the Work" shall first be approved by the Board of Trustees of Owner Credit to the Owner for the following items:

   a. Such discounts on invoices as may be obtained provided that Owner advances sufficient funds to pay the invoices within the discount period.

   b. The mutually agreed salvage value of materials, tools or equipment charged to the Owner and taken over by the Contractor for his use or sale at the completion of the work.

   c. Any rebates, refunds, returned deposits or other allowances properly credited to the Cost of the work.

(c) The cost of the work done each day shall be submitted to the Engineer/Architect in a satisfactory form on the succeeding day and shall be approved by him or adjusted at once.

(d) Monthly payments of all charges for the Extra Work in any one month shall be made in full on or before the 15th day of the succeeding month. Those payments shall include the full amount of the fee earned on the cost of the work done.

IN WITNESS WHEREOF the parties hereto have executed this Agreement, the day and year first above written.

PORT OF BROWNSVILLE- OWNER

WITNESS:

_____ BY:_____

WITNESS:

_____
CONTRACTOR

_____ BY: _____
SIGNATURE & TITLE

(CORPORATE SEAL)

Section 01321

CONSTRUCTION PHOTOGRAPHS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Photographic requirements for construction photographs and submittals.

1.02 SUBMITTALS

A. Prints: Furnish 2 sets of 4-inch by 6-inch prints of each view and submit 1 print directly to the Engineer within 7 days of taking photographs. One print shall be always retained by the Contractor in the field office at the Project site and available for reference.

B. Extra Prints: When requested by the Engineer, the Contractor shall submit extra prints of photographs, with distribution directly to designated parties who will pay the costs for the extra prints directly to the photographer.

C. When required by individual sections, submit photographs taken prior to start of construction to show original site conditions.

D. When required by Contract Documents, submit photographs with monthly Pay Estimate.

E. Negatives: With each submittal, include photographic negatives, in protective envelopes, identified by Project name, Contractor, and date photographs were taken.

F. In lieu of negatives, Contractor may submit electronic files of digital photographs if using a digital camera but must comply with Parts 1 and 2 of this section.

1.03 QUALITY ASSURANCE

A. Contractor shall be responsible for the timely execution of the photographs, their vantage point, and quality.

B. Contractor is responsible to assure all subcontractors comply with this specification.

B. Photographs: Two prints; color, matte finish; 4 x 6 –inch size, mounted on 8-1/2 x 11- inch soft card stock, with left edge binding margin for three-hole punch. Digital photos shall not be distorted to fit card stock.

PART 2 P R O D U C T S

2.01 PRECONSTRUCTION PHOTOGRAPHS

A. Prior to the commencement of any construction, take 35 mm or digital color photographs of the

site of the project and present two sets of prints to the Engineer for their use in contract administration and inspection. Subject matter of the photographs to be determined by the Engineer.

B. The photographs shall show on a non-reflective chalkboard readable in the photograph:

1. Job number.

2. Date and time photographs were taken.

3. Location and compass direction of the photograph, along with the project number.

4. Date shall be negative (35mm) or on digital image.

5. Provide notation of vantage point marked for location and direction of shot, on a key plan of the site.

C. Enough photographs shall be taken to show the existence or non-existence of cracked paved surfaces and the condition of trees, shrubs, grass, fences, driveways, miscellaneous, structures, and reinforced concrete pipe.

D. Identify each photograph with an applied label or rubber stamp on the back with the following information:

1. Name of the Project.

2. Name and address of the photographer (if a professional photographer is used).

3. Name of the Contractor.

4. Date the photograph was taken.

5. Photographs shall be in plastic pockets and bound in three-ring notebook for easy access and viewing.

2.02 PROGRESS PHOTOGRAPHS

A. Take photographs of subject matter selected by Resident Project Representative at intervals, coinciding with the cutoff date associated with each application for payment. Select the vantage points for each shot each month to best show the status of construction and progress since the last photographs were taken.

1. Vantage Points: Follow direction by the Resident Project Representative to select vantage points. During each of the following construction phases, take not less than 2 of the required shots from the same vantage point each time to create a time-lapse sequence.

2. Photos shall be submitted according to Paragraphs 1.03 B. and 2.01 B and D.

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01326

CONSTRUCTION SCHEDULE (BAR CHART)

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Prepare and submit to the Engineer an initial Construction Schedule as required by this section for the Work. Do not start construction until the schedule is approved by the Engineer.

B. Initial approval construction schedule shall be recognized as “baseline schedule” for evaluation of project resources, production rates, and projected project completion.

1.02 FORM AND CONTENT OF INITIAL CONSTRUCTION SCHEDULE

A. Bar Chart:

1. Show major construction activities such as pipe laying (by traffic control phases or other approved key areas), tunnel construction, pavement removal, pavement replacement, pressure testing, disinfection, clean up and punch out as separate activities on the schedule.

2. Show all work items where new water mains and other new utilities connect to Owner facilities. Activities shall be no more than two-weeks in duration.

3. Show separate activities for each shop drawing and product data submittal that are critical to timely completion. Show submission dates and dates approved submittals will be needed from the Engineer.

4. Provide separate horizontal bar for each activity. List start and finish date for each activity at left side of diagram.

5. Horizontal Time Scale: Identify first workday of each week.

6. Scale and Spacing: Notes must be legible, and Contractor must allow space for notations and future revisions.

7. Order of Listings: Order bar chart listings by phases or other approved groups of activities that are contiguous. Activities shall be in chronological order within each phase or group. For example, for each segment of new open cut water main placement, the schedule shall have an activity for layout, traffic control, pavement removal, water main placement and backfill, pavement restoration, traffic control removal, pavement markings restoration and clean up. For each tunnel or auger activity, the schedule shall have an activity for layout, traffic control, shaft construction, tunnel construction or auger activity, pipe placement in tunnel or auger, routing (if required), shaft removal, pavement replacement, pavement marking replacement, traffic control removal, pavement marking restoration and clean up.

B. Narrative Description:

1. Submit narrative description of anticipated work sequence as indicated by sequence of activities presented in the schedule.

2. Narrative shall be of sufficient detail to discuss any activity that affects the public (such as phases of traffic control), interaction with specific Owner forces (such as valve operation, and testing) or other associated prime Contractors.

1.03 PROGRESS REVISIONS

A. Submit progress updates and revisions monthly at monthly progress meeting and as part of Application for Payment or information necessary for Application for Payment. Application for Payment shall not be considered complete or processed for payment until progress revision is submitted. When required, re-submittal for rejected revision must be made, reviewed and approved prior to the following month's pay application being processed. Pay Application for the following month will not be processed until re-submittal is approved and Progress Revision required that month is received.

B. Provide Narrative Report to describe:

1. Major changes in scope.

2. Revised projections in progress, and completion, or changes in activity durations.

3. Other identifiable changes.

4. Problem areas, anticipated delays, and the impact on schedule.

5. Corrective action recommended and its effect.

6. Effect of changes on schedules or other prime contractors.

7. Material delivery delays.

C. Additional data to be included with Bar Chart described in Paragraph 1.01 of this section:

1. Original dates shown for each activity in the approved initial progress schedule shall be shown by a narrow bar next to wider bar for current schedule.

2. Date that each activity started or finished if that event has occurred. Actual dates must be clearly identified in two right-most columns in the left portion of 11- inch by 17-inch chart.

3. Indicate percentage progress of each activity to the date of submission.

1.04 SUBMISSIONS

A. Submit initial progress schedule within 15 days after award of contract. The Engineer will review the schedule and return the review copy.

B. Cut-off date for progress revision may be as early as the twentieth of the month so that submittal can be made without delay to processing of Application for Payment. Use same cut-off day for all revisions as used in first approved revision.

C. When required, resubmit within 7 days after return of review copy.

D. Schedule shall include connecting lines between bars to indicate sequence that activities will be accomplished such that if activity's start or finish is modified, then impact will be known by the corresponding changes to preceding or succeeding activities identified by the connecting lines.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01330

SUBMITTAL PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Submittal procedures for:

1. Schedule of Values.
2. Construction Schedules.
3. Shop Drawings, Product Data, and Samples
4. Operations and Maintenance Data.
5. Manufacturer's Certificates.
6. Construction Photographes.
7. Project Record Documents.
8. Video Tapes.
9. Design Mixes.

1.02 SUBMITTAL PROCEDURES

A. Scheduling and Handling:

1. Schedule submittals well in advance of the need for the material or equipment for construction. Allow time to make delivery of material or equipment after submittal has been approved.

2. Develop a submittal schedule that allows sufficient time for initial review, correction, resubmission and final review of all submittals. The Engineer will review and return submittals to the Contractor as expeditiously as possible but the amount of time required for review will vary depending on the complexity and quantity of data submitted. In no case will a submittal schedule be acceptable which allows less than 30 days for initial review by the Engineer. This time for review shall in no way be justification for delays or additional compensation to the Contractor. Recognizing that time is of the essence, the Contractor is to stamp the top of each submittal with the words ROUTINE or CRITICAL. Routine submittals shall be processed in accordance with the timeframe set forth previously. Critical submittals are those that: were overlooked by the Contractor, involve complex coordination, or are crucial to the successful completion of a specific portion of the project. For critical submittals:

a). Contractor shall indicate on the submittal his realistically estimated date of when a review must be returned.

b). Upon return of critical submittals, Contractor shall date-stamp the transmittal page with date and time received.

c). Contractor is cautioned that the use of critical submittals is not a substitute for proper due diligence on his part. Review of critical submittals found to be routine shall be accompanied by an invoice for excess time and material expenditures that were required to complete the critical review as compared to a routine review. The Resident Project Representative shall make the determination as to whether a critical submittal was in fact routine.

3. The Engineer's review of submittals covers only general conformity to the Drawings, Specifications and dimensions which affect the layout. The Contractor is responsible for quantity determination. Quantities may be verified by the Engineer. The Contractor is responsible for any errors, omissions or deviations from the Contract requirements; review of submittals in no way relieves the Contractor of his obligation to furnish required items according to the Drawings and Specifications.

4. Submit sufficient copies of documents. Unless otherwise specified in the following paragraphs or in the Specifications, provide 6 copies in addition to the number the Contractor requires returned. For portions of the project involving electrical or signal components, provide one additional copy (7 copies in addition to the number the Contractor requires returned).

5. Revise and resubmit submittals as required. Identify all changes made since previous submittal.

6. A maximum of three (3) reviews will be conducted on any one submittal. Submittals requiring more than three (3) reviews will be considered inadequate and result in a recovery of review expenses from the Contractor.

7. The Contractor shall assume the risk for material or equipment which is fabricated or delivered prior to approval. No material or equipment shall be incorporated into the Work or included in periodic progress payments until approval has been obtained in the specified manner.

8. Log

B. Transmittal Form and Numbering:

1. Transmit each submittal to the Engineer with a Transmittal Cover.

2. Sequentially number each transmittal form beginning with the number 1. Re-submittals shall use the original number with an alphabetic suffix (i.e., 2A for first re-submittal of Submittal 2 or 15C for third re-submittal of Submittal 15). Each submittal shall only contain one type of work, material, or equipment. Mixed submittals will not be accepted.

3. Identify time nature of submittal, either ROUTINE or CRITICAL.

4. Identify variations from requirements of Contract Documents and identify product or system limitations.

5. For submittal numbering of video tapes, see paragraph 1.10 Video.

C. Transmittal Cover:

1. Transmittal Cover, certifying that the items have been reviewed in detail and are correct and in accordance with Contract Documents, except as noted by any requested variance. A stamp may be used to print the information on the Transmittal Cover except for the Contractor's signature. Regardless of whether the transmittal cover is typed or stamped, the transmittal cover text shall be a minimum of fourteen (14) points.

2. As a minimum, Transmittal Cover information shall include:

a. Contractor's name.
b. Job number.
c. Submittal number.
d. Certification statement that the Contractor has reviewed the submittal, and it is following the Contract Documents.
e. Signature line for Contractor.
f. Submittal type – routine or critical

3. The bottom half of the Transmittal Cover shall be kept blank.

1.03 SCHEDULE OF VALUES

A. Submit a Schedule of Values in accordance with Section 01292 - Schedule of Values.

1.04 CONSTRUCTION SCHEDULES

A. Submit Construction Schedules as provided in Project Manual.

1.05 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

A. Submit shop drawings in accordance with Section 01340 - Shop Drawings, Product Data, and Samples.

B. Product data and sample information shall be current and no more than a year old acceptable to engineer.

1.06 OPERATIONS AND MAINTENANCE DATA

A. Submit Operations and Maintenance data in accordance with Section 01782 - Operations and Maintenance Data.

1.07 MANUFACTURER'S CERTIFICATES

A. When required in Specification sections or as requested by engineer, submit manufacturers' certificate of compliance for review by Engineer.

B. Transmittal Cover, as described in paragraph 1.02C, shall be placed on front page of the certification.

C. Submit supporting current reference data, affidavits, and certifications as appropriate.

D. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

1.08 CONSTRUCTION PHOTOGRAPHS

A. Submit Construction Photographs in accordance with Section 01321 - Construction Photographs.

1.09 PROJECT RECORD DOCUMENTS

A. Submit Project Record Documents in accordance with Section 01785 - Project Record Documents.

1.10 VIDEO

A. Submit television video tapes as required in Section 02533 - Acceptance Testing for Sanitary Sewers.

B. Transmittal forms for video tapes shall be numbered sequentially beginning with T01, T02, T03, etc.

1.11 DESIGN MIXES

A. When specified in Specifications, submit design mixes for review, timely, prior to stat of related work.

B. Transmittal Cover, as described in paragraph 1.02C, shall be placed on front page of each design mix.

C. Mark each design mix to identify proportions, gradations, and additives for each class and type of design mix submitted. Include applicable and current test results on samples for each mix.

D. Maintain a copy of approved design mixes at mixing plant.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

A. Submittals made as part of this project will become a vital portion of the project record and will be referenced by the Owner for the useful life of the project. All submittals shall be of high quality. To this end, the following requirements are made:

i. As much as possible, all catalog cuts and manufacturer's information shall be original.

ii. Copies, when required, shall be clean and entirely legible.

iii. Neither facsimiles nor copies of facsimiles are to be included as part of any submittal.

iv. Binders, if used, shall be rugged, lock-ring type. The spine of binders shall be clearly labeled with the information outlined in items 1.02 C.2.a. through c.

B. Reviewed submittals shall be returned to Contractor for distribution to subcontractors and other trades as required. As a minimum, submittals returned to the Contractor will be marked with review comments indicating findings of the review and giving instruction as to necessity of a re-submittal. The Engineer may, at his option, use a stamp for this purpose. Detailed correspondence covering the review may also accompany returned submittals.

END OF SECTION

Section 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Methods, schedule, and process to be followed for shop drawings, product data, and sample submittals.

1.02 REQUIREMENT

A. Submit shop drawings, product data and samples as required by the General Conditions and as designated in the Specifications using the procedures specified in Section 01330 – Submittal Procedures and the requirements of this Section.

B. Shop drawings, product data and samples are not considered Contract Documents.

1.03 SHOP DRAWING/SUBMITTAL SCHEDULE

A. Submit a separate Shop Drawing/Submittal schedule at the same time the construction schedule is submitted. List products, materials and equipment for which Shop Drawings and other submittals are required in the order in which they appear in the Specifications. Including product data and sample submittals in schedule.

1.04 SHOP DRAWINGS

A. Submit shop drawings for review as required by the Specifications.

B. Place Contractor's Transmittal Cover on each drawing as described in Section 01330 – Submittal Procedures.

C. On the drawings, show accurately and distinctly, the following:

1. Field and erection dimensions clearly identified as such.

2. Arrangement and section views.

3. Relation to adjacent materials or structure, including complete information for making connections between work under this Contract and work under other contracts.

4. Kinds of materials and finishes.

5. Parts list and descriptions.

6. Assembly drawings of equipment components and accessories showing their respective positions and relationships to the complete equipment package.

7. Where necessary for clarity, identify details by reference to the Contract Drawings.

D. Make drawings to scale providing a true representation of the specific equipment or item to be furnished.

E. Engineer's stamp or seal requested drawings will be at Contractor's expense.

1.05 PRODUCT DATA

A. Submit product data for review as required in Specification sections.

B. Place Contractor's Transmittal Cover on each data item submitted, as described in Section 01330 – Submittal Procedures.

C. Mark each copy to identify applicable products, models, and options to be used in this Project. Supplement manufacturers' standard data to provide information unique to this Project, where required by the Specifications.

D. For products specified only by reference standard, give manufacturers, trade name, model or catalog designation and applicable reference standard.

1.06 SAMPLES

A. Submit samples for review as required by the Specifications or as requested by engineer.

B. Place Contractor's Transmittal Cover on each sample as described in Section 01330 – Submittal Procedures.

C. Submit the number of samples specified in Specifications.

D. Reviewed samples which may be used in the Work are identified in Specifications.

PART 2 PRODUCTS – Not Used

PART 3 EXECUTION – Not Used

END OF SECTION

Section 01422

REFERENCE STANDARDS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Section includes general quality assurance as related to Reference Standards and a list of references.

1.02 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or Federal Standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on the date of the Contract.

C. Request clarification from Engineer before proceeding should specified reference standards conflict with Contract Documents.

1.03 SCHEDULE OF REFERENCES

AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W. Washington, DC 20001
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, MI 48333-9094
AGC	Associated General Contractors of America 1957 E Street, N.W. Washington, DC 20006
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AITC	American Institute of Timber Construction 333 W. Hampden Avenue Englewood, CO 80110
AISC	American Institute of Steel Construction 400 North Michigan Avenue Eighth Floor Chicago, IL 60611
AISI	American Iron and Steel Institute

	1000 16th Street, N.W. Washington, DC 20036
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
APA	American Plywood Association Box 11700 Tacoma, WA 98411
API	American Petroleum Institute 1220 L Street, N.W. Washington, DC 20005
AREA	American Railway Engineering Association 50 F Street, N.W. Washington, DC 20001
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWPA	American Wood-Preservers' Association 7735 Old Georgetown Road Bethesda, MD 20014
AWS	American Welding Society P.O. Box 35104 Miami, FL 33135
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
CFR	Code of Federal Regulations
CLFMI	Chain Link Fence Manufacturers Institute 1101 Connecticut Avenue, N.W. Washington, DC 20036
CRSI	Concrete Reinforcing Steel Institute 933 Plum Grove Road Schaumburg, IL 60173-4758
DIPRA	Ductile Iron Pipe Research Association
EJMA	Expansion Joint Manufacturers Association

	707 Westchester Avenue White Plains, NY 10604
FS	Federal Standardization Documents General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20406
ICEA	Insulated Cable Engineer Association P.O. Box 440 S. Yarmouth, MA 02664
IEEE	Institute of Electrical and Electronics Engineers 445 Hoes Lane P.O. Box 1331 Piscataway, NJ 0855-1331
ISA	International Society of Arboriculture 303 West University P.O. Box GG Savoy, IL 61874
MIL	Military Specifications General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20406
NACE	National Association of Corrosion Engineers 1440 South Creek Drive Houston, TX 71084
NEMA	National Electrical Manufacturers' Association 2101 L Street, N.W., Suite 300 Washington, DC 20037
NFPA	National Fire Protection Association Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101
NRMCA	National Ready Mix Concrete Association
NSF	National Sanitary Foundation
OSHA	Occupational Safety Health Administration U.S. Department of Labor Government Printing Office Washington, DC 20402

PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077-1083
PCI	Prestressed Concrete Institute 201 North Wacker Drive Chicago, IL 60606
SDI	Steel Deck Institute Box 9506 Canton, OH 44711
SSPC	Steel Structures Painting Council 4400 Fifth Avenue Pittsburgh, PA 15213
TAC	Texas Administrative Code
TxDOT	Texas Department of Transportation 11th and Brazos Austin, TX 78701 2483
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
UNI-BELL	UNI-BELL Pipe Association 2655 Villa Creek Drive, Suite 155 Dallas, TX 75234

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01450

CONTRACTOR'S QUALITY CONTROL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Quality assurance and control of installation and manufacturer's field services and reports.

1.02 MEASUREMENT AND PAYMENT

A. No payment will be made for this section item. Include all the cost of Contractor's quality control in overhead cost for this project.

1.03 QUALITY ASSURANCE/CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply fully with manufacturers' installation instructions, including each step in sequence.

C. Independent testing lab-Section 01454.

D. Request clarification from Engineer before proceeding should manufacturers' instructions conflict with Contract Documents.

E. Comply with specified standards as minimum requirements for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

F. Perform work by persons qualified to produce the specified level of workmanship.

G. Perform all work to assure all manufacturer’s warranties remain intact and are not void.

H. Utilize services, skill and knowledge of manufacturers or suppliers designated representative when necessary to ensure proper installation, operation or maintenance.

1.04 REFERENCES

A. Obtain copies of standards and maintain at job site when required by individual Specification sections.

1.05 MANUFACTURERS' FIELD SERVICES AND REPORTS

A. When specified in individual Specification sections, provide material or product suppliers' or manufacturers' technical representative to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, operator training, test, adjust, and balance of equipment as applicable, and to initiate operation, as required. Conform to minimum time requirements for start-up operations and operator training if defined in Specification sections.

B. Manufacturer's representative shall report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions. Submit report within 14 days of observation to Resident Project Representative for review.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01452

INSPECTION SERVICES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Inspection services and references

1.02 INSPECTION

A. Engineer and/or Owner will appoint Resident Project Representative as a representative of the Owner to perform inspections, tests, and other services specified in individual specification Sections and general conditions; observe tests.

B. Alternately, an Engineer and/or Owner may appoint, employ, and pay an independent firm to provide additional inspection, tests or construction management services as indicated in Section 01454 - Testing Laboratory Services.

C. Reports will be submitted by the independent firm to Engineer, and Owner, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

D. Assist and cooperate with the Resident Project Representative; furnish samples of materials, design mix, equipment, tools, and storage.

E. Notify Resident Project Representative 24 hours prior to expected time for operations requiring services.

F. Sign and acknowledge observation or testing reports when requested by Resident Project Representative or independent firm.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

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Section 01454

TESTING LABORATORY SERVICES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Testing laboratory services and Contractor responsibilities related to those services.

1.02 REFERENCES

A. ASTM C 1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

B. ASTM D 3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

C. ASTM D 3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

D. ASTM E 329 - Specification for Minimum Requirements for Agencies Engaged the Testing and/or Inspection of Materials Used in Construction.

1.03 SELECTION AND PAYMENT

A. The Contractor shall employ and pay for the services of an independent testing laboratory, or laboratories, to perform product and material quality control, perform in-place quality control and verification identified in individual Specification sections.

B. The Owner, with the assistance of the Engineer, shall have control of testing, sampling, and expenditures. The contractor's incidental labor and material expense and overhead and profit associated with the testing shall be included in the various other price bid.

C. The Contractor shall coordinate the services of the project's Geotechnical Engineer of Record and the Resident Project Representative to conduct observation and testing of the subgrade preparation, and the selection, placement and compaction of select fill material. The foundation excavations for structures shall be observed by the Geotechnical Engineer of Record prior to steel and/or concrete placement to assess that the foundation materials can support the design loads and are consistent with the subsurface materials described in the project's Geotechnical Engineering Study.

D. Employment of a testing laboratory by the Contractor shall not relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

E. Remedial work and re-testing costs, resulting from deficiencies in materials and/or workmanship, shall be borne by the Contractor. Re-testing costs shall not be paid for by the Owner.

1.04 QUALIFICATION OF LABORATORY

A. Meet laboratory requirements of ASTM E 329 and applicable requirements of ASTM C 1077,

ASTM D 3666, and ASTM D 3740.

B. Where a laboratory subcontracts any part of the testing services, such work shall be placed with a laboratory complying with the requirements of this Section.

1.05 LABORATORY REPORTS

A. The testing laboratory shall provide and distribute copies of laboratory reports to the distribution list provided by the Engineer.

B. One copy of each laboratory report distributed or faxed to the Contractor shall be kept at the site field office for the duration of the project.

C. Before close of business on the working day following test completion and review, reports which indicate failing test results shall be transmitted immediately via fax from the testing laboratory to the material supplier, Contractor, Engineer and Resident Project Representative.

1.06 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of the Contractor.

D. Laboratory has no authority to stop the Work.

1.07 CONTRACTOR RESPONSIBILITIES

A. Provide safe access to the Work and to manufacturer's facilities for the Engineer, Resident Project Representative and for testing laboratory personnel.

B. Provide to the testing laboratory a copy of the construction schedule and a copy of each update to the construction schedule.

C. Notify the Resident Project Representative and the testing laboratory during normal working hours of the day before the expected time for operations requiring inspection and testing services. If the Contractor fails to make timely prior notification, then the Contractor shall not proceed with the operations requiring inspection and testing services.

D. Notify the Resident Project Representative 24 hours in advance if the Specification requires the presence of the Resident Project Representative or testing laboratory for sampling or testing.

E. Request and monitor testing as required to provide timely results and to avoid delay to the Work. Provide samples to the laboratory in sufficient time to allow the required test to be performed in accordance with specified test methods before the intended use of the material.

F. Cooperate with laboratory personnel in collecting samples on site. Provide incidental labor and facilities for safe access to the Work to be tested; to obtain and handle samples at the site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 CONDUCTING TESTING

A. Laboratory sampling and testing specified in individual Specification sections shall conform to the latest issues of ASTM standards, TxDOT methods, or other recognized test standards as approved by the Engineer.

B. The requirements of this section shall also apply to those tests for approval of materials, for mix designs, and for quality control of materials as performed by the testing laboratories employed by the Contractor.

END OF SECTION

Section - 01510

TEMPORARY FACILITIES

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish temporary facilities, including field offices, storage sheds, and temporary utilities needed to complete the work.

B. Furnish, install, and maintain temporary project identification signs. Provide temporary on-site informational signs to identify key elements of the construction facilities. Do not allow other signs to be displayed.

2.00 PRODUCTS

2.01 SIGN MATERIALS

A. Provide new or used, wood or metal, in sound condition for structure and framing. Materials are to be structurally adequate and suitable for the indicated finish.

B. Provide 3/4" exterior grade A/D face veneer plywood with medium density overlay for sign surface.

C. Bolts, brackets, fasteners, and other hardware are to be galvanized or stainless steel.

2.03 TEMPORARY STORAGE BUILDINGS

Furnish storage buildings of adequate size to store any materials or equipment delivered to the site that might be affected by weather.

2.04 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the job site from the commencement of the project to its conclusion. Always maintain these facilities in a clean and sanitary condition and comply with the requirements of the local health authority.

B. Contractor's workmen shall always use these sanitary facilities. Rest rooms within existing or Owner-occupied buildings shall not be used.

2.06 TEMPORARY UTILITIES

A. Provide the temporary utilities needed by the trades during construction, including electrical power, water, and telephone. Provide a source of temporary electrical power of adequate size for the construction procedures.

B. Electrical pole and service shall comply with OSHA and other safety requirements and the requirements of the power company.
   b. Make the electrical power available to the trades as needed.
   c. Provide extensions to the various parts of the building as needed.
   d. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.

2. Provide temporary water. Extend water to the construction site and maintain the source until such time that the permanent water supply can be extended to the site.

3. Provide telephone service to the site and install telephones inside the Contractor's and the Engineers office.

C. Decide with the local utility company, comply with utility company's requirements and pay for the utility costs during construction.

D. Make utilities available to the trades during construction.

3.00 EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

A. Locate all temporary facilities in an area that will not interfere with any work to be performed under this contract.

B. Construct and install signs at locations as required by applicable regulatory agencies or as selected by the Owner. Install informational signs at the height of optimum visibility, on ground-mounted poles, or attach to temporary structural surfaces.

3.07 REMOVAL OF TEMPORARY FACILITIES

A. Remove temporary buildings, shed, and utilities at the conclusion of the project and restore the site to its original condition or finished in accordance with the drawings.

B. Remove informational signs upon completion of construction.

C. Remove project identification signs, framing, supports, and foundations upon completion of the project.

END OF SECTION

Section 01540

DIVERSION PUMPING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Diversion pumping.

1.02 UNIT PRICES

A. No separate payment will be made for installation, operation and maintenance of diversion pumping system. Include all costs of diversion pumping in other related bid items

1.03 DEFINITIONS

A. Diversion pumping is the installation, operation, and maintenance of bulkheads, plugs, hoses, piping, and pumps to maintain sewage flow and prevent backup and overflow.

1.04 SYSTEM DESCRIPTION

A. Diversion pumping provides continuous sewer service to the users of the sanitary sewer system while maintenance or construction operations are in progress by diverting flow when necessary around the construction location and pumping it to a downstream manhole. Maintain sewage flow to prevent backup or overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways. Do not divert sewage outside of the sanitary sewer system.

B. Any time the diversion pump(s) are operating, an experienced operator shall be on site to monitor the operation, adjust pump speed, valves, etc., make minor repairs to the system and report problems.

1.05 SUBMITTALS

A. Make submittals in conformance with Section 01330 - Submittals Procedures.

B. Diversion pumping systems bypassing line segments with 42-inch diameter or greater sewers, require submittal (prior to installation) of a Diversion Pumping Plan with sufficient detail to show the location, number and size of pumps, the number, location, size and type of hoses and/or rigid piping, and the location of the downstream discharge. Show any special features were pipes or hoses cross roadways, such as temporary trenches, support bridges, etc.

1.06 SCHEDULING

A. If the Owner is operating or maintaining diversion pumping in the construction area, the Contractor shall coordinate with the Owner, as necessary.

B. The Contractor shall not cease diversion pumping operations before being directed to do so by the Resident Project Representative.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Design piping, joints, and accessories to withstand at least twice the maximum system pressure or 50 psi, whichever is greater.

B. Pumps shall be self-priming type or submersible electric, in good working order, with a working pressure gauge on the discharge.

PART 3 E X E C U T I O N

3.01 FIELD QUALITY CONTROL

A. During diversion pumping, do not allow sewage to be leaked, dumped, or spilled in or onto any area outside of the existing sanitary sewer system.

B. In the event of accidental spill or overflow, immediately remedy the situation and act to clean up and disinfect the spill. Promptly notify the Resident Project Representative so that required reporting can be made to the Texas Natural Resources Conservation Commission (TNRCC) and the Environmental Protection Agency (EPA) by the Owner.

3.02 CLEANING

A. When diversion pumping operations are complete, piping shall be drained into the sanitary sewer prior to disassembly.

END OF SECTION

Section 01542

OPERATIONS WITHIN SEWAGE DISPOSAL SYSTEMS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Construction operations within, through, and adjacent to existing sewage disposal systems. Sewage disposal systems include, but are not limited to, septic tanks, absorption fields, disposal trenches, cesspools, leach beds, leach fields, privies, and spray mounds.

1.02 UNIT PRICES

A. No separate payment will be made for Operations Within Sewage Disposal Systems. Include all costs associated with Operations Within Sewage Disposal Systems in work requiring such operation.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to the requirements of Section 01330 - Submittal Procedures.

1.04 DESCRIPTION

A. Operations Within Sewage Disposal Systems provides for the removal, disposal, and temporary replacement of existing sewage disposal systems that may be encountered during the execution of the project.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 ENCOUNTER

A. Prior to initiating an excavation or other construction operation, Contractor shall first make a reconnaissance of the immediate and adjacent work area to ascertain the existence of sewage disposal systems. Existing and suspected disposal systems within the work area shall be flagged and their location(s) marked on the Drawings. Findings shall be reported to the Resident Project Representative.

B. Sewage disposal systems encountered after excavation has begun shall be flagged and documented on the Drawings. Findings shall be reported to the Resident Project Representative.

3.02 EXCAVATION WITHIN DISPOSAL AREAS

A. Contractor shall segregate spoil removed from sewage disposal areas. Spoil removed from these areas shall be considered to pose a human health risk. Segregation measures shall be

as necessary to: limit public contact with spoil, limit worker contact with spoil, limit spreading of waste materials, prevent nuisance conditions, and prevent runoff from escaping the temporary storage site. Spoil shall be removed and disposed of at the end of each working day. Spoil removed from sewage disposal areas shall not be stockpiled overnight or longer.

C. At Contractor's option, spoil may be removed immediately. However, Contractor shall take measures as necessary to minimize dispersal of liquid wastes from spoil material.

D. Seepage fluid entering excavations shall be removed by vacuum truck. Ground and surface water entering excavations in sewage disposal areas shall be removed by vacuum trucks.

E. Contractor shall adjust his work procedures as necessary to limit worker and public exposure to sewage disposal area materials.

3.03 HANDLING EXCAVATED MATERIALS

A. Materials excavated from sewage disposal areas shall not be incorporated in the work.

B. Solids removed from excavations in sewage disposal areas shall be properly disposed of in accordance with Section 01576 – Waste Material Disposal. Contractor shall provide Owner receipts and manifests as required to verify proper disposal.

C. Liquids removed from excavations in sewage disposal areas shall be properly disposed of in accordance with Section 01576 – Waste Material Disposal. Contractor shall provide Owner receipts and manifests as required to verify proper disposal.

3.04 RECONDITIONING OF EXCAVATED SEWAGE DISPOSAL AREAS

A. Contractor shall recondition sewage disposal areas as necessary to return functional use to the sewage disposal areas excavated during construction.

B. As soon as practical, Contractor shall cover excavated sewage disposal areas, temporary excavated material stockpile areas, and other areas encountering excavated sewage disposal area materials with a minimum of two (2) inches of clean soil.

END OF SECTION

Section 01555

TRAFFIC CONTROL AND REGULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Traffic Control and Regulation

1.02 METHODS OF PAYMENT

A. No separate payment will be made for traffic control and regulation. Include the cost of traffic control and regulation in unit price for work requiring such control.

1.03 REFERENCES

A. Texas Manual of Uniform Traffic Control Devices (TMUTCD)

B. Texas Department of Transportation (TxDOT) permit (if applicable)

C. Railroad company permit(s) (if applicable)

1.04 PERFORMANCE REQUIREMENTS

A. Provide all necessary traffic control devices (speed zone signs, warning signs, directional advisory signs, etc.) barricades, marking, lighting, and other equipment and supplies required to comply with the TMUTCD (and TxDOT permit, and/or Railroad Company permit, if applicable.) Properly maintain all traffic Control devices and ensure they are always legible.

B. Provide all necessary certified flagmen required to comply with the TMUTCD (and TxDOT permit, if applicable.)

C. Provide Licensed Professional Engineer to certify any contractor proposed major modifications traffic control plan.

D. The Contractor must be aware of the Texas traffic laws regarding the legal limit of axle load (legal weights) for trucks hauling materials to site. Copies of law can be obtained from the TX Dept. of public Safety.

E. Document the Traffic Control Regulations activities in the diaries /work reports and on Form Log.

F. Maintain Documentation of detailed inspections made by photographs, video, Form 599, memo or other media.

PART 2 PRODUCTS

A. Equipment and materials must be furnished, installed and operated by an experienced contractor regularly engaged in traffic control system design, installation and operation.

B. All equipment must be in good repair and operating order.

C. Sufficient standby equipment and materials shall be made available to ensure continuous operation, where required.

PART 3 EXECUTION

A. Provide labor, material, equipment, techniques and methods required to provide safe traffic control and regulation. Monitor effectiveness of the installed system and its effect on adjacent property.

B. Notify TxDOT and/or Railroad Company as required by the permit(s) (if applicable).

C. Provide continuous system operation, including nights, weekends and holidays. Arrange for appropriate backup if electrical power is primary energy source for traffic control system.

D. Remove system(s) upon completion of construction or when traffic control is no longer required.

END OF SECTION

Section 01561

TRENCH SAFETY SYSTEM

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Trench safety system for the construction of trench excavations.

B. Trench safety system for structural excavations which fall under provisions of State and Federal trench safety laws.

1.02 UNIT PRICES

A. Measurement for trench safety systems used on trench excavations is on a linear foot basis measured along the centerline of the trench, including manholes and other line structures.

B. Refer to Section 01270 - Measurement and payment for unit price procedures.

C. Cost of trench safety system for boring tunneling. Angering should be included in related bid items.

1.03 DEFINITIONS

A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

B. The trench safety system requirements will apply to larger open excavations if the erection of structures or other installations limit the space between the excavation slope and the installation to dimensions equivalent of a trench as defined.

C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

D. Provide certification documentation of trench boxes to Resident Project Representative/Engineer.

1.04 SUBMITTALS

A. Submittals shall conform to the requirements of Section 01330 - Submittal Procedures.

B. Submit a safety program specifically for the construction of trench excavation. Design the trench safety program to be in accordance with OSHA 29CFR standards governing the presence and activities of individuals working in and around trench excavations.

C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid for by Contractor.

D. Review of the safety program by the Engineer will only be regarding compliance with this specification and will not constitute approval by the Engineer nor relieve Contractor of obligations under State and Federal trench safety regulations.

1.05 REGULATORY REQUIREMENTS

A. Install and maintain trench safety systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29CFR, Part 1926, as amended. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

B. The Contractor is responsible for obtaining a copy of the OSHA standards.

C. Legislation that has been enacted by the Texas Legislature regarding Trench Safety Systems is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Chapter 756.

1.06 INDEMNIFICATION

A. Contractor shall indemnify and hold harmless the Owner and Engineer, their employees and agents, from all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgements or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.

B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner and Engineer in case the Owner and Engineer is/are negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Install and maintain trench safety systems in accordance with provisions of OSHA 29CFR.

B. Install specially designed trench safety systems in accordance with the Contractor's Trench Excavation Safety Program for the locations and conditions identified in the program.

C. A competent person, as identified in the Contractor's Trench Excavation Safety Program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

3.02 INSPECTION

A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the trench safety systems to ensure that the installed systems and operations meet OSHA 29CFR and other personnel protection regulations requirements.

B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work

in the trench and move personnel to safe locations until the necessary precautions have been taken by Contractor to safeguard personnel entering the trench.

C. Maintain a permanent record of daily inspections.

3.03 FIELD QUALITY CONTROL

A. Contractor shall verify specific applicability of the selected or specially designed trench safety systems to each field condition encountered on the project.

END OF SECTION

Section 01562

TREE AND PLANT PROTECTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Tree and plant protection.

1.02 UNIT PRICES

A. No separate payment will be made for tree and plant protection. Include the cost of both tree and plant protection in other related bid items.

1.03 PROJECT CONDITIONS

A. Preserve and protect existing trees and plants to remain from foliage, branch, trunk, or root damage that could result from construction operations.

B. Prevent following types of damage:

1. Compaction of root zone by foot or vehicular traffic, or material storage.

2. Trunk damage from equipment operations, material storage, or from nailing or bolting.

3. Trunk and branch damage caused by ropes or guy wires.

4. Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.

5. Branch damage due to improper pruning or trimming.

6. Damage from lack of water due to:

    a. Cutting or altering natural water migration patterns near root zones.
    b. Failure to provide adequate watering.

7. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster, or other base materials near roots.

8. Cutting of roots larger than 1-1/2 inches in diameter.

1.04 DAMAGE ASSESSMENT

A. When trees other than those designated for removal are destroyed or badly damaged because of construction operations, remove and replace them with same size, species, and variety up to and including 8 inches in trunk diameter. Trees larger than 8 inches in diameter shall be replaced with an 8-inch diameter tree of the same species and variety and total contract amount will be reduced by an amount determined from the following International Shade Tree Conference formula: 0.7854 x D x D x $38.00 where D is diameter in inches of tree or shrub trunk measured 12 inches above grade.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Asphalt Paint: Emulsified asphalt or other adhesive, elastic, antiseptic coating formulated for horticultural use on cut or injured plant tissue, free from kerosene and coal creosote.

B. Burlap: Suitable for use as tree wrapping.

C. Fertilizer: Liquid containing 20 percent nitrogen, 10 percent phosphorus, and 5 percent potash.

D. All necessary tree replacements shall be as approved by Resident Project Representative.

PART 3 E X E C U T I O N

3.01 PROTECTION AND MAINTENANCE OF EXISTING TREES AND SHRUBS

A. Except for trees and shrubs shown on Drawings to be removed, all trees and shrubs within the project area is to remain and be protected from damage.

B. For trees or shrubs to remain, perform the following:

1. Trimming of trees and shrubs to remain shall be done only under supervision of professional tree surgeon or arborist.

a. Tree pruning will be according to the International Society of Arboriculture specifications.

b. Trees and shrubs requiring pruning for construction shall also be pruned for balance as well as to maintain proper form and branching habit.

c. Cut limbs at branch collar. No stubs are to remain on trees. Branch cuts shall not gouge outer layer of tree structure or trunk.

2. Use extreme care to prevent excessive damage to root systems.

a. Roots in construction areas will be cut smoothly with a trencher before excavation begins. Do not allow ripping of roots with a backhoe or other equipment.

b. Temporarily cover exposed roots with wet burlap to prevent roots from drying out.

c. Cover exposed roots with soil as soon as possible.

3. Prevent damage or compaction of root zone (area below dripline) by construction activities.

a. Do not allow scarring of trunks or limbs by equipment or other means.

b. Do not store construction materials, vehicles, or excavated material under dripline of trees.

c. Do not pour liquid materials under dripline.

4. Water and fertilize trees and shrubs that will remain to maintain their health during construction period.

    a. Supplemental watering of landscaping during construction should be done once every 7 days in cold months and once every 4 days in hotter months.

    b. Watering shall consist of saturating soils at least 6 to 8 inches beneath surface.

5. Water areas currently being served by private sprinkler systems while systems are temporarily taken out of service to maintain health of existing landscapes.

6. At option of the Contractor and with the Resident Project Representative permission, trees and shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.02 PROTECTION

A. Protection of Trees or Shrubs in Open Area:

1. Install steel drive-in fence posts in protective circle, approximately 8 feet on center, not closer than 4 feet to trunk of trees or stems of shrubs.

2. Mount safety fencing to posts.

3. For trees or shrubs in paved areas, mount concrete-filled steel pipe 2-1/2 inches in diameter minimum in rubber auto tires filled with concrete (movable posts).

B. Timber Wrap Protection for Trees in Close Proximity of Moving or Mechanical Equipment and Construction Work:

1. Wrap trunk with layer of burlap.

2. Install 2 x 4's (5-foot to 6-foot lengths) vertically, spaced 3 inches to 5 inches apart around circumference of tree trunk.

3. Tie in place with 12-to-9-gauge steel wire.

3.03 MAINTENANCE OF NEWLY PLANTED TREES

A. Show proof of capacity to water during dry periods.

B. The Contractor guarantees that trees planted for this Project shall remain alive and healthy at least until the end of a one-year warranty period.

1. Within four weeks of notice from Owner, Contractor shall replace, at his expense, any dead trees or any trees that in the opinion of Owner, have become unhealthy or unsightly or have lost their natural shape because of additional growth, improper pruning or maintenance, or weather conditions.

2. When tree must be replaced, the guarantee period for that tree shall begin on date of

replacement of tree, subject to the Owner's inspection, for no less than one year.

3. Dispose of trees rejected at any time by Owner at Contractor's expense.

END OF SECTION

Section 01570

TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Section describes the requirements for the documents to be prepared by the Contractor for the Texas Pollutant Discharge Elimination System program for construction storm water. These documents are to be prepared, reviewed, and submitted to the Texas Commission on Environmental Quality (TCEQ) prior to commencing construction operations.

1.02 UNIT PRICES

A. No separate payment will be made for work performed under this Section. Include the cost of work performed under this Section in pay items of which this work is a component.

1.03 REFERENCES

A. Texas Commission on Environmental Quality – TPDES General Permit Number TXR150000 (attached)

B. Texas Department of Transportation – Storm Water Management Guidelines for Construction Activities

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.01 TEXAS POLLUTANT DISCHARGE ELIMINATION SYSTEM

A. The Contractor shall prepare the necessary forms, Storm Water Pollution Prevention Plan (SWPPP), and comply with the TPDES General Permit Number TXR15000 referenced in item 1.03 A of this specification.

B. Copies of the Notice of Intent (NOI) with instructions, Notice of Termination (NOT) with instructions, and TPDES General Permit TXR150000 are attached for the Contractor's use.

C. The Contractor must pay any required application fees and water quality fees as outlined in the TPDES General Permit TXR150000.

3.02 PRECONSTRUCTION REVIEW AND SUBMITTALS

A. The Contractor shall submit to the Resident Project Representative a copy of the NOI prior to commencing construction.

3.03 CONSTRUCTION REQUIREMENTS

A. The Contractor shall be responsible for preparation of applicable forms, payment of fees, and retaining records as outlined in the TPDES General Permit TXR150000.

END OF SECTION

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Section 01571

STORM WATER POLLUTION PREVENTION PLAN

PART 1 G E N E R A L

1.04 SECTION INCLUDES

A. Section describes the requirements for the documents to be prepared by the Contractor for the Storm Water Pollution Prevention Plan (SWPPP). These documents are to be prepared and reviewed prior to commencing construction operations.

1.05 UNIT PRICES

A. No separate payment will be made for work performed under this Section. Include all the costs of work performed under this Section in pay items of which this work is a component.

1.06 REFERENCES

D. Texas Commission on Environmental Quality – TPDES General Permit Number TXR150000

E. Texas Department of Transportation – Storm Water Management Guidelines for Construction Activities

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.04 STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

A. The Contractor shall prepare the SWPPP in accordance with the TPDES General Permit Number TXR15000 referenced in item 1.03 A of this specification.

B. The Contractor shall prepare the SWPPP using structural and nonstructural control measures included in the Plans and Specifications throughout the construction and post construction periods. These control measures shall not be used as a substitute for the permanent pollution control measures unless otherwise directed by the Resident Project Representative in writing. The control measures may include silt fences, straw bales, stabilized construction exits, or other structural or nonstructural storm water pollution controls. Additional information regarding these controls can be found in the Texas Department of Transportation Manual referenced in item 1.03 B of this specification.

C. The SWPPP shall include at a minimum:

1. A site map showing the areas of soil disturbance, areas not to be disturbed, drainage patterns, approximate slopes anticipated after major grading activities, locations where storm water discharges to surface waters (including wetlands) and/or leaves the project site.

2. Locations of structural and nonstructural controls for regulating the discharge of stormwater pollutants, locations of waste, borrow, and equipment storage areas, and location were stabilization practices are expected to occur.

3. A description including the nature of the construction activity, a description of the intended sequence of major activities which disturb soils for major portions of the site (grubbing, excavation, grading, utilities and infrastructure installation), estimates of the total area of the site, and the total area of the site that is to be disturbed.

4. A description of the control measures that will be implemented as part of the construction activity to control pollutants in storm water discharges, and the general timing during the construction process that these measures will be implemented.

5. A description of construction and waste materials expected to be stored on site with updates as appropriate. The SWPPP shall also include a description of controls to reduce pollutants from these materials including storage practices to minimize exposure of the materials to storm water, and spill prevention and response.

6. A description of pollutant sources from areas other than the construction site over which the contractor has control for the project (including but not limited to dedicated asphalt plants, dedicated concrete plants, haul roads, and field offices), and the control measures implemented to reduce pollutants.

3.05 PRECONSTRUCTION REVIEW AND SUBMITTALS

A. The Contractor shall review implementation of the SWPPP in a meeting with the Engineer and the Resident Project Representative prior to the start of construction.

B. The Contractor shall submit to the Resident Project Representative for acceptance schedules for accomplishment of the storm water pollution control measures in accordance with the SWPPP. Work on the project shall not begin until the schedules for implementation of the controls and methods of operation have been reviewed and accepted in writing by the Resident Project Representative.

3.06 CONSTRUCTION REQUIREMENTS

A. The Contractor shall be responsible for implementation, maintenance, and inspection of storm water pollution prevention control measures and other practices shown on the SWPPP, the Plan Drawings, or specified elsewhere in this or other Specifications.

B. The contractor shall effectively prevent and control erosion and sedimentation on the site at the earliest practicable time as outlined in the approved schedule and SWPPP. Control measures, where applicable, will be implemented prior to the commencement of each construction operation or immediately after the area has been disturbed.

C. Contractor shall immediately correct, install, replace, relocate, any control measures deemed necessary by Resident Project Representative.

END OF SECTION

Section 01572

SOURCE CONTROLS FOR EROSION AND SEDIMENTATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Description of erosion and sediment control and other control-related practices which shall be utilized during construction activities.

1.02 UNIT PRICES

A. No separate payment will be made for work performed under this Section. Include all costs of work performed under this Section in pay items of which this work is a component.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION AND INSTALLATION

A. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than site work specifically directed by the Resident Project Representative to allow soil testing and surveying.

B. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately by the Contractor.

C. The Contractor shall be responsible for collecting, storing, hauling, removing and disposing of spoil, silt, and waste materials as specified in this or other Specifications and in compliance with applicable federal, state, and local rules and regulations.

D. Contractor shall conduct all construction operations under this Contract in conformance with the erosion control practices described in the SWPPP, Drawings, and this Specification.

E. The Contractor shall install, maintain, and inspect erosion and sediment control measures and practices as specified in the SWPPP, Drawings, and in this or other Specifications Sections.

3.02 TOPSOIL PLACEMENT FOR EROSION AND SEDIMENT CONTROL SYSTEMS

A. When topsoil is specified as a component of another Specification, the Contractor shall conduct erosion control practices described in this Specification during topsoil placement operations.

1. When placing topsoil, maintain erosion and sediment control systems, such as swales, grade stabilization structures, berms, dikes, waterways, and sediment basins.

2. Maintain grades which have been previously established on areas to receive topsoil.

3. After the areas to receive topsoil have been brought to grade, and immediately prior to dumping and spreading the topsoil, loosen the subgrade by discing or by scarifying to a depth of at least 2 inches to permit bonding of the topsoil to the subsoil.

4. No sod or seed shall be placed on soil which has been treated with soil sterilant until sufficient time has elapsed to permit dissipation of toxic materials.

3.03 SEDIMENT CONTROL MAINTENANCE

A. All erosion, sediment, and water pollution controls will be maintained in good working order. A rain gauge provided by the Contractor shall be located on the project site. Within 24 hours of a rainfall event of 0.5 inches or more as measured by the project rain gauge, the Contractor and the Resident Project Representative shall inspect the entire project to determine the condition of the control measures. Sediment shall be removed, and devices repaired as soon as practicable but no later than 7 days after the surrounding ground has dried sufficiently to prevent further damage from equipment operations needed for repairs.

B. In the event of continuous rainfall over a 24-hour period, or other circumstances that preclude equipment operation in the area, the Contractor shall install additional backup storm water pollution control devices, as determined by the Resident Project Representative, by other appropriate methods. The Contractor shall remove sediment accumulations and deposit the spoils in an area approved by the Resident Project Representative as soon as practical and in accordance with the SWPPP. Any corrective action needed for the control measures is to be accomplished in the sequence directed by the Resident Project Representative; however, areas adjacent to receiving waters shall generally have priority, followed by devices protecting storm sewer inlets.

3.04 DUST CONTROL

A. Implement dust control methods to control dust creation and movement on construction sites and roads and to prevent airborne sediment from reaching receiving streams or storm water conveyance systems, to reduce on-site and off-site damage, to prevent health hazards, and to improve traffic safety.

B. Control blowing dust by using one or more of the following methods:

1. Mulches bound with chemical binders.

2. Temporary vegetative cover.

3. Spray-on adhesives on mineral soils when not used by traffic.

4. Tillage to roughen the surface and bring clods to the surface.

5. Irrigation by water sprinkling.

6. Barriers using solid board fences, snow fences, burlap fences, crate walls, bales of straw, or similar materials.

C. Implement dust control methods immediately whenever dust can be observed blowing on the project site.

D. Contractor is to provide all water for sprinkling and equipment, specifically the water truck, at no additional cost to owner.

3.05 KEEPING STREETS CLEAN

A. Keep streets clean of construction debris and mud carried by construction vehicles and equipment. If necessary to keep the streets clean, install stabilized construction exits at construction, staging, storage, and disposal areas. A vehicle/equipment wash area (stabilized with coarse aggregate) may be installed adjacent to the stabilized construction exit, as needed. Release wash water into a drainage swale or inlet protected by erosion and sediment control measures. Construction exits and wash areas are specified in Section 01575 - Stabilized Construction Exit.

B. In lieu of or in addition to stabilized construction exits, shovel or sweep the pavement to the extent necessary to keep the street clean. Water hosing or sweeping of debris and mud off the street into adjacent areas is not allowed. All costs of sweeping are the responsibility of the contractor.

3.06 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose. Locate such areas so that oils, gasoline, grease, solvents, and other potential pollutants cannot be washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid as well as solid waste. Clean and inspect maintenance areas daily.

B. On a construction site where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.07 WASTE COLLECTION AND DISPOSAL

A. Contractor shall formulate and implement a plan for the collection and disposal of waste materials (contaminated, solid waste, and construction debris) from the construction site. In the plan, designate locations for trash and waste receptacles and establish a collection schedule. Methods for ultimate disposal of waste shall be specified and carried out in accordance with applicable local, state, and federal health and safety regulations. Make special provisions for the collection and disposal of liquid waste and toxic or hazardous materials.

B. Keep receptacles and waste collection areas neat and orderly to the extent possible. Waste shall not be allowed to overflow its container or accumulate from day-to-day. Locate trash collection points where they will least likely be affected by concentrated storm water runoff.

3.08 WASHING AREAS

A. Vehicles such as concrete delivery trucks or dump trucks and other construction equipment shall not be washed at locations where the runoff will flow directly into a watercourse or storm water conveyance system. Designate special areas for washing vehicles. Locate these areas where the wash water will spread out and evaporate or infiltrate directly into the ground, or where the runoff can be collected in a temporary holding or seepage basin. Beneath wash areas construct a gravel or rock base to minimize mud production.

3.09 STORAGE OF CONSTRUCTION MATERIALS AND CHEMICALS

A. Isolate sites where chemicals, cements, solvents, paints, or other potential water pollutants are stored in areas where they will not cause runoff pollution.

B. Store toxic chemicals and materials, such as pesticides, paints, and acids in accordance with manufacturers' guidelines. Protect groundwater resources from leaching by placing a plastic mat, packed clay, tar paper, or other impervious materials on any areas where toxic liquids are to be opened and stored.

3.10 DEMOLITION AREAS

A. Demolition activities which create large amounts of dust with significant concentrations of heavy metals or other toxic pollutants shall use dust control techniques to limit transport of airborne pollutants. However, water or slurry used to control dust contaminated with heavy metals or toxic pollutants shall be retained on the site and shall not be allowed to run directly into watercourses or storm water conveyance systems. Methods of ultimate disposal of these materials shall be carried out in accordance with applicable local, state, and federal health and safety regulations.

3.11 SANITARY FACILITIES

A. Provide and maintain sanitary facilities for persons on the job site; comply with the regulations of State and local departments of health.

B. Enforce the use of sanitary facilities by construction personnel at the job site. Such facilities shall be enclosed. Pit-type toilets will not be permitted. No discharge will be allowed from these facilities. Collect and store sewage and waste so as not to cause a nuisance or health problem; have sewer and waste hauled off-site and properly disposed in accordance with City regulations.

C. Located toilets near the Work site and secluded from view insofar as possible. Keep toilets clean and supplied throughout the course of the Work.

3.12 PESTICIDES

A. Use and store pesticides during construction in accordance with manufacturers' guidelines and with local, state, and federal regulations. Avoid overuse of pesticides which could produce contaminated runoff. Take great care to prevent accidental spillage. Never wash pesticide containers in or near flowing streams or storm water conveyance systems.

END OF SECTION

Section 01573

FILTER FABRIC FENCE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installation of erosion and sediment control filter fabric fences used during construction and until final development of the site. The purpose of filter fabric fences is to contain pollutants from overland flow. Filter fabric fences are not for use in channelized flow areas.

1.02 UNIT PRICES

A. No separate payment will be made for Filter Fabric Fence under this section. Include payment in unit price for related sections.

1.03 SUBMITTALS

A. Manufacturer's catalog sheets and other product data on geotextile fabric.

1.04 REFERENCES

A. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics

B. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

PART 2 P R O D U C T S

2.01 FILTER FABRIC

A. Provide woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric shall have a grab strength of 100 psi in any principal direction (ASTM D-4632), Mullen burst strength exceeding 200 psi (ASTM D-3786), and the equivalent opening size between 50 and 140.

C. Filter fabric material shall contain ultraviolet inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F.

D. Representative Manufacturers: Mirafi, Inc., or equal.

PART 3 E X E C U T I O N

3.01 PREPARATION AND INSTALLATION

A. Provide erosion and sediment control systems at the locations shown on the SWPPP. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than site work specifically directed by the Resident Project Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Resident Project Representative to remove and discard the existing system.

D. Regularly inspect and repair or replace damaged components of filter fabric fences as specified in this Section. Unless otherwise directed, maintain the erosion and sediment control systems until the project area stabilization is accepted by the city. Remove erosion and sediment control systems promptly when directed by the Resident Project Representative. Discard removed materials off site.

E. Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil site is not designated on the Drawings, dispose of sediment off site at a location not in or adjacent to a stream or floodplain. Off-site disposal is the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into a stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state, and local rules and regulations.

F. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

G. Conduct all construction operations under this Contract in conformance with the erosion control practices described in Section 01572- Source Controls for Erosion and Sedimentation.

3.02 CONSTRUCTION METHODS

A. Provide filter fabric fence systems in accordance with the Drawing detail for Filter Fabric Fences. Filter fabric fences shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the filter fabric to steel posts spaced 6 to 8 feet and embedded a minimum of 18 inches. Steel posts shall have a minimum length of 4 feet. If filter fabric is factory preassembled with support netting, then maximum spacing allowable is 8 feet. Install stakes at a slight angle toward the source of anticipated runoff.

C. Trench in the toe of the filter fabric fence with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. The v-trench configuration as shown on the Drawings may also be used. Lay filter fabric along the edges of the trench. Backfill and compact trench.

D. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

E. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

F. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately. Remove sediment deposits when silt reaches a depth one-third the height of the fence or 6 inches, whichever is less.

END OF SECTION

Section 01575

STABILIZED CONSTRUCTION EXIT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installation of erosion and sediment control for stabilized construction exits used during construction and until final development of the site.

1.02 SUBMITTALS

A. Manufacturer's catalog sheets and other product data on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Specification.

1.03 UNIT PRICES

A. No separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items for which this work is a component.

1.04 REFERENCES

A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 P R O D U C T S

2.01 GEOTEXTILE FABRIC

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632), and the equivalent opening size between 50 and 140.

C. Both the geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable life at a temperature range of 0°F to 120°F.

D. Representative Manufacturers: Mirafi, Inc., or equal.

2.02 COARSE AGGREGATES

A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to the following gradation requirements.

Sieve Size (Square Mesh)	Percent Retained (By Weight)
2-1/2”	0
2”	0 - 20
1-1/2”	15 - 50
3/4”	60 - 80
No. 4	95 - 100

PART 3 E X E C U T I O N

3.01 PREPARATION AND INSTALLATION

A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, Contractor shall provide stabilized construction roads and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the details shown on the Drawings and specified in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than as specifically directed by the Resident Project Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Resident Project Representative to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction exits. Unless otherwise directed, maintain the stabilized construction roads and exits until the project is accepted by the City. Remove stabilized construction roads and exits promptly when directed by the Resident Project Representative. Discard removed materials off site.

E. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

F. Conduct all construction operation under this Contract in conformance with the erosion control practices described in the Specification 01572 - Source Controls for Erosion and Sedimentation.

3.02 CONSTRUCTION METHODS

A. Provide stabilized construction exits, and truck washing areas when approved by Resident Project Representative, of the sizes and locations were shown on SWPPP or as specified in this Section.

B. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas which drain into a drainage system protected by erosion and sediment control measures.

C. Details for stabilized construction exit shall be shown on the SWPPP. Construction of all other stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential.

D. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

E. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

F. The length of the stabilized area shall be as shown on the SWPPP, but not less than 50 feet. The thickness shall not be less than 8 inches. The width shall not be less than the full width of all points of ingress or egress.

G. Stabilization for other areas shall have the same coarse aggregate, thickness, and width requirements as the stabilized construction exit, except were shown otherwise on the SWPPP.

H. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Resident Project Representative.

I. Alternative methods of construction may be utilized when shown on SWPPP, or when approved by the Resident Project Representative. These methods include the following:

1. Cement-Stabilized Soil - Compacted cement-stabilized soil or other fill material in an application thickness of at least 8 inches.

2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.

3. Steel Mats - Perforated mats placed across perpendicular support members.

END OF SECTION

Section 01576

WASTE MATERIAL DISPOSAL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.02 UNIT PRICES

A. No separate payment will be made for waste material disposal under this Section unless it is contaminated. Include payment in unit price for related sections for uncontaminated soil including solid waste and construction debris.

1.03 SUBMITTALS

A. Submittals shall conform to the requirements of Section 01330 - Submittal Procedures.

B. Obtain and submit disposal permits for proposed disposal sites if required by local ordinances.

C. Submit a copy of written permission from property owner, along with description of property, prior to disposal of excess material adjacent to the Project. Submit a written and signed release from property owner upon completion of disposal work.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at a location or locations shown on Drawings outside the limits of Project.

B. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

3.02 EXCESS MATERIAL

A. Vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage, shall become the property of Contractor and shall be removed from the job site and legally disposed of.

B. Excess soil may be deposited on private property adjacent to the Project when written permission is obtained from the property owner. See Paragraph 1.03 C above.

C. Waste materials shall be removed from the site daily, such that the site is

maintained in a neat and orderly condition.

END OF SECTION

SECTION 01577

STRAW BALE FENCE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. This Section includes the furnishing, installation and maintenance of straw bale fences for erosion and sedimentation control utilized during construction and prior to the final development of the site.

1.02 UNIT PRICES

A. No separate payment for work performed under this Section. Include cost of work performed under this Section in Contract prices bid for items of which this work is a component.

1.03 REFERENCES – Not Used

PART 2 P R O D U C T S – Not Use

PART 3 E X E C U T I O N

3.01 GENERAL

A. Provide erosion and sedimentation control systems at the location(s) shown on SWPPP. Such systems to be of the type indicated and constructed in accordance with the requirements shown in the Plans and specified within this Section.

B. No clearing and grubbing or rough cutting, other than as specifically directed by the Resident Project Representative to allow soil testing and surveying, to be permitted until erosion and sedimentation control systems are in place.

C. Maintain existing erosion and sedimentation control systems located within the project site installed by others prior to start of construction under this contract until acceptance of the project or until directed by the Resident Project Representative to remove and discard the existing systems.

D. Inspect and repair or replace components of all erosion and sedimentation control systems as specified within this Section. Unless otherwise directed, maintain the erosion and sedimentation control systems promptly when directed by the Resident Project Representative. Discard removed materials offsite.

E. Remove and dispose sediment deposits at the project spoil site. If a project spoil site is not designated on Plans, dispose of sediment offsite at location not in or adjacent to stream or floodplain. Off-site disposal will be the responsibility of the Contractor. Sediment to be placed at the project site should be spread, compacted and stabilized as directed by the Resident Project Representative.

Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it must be disposed of in accordance with existing federal, state and local regulations.

F. Equipment and vehicles be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damages caused by construction traffic to erosion and sedimentation control system to be repaired immediately.

3.02 (NOT USED)

3.03 CONSTRUCTION REQUIREMENTS

A. Provide straw bale fences at locations shown on the SWPPP. Straw bale fences shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Bind bales with either wire, nylon, or polypropylene rope tied across the straw bales. Jute or cotton binding is not allowed.

C. Place bales in a row with ends tightly abutting the adjacent bales. Place bales with bindings parallel to the ground surface.

D. Embed each bale in the soil a minimum of 4-inches, where possible.

E. Anchor bales securely in place with 2-3/8-inch rebar stakes driven through the bales. The first stake in each bale to be angled toward the previously laid bale to force bales together.

F. Fill the gaps between bales with straw to prevent sediment from escaping between bales. Wedge carefully in order not to separate bales.

G. Inspect straw bale fences after each rainfall, daily during periods of prolonged rainfall, or at a minimum of once a week. Repair or replace damaged sections immediately. Remove sediment deposits when silt reaches one-third of the height of the fence.

END OF SECTION

Section 01578

CONTROL OF GROUND WATER AND SURFACE WATER

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in a stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising flood waters.

C. Disposing of removed water.

1.02 METHOD OF PAYMENT

No separate payment will be made for control of ground water and surface water unless a quantity is included in the schedule of unit prices. Include all additional costs to control ground water and surface water in unit price for work in related sections.

1.03 REFERENCES

A. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49 kg) Rammer and 12-inch (304.8 mm) Drop.

B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

C. Federal Register 40 CFR (Vol. 55, No. 222) Part 122, EPA Administered Permit Programs (NPDES), Para.122.26(b)(14) Storm Water Discharge.

D. Texas Commission of Environmental Quality, TCEQ General Permit Number TX150000 Relating to Discharges from Construction Activities.

1.04 DEFINITIONS

A. Ground water control includes both dewatering and depressurization of water-bearing soil layers.

1. Dewatering includes lowering the water table and intercepting seepage which would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts, and disposing of removed water. The intent of dewatering is to increase stability of tunnel excavations and excavated slopes; prevent dislocation of material from slopes or bottoms of excavations; reduce lateral loads on sheeting and bracing; improve excavating and hauling characteristics of excavated material; prevent failure or heaving of the bottom of excavations; and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.

2. Depressurization includes reduction in piezometric pressure within strata not controlled by dewatering alone, as required to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage includes keeping excavations free of surface and seepage water.

C. Surface drainage includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines as required to protect the Work from any source of surface water.

D. Equipment and instrumentation for monitoring and control of the ground water control system includes piezometers and monitoring wells, and devices, such as flow meters, for observing and recording flow rates.

1.05 PERFORMANCE REQUIREMENTS

A. Conduct surface and subsurface investigations to identify ground water and surface water conditions and to provide parameters for design, installation, and operation of control systems.

B. Design a ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 01561 - Trench Safety Systems, to produce the following results:

1. Effectively reduce the hydrostatic pressure affecting:
    a. Excavations.
    b. Tunnel excavation, face stability or seepage into tunnels.

2. Develop a substantially dry and stable subgrade for subsequent construction operations.

3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work.

4. Prevent the loss of fines, seepage, boils, quick condition, or softening of the foundation strata.

5. Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems that may include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from any other source entering the excavation. Excavation drainage may include placement of drainage materials, such as crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water and surface water control systems and for any loss or damage resulting from partial or complete failure of protective measures and any settlement or resultant damage caused by the control operations. Modify control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells, or affect potentially contaminated areas. Repair damage caused by control systems or resulting from failure of the system to protect property as required.

H. Conduct investigations to determine impacts of rainfall on water tables and provide controls systems.

1.06 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittals.

B. Submit a Ground Water and Surface Water Control Plan for review by the Engineer prior to start of any field work. Submit a plan to include the following:

1. Results of subsurface investigation and description of the extent and characteristics of water bearing layers subject to ground water control.

2. Excavation drainage methods including typical drainage layers, sump pump application and other necessary means.

3. Surface water control and drainage installations.

4. Proposed methods and locations for disposing of removed water.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Obtain permit from TCEQ under the Texas Pollutant Discharge Elimination System (TPDES), for storm water discharge from construction sites. Refer to Section 01570 – Texas Pollutant Discharge Elimination System. (If Applicable)

C. Monitor ground water discharge for contamination while performing pumping in the vicinity of potentially contaminated sites.

PART 2 P R O D U C T S

2.01 EQUIPMENT AND MATERIALS

A. Equipment and materials are at the option of Contractor as necessary to achieve desired results for control of ground and surface water.

B. Eductors, well points, or deep wells, where used, must be furnished, installed and operated by an experienced contractor regularly engaged in ground water control system design, installation, and operation.

C. All equipment must be in good repair and operating order.

D. Sufficient standby equipment and materials shall be kept available to ensure continuous operation, where required.

PART 3 E X E C U T I O N

3.01 GROUND WATER CONTROL

A. Provide labor, material, equipment, techniques and methods to lower, control and manage ground water in a manner compatible with construction methods and site conditions. Monitor effectiveness of the installed system and its effect on adjacent property.

B. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify the Engineer in writing of any changes made to accommodate field conditions and changes to the Work. Provide revised drawings and calculations with such notification.

C. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is primary energy source for dewatering system.

D. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.

E. Compacts backfill to not less than 95 percent of the maximum dry density in accordance with ASTM D 698.

3.02 EXCAVATION DRAINAGE

A. Contractor may use excavation drainage methods if necessary to achieve well drained conditions. The excavation drainage may consist of a layer of crushed stone and filter fabric, and sump pumping in combination with sufficient wells for ground water control to maintain stable excavation and backfill conditions.

3.03 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. The requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by such agencies.

END OF SECTION

Section 01610

BASIC PRODUCT REQUIREMENTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Requirements for transportation, delivery, handling, and storage of materials and equipment.

1.02 PRODUCTS

A. Products: Means material, equipment, or systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components designated for reuse.

B. Do not reuse materials and equipment, designated to be removed, except as specified by the Contract Documents.

C. Provide equipment and components from the fewest number of manufacturers as is practical, in order to simplify spare parts inventory and to allow for maximum interchangeability of components. For multiple components of the same size, type or application, use the same make and model of component throughout the project.

1.03 TRANSPORTATION

A. Decide for transportation, delivery, and handling of equipment and materials required for timely completion of the Work.

B. Transport and handle products in accordance with instructions.

C. Consign and address shipping documents to the proper party giving the name of Project and street address. Shipments shall be delivered to the Contractor.

1.04 DELIVERY

A. Arrange deliveries of products to accommodate the short-term site completion schedules and in ample time to facilitate inspection prior to installation. Avoid deliveries that cause unnecessarily lengthy use of limited storage space.

B. Coordinate deliveries to avoid conflict with Work and conditions at the site and to accommodate the following:

1. Work of other contractors or the Owner.

2. Limitations of storage space.

3. Availability of equipment and personnel for handling products.

4. Owner's use of premises.

C. Have products delivered to the site in manufacturer's original, unopened, labeled containers.

D. Immediately upon delivery, inspect shipment to assure:

1. Product complies with requirements of Contract Documents.

2. Quantities are correct.

3. Containers and packages are intact; labels are legible.

4. Products are properly protected and undamaged.

1.05 PRODUCT HANDLING

A. Coordinate the off-loading of materials and equipment delivered to the job site. If necessary to move stored materials and equipment during construction, Contractor shall relocate materials and equipment at no additional cost to the Owner.

B. Provide equipment and personnel necessary to handle products, including those provided by the Owner, by methods to prevent damage to products or packaging.

C. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging products or surrounding areas.

D. Handle products by methods to prevent over bending or overstressing.

E. Lift heavy components only at designated lifting points.

F. Handle materials and equipment in accordance with Manufacturer's recommendations.

G. Do not drop, roll, or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

1.06 STORAGE OF MATERIAL

A. Store and protect materials in accordance with manufacturer's recommendations and requirements of these Specifications.

B. Make necessary provisions for safe storage of materials and equipment. Place loose soil materials, and materials to be incorporated into the Work to prevent damage to any part of the Work or existing facilities and to always maintain free access to all parts of the Work and to utility service company installations in the vicinity of the Work. Keep materials and equipment neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage in a manner to provide easy access for inspection.

C. Restrict storage to areas available on the construction site for storage of material and equipment as shown on Drawings or approved by the Resident Project Representative.

D. Provide off-site storage and protection when on-site storage is not adequate.

E. Do not use lawns, grass plots, or other private property for storage purposes without written permission of the owner and other person in possession of or control of such premises.

F. Protect stored materials and equipment against loss or damage.

G. Store in manufacturers' unopened containers.

H. Materials delivered and stored along the line of the Work shall be neatly, safely, and compactly stacked along the work site in such manner as to cause the least inconvenience and damage to property owners and the general public and shall be not closer than 3 feet to any fire hydrant. Public and private drives and street crossings shall be kept open.

I. Damage to lawns, sidewalks, streets or other improvements shall be repaired or replaced to the satisfaction of the Resident Project Representative. The total length which materials may be distributed along the route of construction at any one time is 1000 lineal feet, unless otherwise approved in writing by the Resident Project Representative.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01630

PRODUCT SUBSTITUTION PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Options for making product or process selections.

B. Procedures for proposing equivalent construction products or processes.

1.02 DEFINITIONS

A. Product: Means materials, equipment, or systems incorporated into the Project. Product does not include machinery and equipment used for production, fabrication, conveying, and erection of the Work. Products may also include existing materials or components designated for reuse.

B. Process: Any proprietary system or method for installing system components resulting in an integral, functioning part of the Work. For this Section, the word Product includes Processes.

1.03 SELECTION OPTIONS

A. Approved Products: Construction products or processes of certain manufacturers or suppliers designated in the Specifications followed by the words "or approved equal." Approval of alternate products or processes not listed in the Specifications may be obtained through provisions for product options and substitutions in Document 00700 - General Conditions, and by following the submittal procedures specified in 01330- Submittal Procedures.

B. Product Compatibility: To the maximum extent possible, provide products that are of the same type or function from a single manufacturer, make, or source. Where more than one choice is available as a contractor’s option, select a product which is compatible with other products already selected, specified, or in use by the Owner.

1.04 CONTRACTOR'S RESPONSIBILITY

A. The Contractor's responsibility related to product options and substitutions is defined in Document 00700 - General Conditions.

B. Furnish information the Engineer deems necessary to judge equivalency of the alternate product.

C. Pay for laboratory testing, as well as any other review or examination costs, needed to establish the equivalency between products to obtain information upon which the Engineer can base a decision.

D. If the Engineer determines that an alternate product is not equal to that named in the Specifications, the Contractor shall furnish the specified products.

1.05 ENGINEER'S REVIEW

A. Alternate products or processes may be used only if approved in writing by the Engineer. The Engineer's determination regarding acceptance of a proposed alternate product is final.

B. Alternate products will be accepted if the product is judged by the Engineer to be equivalent to the specified product or to offer substantial benefit to the Owner.

C. The Owner retains the right to accept any product or process deemed advantageous to the Owner, and similarly, to reject any product or process deemed not beneficial to the Owner.

1.06 SUBSTITUTION PROCEDURE

A. Collect and assemble technical information applicable to the proposed product to aid in determining equivalency as related to the approved product specified.

B. Submit a written request for a construction product to be considered as an alternate product.

C. Submit the product information after the effective date of the Agreement.

C. Submit 5 copies of each request for alternate product approval. Include the following information (**Complete data substantiating compliance of proposed substitution with Contract Documents**).

2. For products:
   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature with product description, performance and test data, and reference standards.
   c. Samples, as applicable.
   d. Name and address of similar projects on which product was used and date of installation. Include the name of the Owner, Architect/Engineer, and installing contractor.

3. For construction methods:
   a. Detailed description of proposed method.
   b. Drawings illustrating methods.

4. Itemized comparison of proposed substitution with product or method specified.

5. Data relating to changes in construction schedule.

7. Relation to separate contracts, if any.

8. Accurate cost data on proposed substitution in comparison with product or method specified.

9. Other information requested by the Engineer.

E. Approved alternate products will be subject to the same review process as the specified product would have been for shop drawings, product data, samples, warranties, guarantees, expected life, and performance.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01725

FIELD SURVEYING

PART 1 G E N E R A L

1.01 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors.

1.02 UNIT PRICES

A. No separate payment will be made for Field Surveying. Include the cost of Field Surveying in other related bid items.

1.03 SUBMITTALS

A. Submit to Engineer the name, address, and telephone number of Surveyor before starting survey work.

B. Submit documentation verifying accuracy of survey work on request.

C. Submit certificate signed by surveyor, that the elevations and locations of the Work are in conformance with Contract Documents.

D. Submit information under provisions of Section 01330 - Submittal Procedures.

1.04 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site Work upon completion of foundation walls and major site improvements.

C. Maintain elevations and coordinates of all line and manhole placement for “As-Builts.”

D. Submit Record Documents under provisions of Section 01785 - Project Record Documents.

1.05 EXAMINATION

A. Verify locations of survey control points prior to starting Work.

B. Notify Engineer immediately of any discrepancies discovered.

C. Provide cut sheets with flow line elevations, stations, line ID size structure description, offsets, natural ground elevation, and cut and fill ranges.

D. Provide elevations of manholes to calculate additional depth in vertical feet to support pay item quantity

1.06 SURVEY REFERENCE POINTS

A. Control datum for survey is that established by Owner-provided survey as indicated on Drawings.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Engineer 48 hours in advance of need for relocation of reference points due to changes in grades or other reasons.

D. Report promptly to Engineer the loss or destruction of any reference point.

E. Contractor shall reimburse Owner for cost of reestablishment of permanent reference points disturbed by Contractor's operations.

1.07 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish elevations, lines and levels to provide appropriate controls for the Work. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading; fill and topsoil placement; utility locations, slopes, and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, ground floor elevations.

C. Verify periodically layouts by same means.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01732

PROCEDURE FOR WATER VALVE ASSISTANCE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Operation of existing valves is by the owner's employees. Operation of new valves by the Contractor's employees is included in the project. No valve will be operated without prior approval by the Resident Project Representative.

1.02 MEASUREMENT AND PAYMENT

A. No separate payment will be made for this item. Include the cost of valve operation and valve assistance in Unit Price bid for valves and water mains.

1.03 PROCEDURE

A. The Contractor will notify the Resident Project Representative to coordinate valve operation.

1.04 CANCELLATION

A. Scheduled valve closures may be terminated in the event of a water system emergency at no cost to the Owner.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01740

RESTORATION OF SITE IMPROVEMENTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Restoration of the Work site in public rights-of-way or easements and adjacent public or private property affected by construction operations, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.02 UNIT PRICES

A. Unpaved Surface Restoration.

1. No separate payment will be made for Restoration of Site Improvements in unpaved areas. Include the cost of the Restoration of Site Improvements in unpaved areas in the unit prices of other associated work.

B. Paved Surface Restoration.

1. Pavement and Driveway Replacement. Measure replaced pavement by the linear foot along the associated pipeline. Payment will be made at the applicable unit price for concrete pavement replacement. Payment will be made at the applicable unit price for asphaltic concrete pavement replacement. Payment will be made at the applicable unit price for gravel (crushed stone) road or driveway replacement.

2. Sidewalk Replacement. Measure sidewalks by the linear foot along the associated pipeline. Payment will be made at the unit price for sidewalk replacement.

3. Curb and Gutter. Measure curb and gutter by the linear foot for the distance between the limits of the minimum trench width plus 2 feet or the trench length, as applicable. Payment will be made at the unit price for curb and gutter replacement.

4. Replacement Outside of Minimum Dimensions. Pavements, driveways and sidewalks damaged outside of the minimum dimensions for payment shall be replaced by the Contractor at no additional cost to the owner, City, Federal Agency, County or TxDOT.

1.03 REFERENCES

A. ANSI Z60.1. American Standard for Nursery Stock.

1.04 DEFINITIONS

A. Site Restoration. Replacement or reconstruction of site improvements to rights-of-way, easements, public property, and private property that are affected or altered by construction operations, with the improvements restored to a condition which is equal to, or better than, that which existed prior to construction operations.

B. Site Improvements. Includes but is not limited to pavement, curb and gutter, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, and landscaping.

1.05 SUBMITTALS

A. Make submittals in conformance with Section 01330 - Submittal Procedures.

1.06 QUALITY ASSURANCE

A. Have landscape plants planted by qualified personnel.

1.07 SCHEDULING

A. Site restoration shall be performed no later than 60 days following installation of the Work.

1.08 WARRANTY

A. Replaced plants and grasses are covered by the Contractor's general warranty and guarantee.

B. Replace plants that fail during the warranty period.

C. Contractor is to provide a written notification to homeowner stating that homeowner is responsible for watering replaced plants and grasses.

D. Damage caused by natural hazards such as hail, high winds or storm is not covered by the warranty.

E. Existing plant materials required to be moved on the site are covered under the warranty.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Pavement, Sidewalks and Driveways. Use materials as specified in Section 02951 - Pavement Replacement for Utility Construction.

B. Seeding and Sodding. Provide sod as specified in Section 02922 - Sodding. For areas to be seeded, conform to Section 02921 - Hydro mulch Seeding.

C. Landscape Plantings, Trees and Shrubs. Provide trees, shrubs and plants of quantity, size, genus, species and variety of those being replaced and complying with recommendations and requirements of ANSI Z60.1.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Construction Site Photographs. Document conditions on and adjacent to the construction site with construction photographs.

3.02 PREPARATION

A. Removing Pavements and Structures.

1. Remove the minimum pavement, curb and gutter, and other structures as required to perform the Work.

2. Remove concrete and asphaltic concrete material using sawed joints in accordance with Section 02752 - Concrete Pavement Joints.

B. Remove or relocate existing fencing, if required, for construction operations. Maintain the integrity of the private property owner's fencing if needed for protection of children, pets, livestock or property. Notify the property owner 72 hours in advance before removing fencing and coordinate security needs.

3.03 INSTALLATION

A. Pavement, Sidewalk, and Driveway Restoration.

1. Replace pavement, curb and gutter, sidewalks, and driveways removed or damaged as the result of construction operations. Reconstruct in accordance with Section 02951 - Pavement Replacement for Utility Construction.

B. Seeding and Sodding.

1. Clean up construction debris and level the area with bank sand so that the resulting surface of the new grass matches the level of the existing grass and maintains pre-construction drainage patterns. Level minor ruts or depressions caused by construction operations where grass is still viable by filling with bank sand.

2. Restore grass areas disturbed or damaged by construction with grass comparable with that previously existing.

3. Restore established lawn areas, including easements and esplanades disturbed or damaged by construction, by sodding and fertilizing in accordance with Section 02922 - Sodding, except that measurement and payment shall be as specified in this Section.

4. Restore grass areas not requiring sodding using hydro mulch methods in accordance with Section 02921 - Hydro mulch Seeding, except that measurement and payment shall be as specified in this Section.

C. Trees, Shrubbery and Plants.

1. Extra care shall be taken in removing and replanting trees, shrubbery and plants. Trees, shrubbery and plants shall be removed in a way that leaves soil around the roots. Trees, shrubbery and plants shall be placed outside of the excavation area.

2. Replace in kind any trees, shrubbery, and plants removed or damaged by construction operations.

3. Have a nursery or landscape firm make tree replacements using balled-and- burn lapped nursery stock. Within the availability of standard nursery stock, replace each removed tree with one of an equivalent species and size, but with not less than a 2-1/2-inch- diameter trunk, as measured 1-1/2 feet above natural ground.

D. Fence Removal and Replacement.

1. Replace fencing removed or damaged, including, but not limited to, posts, caps, concrete footings, concrete curb under fence, wire, wire mesh, wood panels, top and bottom railing.

2. Reconstruct any portion of the fence disturbed by construction which is not equal to or better than that which existed prior to construction operations as evidenced by preconstruction photographs or videos.

3. Remove and dispose of damaged or substandard material.

3.04 CLEANING

A. Remove debris and trash which is the result of the Contractor's operation to maintain a clean and orderly site.

3.05 MAINTENANCE

A. Maintain plantings, sodded areas and seeded areas through warranty period.

B. Replaced plantings and seeded or sodded areas that fail to become established through the warranty period.

C. Maintain plantings as follows:

1. Initial watering shall be by the Contractor. Continued maintenance shall be by the homeowner.

2. Repair or replace bracing as necessary.

3. Prune as necessary.

D. If it is necessary to remove tree branches, have removal and other necessary pruning performed by a qualified nursery or landscape firm utilizing best standard practices.

END OF SECTION

Section 01755

STARTING SYSTEMS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Starting systems.

B. Demonstration and instructions.

C. Testing, adjusting, and balancing.

1.02 UNIT PRICES

A. No separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay item of which this work is a component.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Engineer 7 days prior to startup of each item; provide a written schedule when startup involves multiple hours.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.

D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under Contractor's supervision in accordance with manufacturer's instructions.

G. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, to supervise placing equipment or system in operation, and to provide timely signed results and testing.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.02 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Engineer two weeks prior to date of Substantial Completion.

B. Utilize operation and maintenance manuals as the basis for instruction. Review contents of manual with Resident Project Representative in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

D. Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instruction.

END OF SECTION

Section 01770

CLOSEOUT PROCEDURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Closeout procedures including final submittals such as operation and maintenance data, warranties, and spare parts and maintenance materials.

1.02 CLOSEOUT PROCEDURES

A. Comply with Document 00700 - General Conditions regarding Final Completion and Final Payment when Work is complete and ready for Engineer's final inspection.

B. Provide Project Record Documents in accordance with Section 01785.

C. Provide affidavit that all bills have been paid.

D. Complete or correct items on punch list, with no new items added. Any new items will be addressed during warranty period. Provide details to explain corrective work for items on punch list and verification.

E. The Owner will occupy portions of the Work as specified in other Sections.

1.03 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. For facilities, clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to a sanitary condition.

D. Clean or replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and temporary construction facilities from the site following the final test of utilities and completion of the work.

1.04 ADJUSTING

A. Adjust operating equipment to ensure smooth and unhindered operation.

1.05 OPERATION AND MAINTENANCE DATA

A. Submit operations and maintenance data as noted in 01330 - Submittal Procedures.

1.06 WARRANTIES/CERTIFICATIONS

A. Provide one original of each warranty from Subcontractors, suppliers, and manufacturers.

B. Provide Table of Contents and assemble warranties in 3-ring/D binder with durable plastic cover.

C. Submit warranties prior to final Application for Payment.

D. Warranties shall commence in accordance with the requirements in Document 00700 - General Conditions.

E. Provide written manufacturer certification when required by individual specification sections.

1.07 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, spare part list, manufacturer phone numbers, maintenance and extra materials in quantities specified in individual Specification sections.

B. Deliver to location within the Owner's jurisdiction as directed by Resident Project Representative; obtain receipt prior to final Application for Payment.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01782

OPERATIONS AND MAINTENANCE DATA

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Submittal requirements for equipment and facility operating and maintenance manuals

1.02 MEASUREMENT AND PAYMENT

A. The value of approved equipment operations and maintenance manuals is 5 percent of the individual equipment value as indicated in the Schedule of Unit Price Work or Schedule of Values. This amount can be included in the next Application for Payment after approval of a submitted manual. The costs associated with generating O & M manuals should be added to the cost of individual equipment, no separate payment.

1.03 SUBMITTALS

A. Along with the schedule for other submittals as required in Section 01330 - Submittal Procedures, submit a list of operation and maintenance manuals and parts manuals to be provided.

B. The Contractor shall provide (6) complete sets of hard-covered ring-bound loose-leaf O&M manuals. In addition to" as-built" system drawings, the manuals shall include internal wiring diagrams and operating and maintenance literature for all components provided under this section. The submitted literature shall be in sufficient detail to facilitate the operation, removal, installation, programming and configuration, adjustment, calibration, testing and maintenance of each component and/or instrument. The O&M manual shall be professionally composed and compiled and shall not be an assembly of "cut sheets". Engineer shall have sole discretion of acceptance of O&M manual contents and composition

C. Submit documents, bound in 8-1/2x11-inch text pages, 3-ring/D binders with durable plastic covers.

D. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

E. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

F. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified.

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

   a. Significant design criteria.

   b. List of equipment.

   c. Parts list for each component.

   d. Operating instructions.

   e. Maintenance instructions for equipment and systems.

   f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:

   a. Shop drawings and product data.

   b. Air and water balance reports.

   c. Manufacturer testing/checklist reports

   d. Certificates.

   e. Warranties.

G. Within one month prior to placing the equipment or facility in service, submit two copies of the operation and maintenance manual and parts manual for review.

H. Submit one copy of completed volumes in final form 10 days prior to final inspection. This copy will be returned after final inspection, with Engineer comments. Revise content of documents as required prior to final submittal.

I. Revise and resubmit final volumes within 10 days after final inspection.

1.04 EQUIPMENT OPERATION AND MAINTENANCE DATA

A. Furnish operation and maintenance manuals for all equipment. Operation and maintenance manuals must contain all information required for Owner to operate, maintain, and repair equipment. The manual must be prepared by equipment manufacturer, furnished to the Engineer by Contractor, and, as a minimum, contain the following:

1. Equipment functions, normal operating characteristics, and limiting conditions.

2. Assembly, installation, alignment, adjustment, and checking instructions.

3. Operating instructions for start-up, normal operation, regulation and control, normal shutdown, and emergency shutdown.

4. Lubrication and detailed maintenance instructions. The maintenance instructions are to include detailed drawings giving the location of each maintainable part and lubrication point and detailed instructions on disassembly and reassembly of the equipment.

5. Troubleshooting guide.

6. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.

7. Outline, cross-section, and assembly drawings; engineering data; wiring diagram.

8. Test data and performance curves.

B. Furnish parts manuals for all equipment. The manual must be prepared by equipment manufacturers, furnished to the Engineer by Contractor, and, as a minimum, contain the following.

1. Detailed drawings giving the location of each maintainable part.

2. Complete spare parts list with predicted life of parts subject to wear, lists of spare parts recommended on hand for both initial start-up and for normal operating inventory, and local or nearest source of spare parts availability.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 01785

PROJECT RECORD DOCUMENTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Maintenance and Submittal of Project Record Documents and samples.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Maintain one recorded copy of documents at the site in accordance with Document 00700 - General Conditions.

B. Store Record Documents and samples in the Contractor's field office if a field office is required by Contract Documents, or in a secure location. Provide files, racks, and secure storage for Record Documents and samples.

C. Label each document "PROJECT RECORD" in neat, large, printed letters.

D. Maintain Record Documents in a clean, dry, and legible condition. Do not use Record Documents for construction purposes.

E. Keep Record Documents and Samples available for inspection by Resident Project Representative.

1.03 RECORDING

A. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

B. Contract Drawings and Shop Drawings: Legibly mark each item to record all actual construction, or "as built" conditions, including:

1. Measured depths of elements of foundation in relation to finish first floor datum.

2. Measured horizontal locations and elevations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Elevations of underground utilities referenced to benchmark utilized for project.

4. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.

5. Field changes of dimension and detail.

6. Changes made by modifications.

7. Details not on original contract drawings.

8. References to related shop drawings and modifications.

C. Record information with a red felt-tip marking pen on a set of blue or black line opaque drawings, provided by Engineer.

1.04 SUBMITTALS

A. At contract closeout, deliver Project Record Documents to Engineer.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N - Not Used

END OF SECTION

Section 02080

FIBERGLASS MANHOLES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. This specification shall govern for the furnishing of all work necessary to accomplish and complete the installation of glass-fiber reinforced polyester manholes. Glass-Fiber Reinforced Polyester Manholes shall be a one-piece monolithic designed unit constructed of glass-fiber reinforced, supplier certified, unsaturated commercial grade polyester resin containing chemically enhanced silica to improve corrosion resistance, strength and overall performance. FRP manholes shall be manufactured in strict accordance with *ASTM D-3753 "Standard Specification for Glass-Fiber Reinforced Polyester Manholes."*

1.02 MEASUREMENT AND PAYMENT

MEASUREMENT

A. This item will be measured by each type of individual structure completed. The depth will be measured from the flow line to the top of the rim. The size shall be nominal inside diameter. This item includes, but is not limited to the following:

1. Structural excavation
2. Loading, hauling, and disposing of all excess material
3. Furnishing all labor and materials including fiberglass, concrete, mortar, bricks, drop pipe and fittings, manhole rings and covers
4. Placing and compacting all backfill
5. Final Grading
6. Refer to Section 01270 – Measurement and Payment, for unit price procedures

PAYMENT

A. This item will be paid for at the contract unit price per bid per each structure for the various sizes, types, and various depths of structures complete in place and will be full compensation for all materials required, operations, labor, tools, equipment, and all other incidentals necessary to complete the work as shown on the drawings and specified herein.

B. Refer to Section 01270 – Measurement and Payment, for unit price procedures

1.03 REFERENCES

A. ASTM D-3753: Standard Specification for Glass-Fiber Reinforced Polyester Manholes.

B. ASTM C-581: Practice for Determining Chemical Resistance of Chemical Thermosetting Resins Used in Glass-Fiber Reinforced Structures Intended for Liquid Service.

C. ASTM D-2412: Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading.

D. ASTM D-695: Test Methods for Compressive Properties of Rigid Plastics.

E. ASTM D-2584: Test Method for Ignition Loss of Cured Reinforced Resins.

F. ASTM D-790: Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and electrical Insulating Materials.

G. ASTM D-2583: Test Method for Indentation Hardness of Rigid Plastics by means of a Barcol Impressor.

H. AASHTO H-20: Axial Loading.

1.04 SUBMITTALS

A. Submit product data in accordance with Section 01300 - Submittal Procedures.

B. Submit copies of manufacturer’s specifications, load tables, dimensions diagrams and installation instructions.

C. Submit shop drawings of manhole sections and base units and construction details including reinforcement, jointing methods, materials and dimensions.

PART 2 P R O D U C T S

2.01 GENERAL DESCRIPTION

A. Dimensions: The manhole shall be a circular cylinder, reduced at the top to a circular manway not smaller than 22 1/2" inside diameter. Manholes shall be produced in half-foot increments of length +/- 2". Nominal inside diameters shall be 42", 48", 54", 60", 66", and 72". Tolerance on the inside diameter shall be +/- 1%. Other diameters as agreed upon between purchaser and the manufacturer are covered by this specification. The minimum wall thickness for all FRP manholes at all depths shall be 0.480".

B. Configuration

1. Cone Sections:

   a. The Manway reducer must provide a bearing surface on which a standard ring and cover may be supported and adjusted to grade. The reducer shall be concentric and shall be joined to the barrel section at the factory with resin and glass fiber reinforcement, thus providing required monolithic design to prevent infiltration and/or exfiltration through the manhole.

   b. Manway reducer cone section shall be self-centering to permit vertical height adjustment (raising or lowering) of manhole by contractor utilizing manufacturer provided materials and detailed written instructions.

C. Class: The manhole shall be manufactured in one class of load rating. This class shall be H-20-wheel load (minimum 16,000 pounds dynamic wheel load).

D. Stubouts and Connections:

1. Install rubber gasketed PVC sewer pipe stub outs to manhole with resin and glass-fiber reinforced lay-up. Gaskets shall meet the same performance requirements of the sewer pipe to be installed unless otherwise directed by the Engineer. Resin and fiberglass shall be of the same type and grade as used in the fabrication of the fiberglass manhole.

2. Install PVC or fiberglass reinforced pipe stub outs for use with resilient pipe-to-manhole connectors (boots) which conform to the performance requirements of ASTM C-923.

E. Manhole Bottom: Resin and glass fiber reinforced manhole bottoms may be provided, upon engineer's request. Upon that request, manholes shall be provided with glass reinforced bottom section designed to withstand the hydrostatic head pressure, empty and water to grade, of units at 25-ft. burial depth.
(Units deeper than 25-ft. may require additional reinforcement as required). Fiberglass ribs or fiberglass structural members may be utilized to meet the design criteria. Stiffeners shall be of non-corrosive materials encapsulated in fiberglass. FRP encapsulated wood or lumber will not be permitted. Bottom sections shall be furnished with an integral 3" wide anchoring flange. Invert and bench may be field installed utilizing concrete to the requirements of Division 3. Invert and bench may be factory installed utilizing non-corrosive materials encapsulated in fiberglass minimum 1/4" thick.

F. Marking and Identification: All manholes shall be marked in letters no less than 1" in height with the following information:

1. Manufacturers Identification

2. Manufacturers Serial Number

3. Manhole Length

4. ASTM Designation

5. Installation assist marks (vertical lines 90° apart at base of manhole).

2.02 MATERIALS

A. Resin: The resins used shall be unsaturated, supplier certified, commercial grade polyester resins. Mixing lots of resin from different manufacturers, or "odd lotting" of resins shall not be permitted. Quality-assurance records on the resin shall be maintained. Non-pigmented Resin is required to allow for light or "sand" color of manhole surface to facilitate easy from grade interior inspection. UV Inhibitors shall be added directly to resins to prevent photodegradation. Exterior gel-coating shall not be permitted.

B. Reinforcing Materials: The reinforcing materials shall be commercial grade "E" type glass in the form of mat, continuous roving, chopped roving, roving fabric, or both, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.

C. Surfacing Material: If reinforcing material is used on the surface exposed to the contained substance, it shall be a commercial grade chemical-resistant glass or organic surfacing mat having a coupling agent that will provide a suitable bond with the resin.

D. Fillers and Additives: Fillers, when used, shall be inert to the environment and manhole construction. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. However, calcium carbonate mixed by the fabricator shall not be permitted. The resulting reinforced plastic material must meet the requirement of this specification.

E. Laminate: The laminate shall consist of multiple layers of glass matting and resin. The surface exposed to the sewer/chemical environment shall be resin rich and shall have no exposed fibers.

2.03 MANUFACTURE

A. Manhole cylinders, manway reducers, and connectors shall be produced from glass fiber-reinforced polyester resin. Manhole cylinders to 66" ID to be manufactured by "computer regulated continuous band mandrel process", 72" ID and larger to be manufactured by computer regulated steel mandrel process utilizing structural rib design.

B. Interior Access: All manholes shall be designed so that a ladder or step system can be supported by the installed manhole. Manway openings to accommodate 24" or 32" standard ring and cover.

C. Manway Reducer: Manway reducers shall be concentric with respect to the larger portion of the manhole diameters through 72".

D. Cover Ring and Support: The manhole shall provide an area from which a typical ring and cover plate can be supported without damage to the manhole.

E. Assembly Joints: Product components, i.e., cylinders, reducers, bottoms, and connectors, may be joined together to form a complete manhole.

2.04 REQUIREMENTS

A. Exterior Surface: The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to *eliminate* fiber show. The exterior surface shall be *free of blisters* larger than 0.5" in diameter, delamination and fiber show.

B. Interior Surface: The interior surfaces shall be resin rich with no exposed fibers. The interior surface shall be smooth for improved corrosion resistance and reduced sludge build-up. The surface shall be free of crazing, delamination, blisters larger than 0.5" in diameter, and wrinkles of 0.125" or greater in depth. Surface pits shall be permitted up to 6’ 2" if they are less than 0.75" in diameter and less than 0.0625" deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted up to 4’ 2" if they are less than 0.5" in diameter and less than 0.0625" thick.

C. Repairs: Any manhole repair is required to meet all requirements of this specification.

D. Manhole Lengths: Manhole lengths shall be in whole or 1/2-foot increments +/- 2".

E. Load Rating: The complete manhole shall have a minimum dynamic load rating of 16,000 lbs. When tested in accordance with ASTM 3753, 8.4 (note 1). To establish this rating the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25" at the point of load application when loaded to 24,000 lb.

F. Stiffness**:** The cylindrical portion of the manhole is to be tested in accordance with ASTM Method D 2412. The manhole cylinder shall have the *minimum* pipe-stiffness values shown in the table below, when tested in accordance with ASTM 3753, Section 8.5, (note 1).

Manhole Length (ft)	PSI
3 - 6	0.72
7 - 12	1.26
3 - 20	2.01
21 - 25	3.02
26 - 35	5.24

G. Soundness: In order to determine soundness, an air or water test is to be applied to the manhole test sample. While holding the pressure between 3-5 psi, the entire manhole must be inspected for leaks. Any leakage through the laminate is cause for failure of the test. Refer to ASTM 3753, Sec. 8.6.

H. Chemical Resistance: Per ASTM C 581; (see ASTM 3753, Section 8.7), Flexural strength, flexural modulus, and barcol hardness are plotted versus time on log-log coordinates. The line defined by these points is extrapolated to 100,000 hours. The minimum extrapolation retention allowed for any of these properties is 50%. Test samples used are actual pieces of manhole or samples manufactured in a manner consistent in every way with the manhole component construction.

I. Physical Properties:

Flexural Strength (cone):	Hoop: 15.4 x 103 psi Axial: 17.2 x 103 psi
Flexural Strength (pipe)	Hoop: 22.5 x 103 psi Axial: 14.3 x 103 psi
	Compressive Strength: 18.9 x 103 psi

PART 3 E X E C U T I O N

3.01 TEST METHODS

A. All tests shall be performed as specified in ASTM 3753, Section 8, Titled "Test Methods". See ASTM 3753, Section 8, Note 5, for Test method D-790 and test method D-695.

3.02 QUALITY ASSURANCE/QUALITY CONTROL

A. Examination: Each manhole component part shall be examined for dimensional requirements, hardness, and workmanship.

B. Composition Control: Controls on glass and resin content shall be maintained for all manufacturing processes and for each portion of manhole fabrication. Records shall be maintained of these control checks. Proper glass content may be shown by glass usage checks, by glass and resin application rate checks, in accordance with the material composition test in ASTM 8.8.1.

C. All required ASTM 3753 testing shall be completed, and records of all testing shall be kept and copies of test results shall be presented to the customer upon written request within a reasonable time period.

3.03 CERTIFICATION

A. When requested by the purchaser on his order, a certification shall be made based on acceptance. This shall consist of a copy of the manufacturer's test report or a statement by the supplier, in accompanied by a copy of the test results, that the manhole has been sampled, tested, and inspected in accordance with the provisions of ASTM 3753 and this specification, and meets all requirements. An authorized agent of the supplier or manufacturer shall sign each certification so furnished.

3.04 HANDLING AND STORAGE

A. Do not drop or impact the fiberglass manhole. Lift manhole with two slings on spreader bar in horizontal position or by use of 4" x 4" timber inserted crosswise inside the manhole to the underside of the collar with a rope or chain attached to backhoe or another lifting device. Manhole may be rolled, however, ensure that ground is smooth and free of rocks, debris, etc. Use of chains or cables in contact with manhole surface is prohibited.

3.05 INSTALLATION METHODS

A. General: The manhole installation should strictly follow the manufacturers recommended installation procedures.

1. To Install The Fiberglass Manhole: Fiberglass manholes must be installed according to Containment Solution's "Fiberglass Manhole Installation Instructions".
In addition to these instructions, local codes may apply and should be consulted as applicable in manhole installation. Correct manhole installation requires proper concrete foundation, good backfill and proper handling to prevent manhole damage and insure long-term corrosion resistant service.

B. General Installation Outline: Containment Solution's complete Manhole installation instructions must be consulted before actual installation is performed.

1. Prepare Excavation/Make Manhole Pipe Cut-Outs for stub out connections: Prepare excavation in a normal manner. Excavation at manhole location should be at least wide enough to accommodate the slab specified and to provide working room around manhole. Insure the depth of manhole is sufficient to allow at least one course of brick or one concrete ring for adjustment of ring and cover at top of final grade. Pipe cut-outs at the flowline are made in manhole prior to setting manhole in place over pipe in trench. Quarter marks have been provided on barrel to facilitate alignment of cut-outs.

2. Pour Concrete Base: Concrete slab base should be a minimum of 6" thick. Concrete slab should extend a minimum of 12" beyond manhole outside wall.

3. Set Manhole: To lift manhole, insert 4" x 4" timber crosswise inside the manhole to the underside of the collar with a rope or chain attached to backhoe or another

lifting device. Lower manhole into wet concrete base to a minimum depth of 4". Minimum 2" thick concrete bearing surface beneath bottom edge of the manhole is required. Plumb manhole using standard bubble level and by moving manhole with hands. Work concrete around manhole base and 6 inch minimum over incoming lines. Inverts and laterals are made following standard procedures.

4. Backfill: Backfilling is done just as soon as the concrete base has hardened enough to provide sufficient support for manhole and fill. Native soil (or sand, in unstable areas), free of large stones, debris, or concrete chunks may be used for backfill. Backfill should be place evenly around manhole in 12" maximum lifts and should thoroughly tamped to 90% standard proctor density before the next layer is installed. Backfill material shall be subject to approval by the engineer.

5. Bring to Grade: Construct chimney on flat shoulder of manhole using injection molded-recycled HDPE adjusting rings as manufactured by LADTECH, Inc. or approved equal and installed as per manufacture's recommendations.

3.06 INSPECTION

A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the owner. Such inspections shall be made at the place of manufacture, or at site of delivery, and the sections shall be subject to rejection on account of failure to meet any of the specification requirements. Sections rejected after delivery to the job site shall be marked for identification and shall be removed from the job at once. All sections which have been damaged after delivery will be rejected, and if already installed shall be acceptable if repaired or removed and replaced at the contractor's expense.

B. At the time of inspection, the material will be examined for compliance with the requirements of this specification and the approved drawings.

END OF SECTION

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Section 02084

FRAMES, GRATES, RINGS, AND COVERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for manhole frames and covers, inlet frames and grates, catch basin frames and grates, rings, covers, and seals under this Section. Include payment in unit price for related item and meter vault frames and covers, adjustment rings and extensions.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this section is included in the total Stipulated Price.

1.03 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges.

B. ASTM A 48 - Specification for Gray Iron Castings.

1.04 SUBMITTALS

A. Submit product data in accordance with Section 01330 - Submittal Procedures.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in drawings. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 P R O D U C T S

2.01 CASTINGS

A. Castings for frames, grates, rings and covers shall conform to ASTM A 48, Class 30. Provide locking covers if indicated on Drawings.

B. Castings shall be capable of withstanding the application of an AASHTO H-20 loading without permanent deformation.

C. Fabricate castings to conform to the shapes, dimensions, and with wording or logos shown on the drawings.

D. Castings shall be clean, free from blowholes and other surface imperfections. Cast holes in covers shall be clean and symmetrical, free of plugs.

2.02 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for any position in which the casting may be seated in the frame.

2.03 SPECIAL FRAMES AND COVERS

A. Were indicated on the Drawings, provide watertight manhole frames and covers with a minimum of four bolts and a gasket designed to seal cover to frame.

2.04 FINISH

A. Unless otherwise specified, coat iron castings with the manufacturer's standard asphaltic paint.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Install castings according to the Drawings, approved shop drawings, instructions given in related specifications, and applicable directions from the manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in formwork until permanently set.

END OF SECTION

Section 02085

VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Valve boxes for water service.

B. Meter boxes for water service.

C. Meter vaults for water service.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for valve boxes under this Section. Include payment in unit price for Section 02511 - Water Mains.

2. No separate payment will be made for meter boxes under this Section. Include payment in unit price for Section 02512 - Water Tap and Service Line Installation.

3. Payment for meter vaults is on a unit price basis per vault. Payment will be made for each vault installed, regardless of depth.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM D 256 - Standard Test Methods for Impact Resistance of Plastics and Electrical Insulating Materials.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load.

E. ASTM D 2790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturers' product data for following items for approval:

1. Each type of valve box and lid.

2. Each type of meter box and cover.

3. Each type of meter vault frame and cover.

C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in the State of Texas.

D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

E. Submit manufacturer's certification that plastic meter boxes meet the requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 P R O D U C T S

2.01 VALVE BOXES

A. Provide Type A, cast-iron, slide-type, valve boxes as manufactured by Bass and Hays Foundry, Inc., or approved equal. Provide Type B when 6-inch pipe will not enclose stuffing box section of gate valve. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast a letter "W" into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.

C. Coat boxes, bases, and lids by dipping in hot bituminous varnish.

D. Provide 6-inch PVC, Class 150, DR 18, riser pipes.

E. Concrete for valve box placement:

1. For locations in new concrete pavement, provide strength and mix design of new pavement.

2. For other locations, provide Class A concrete, with minimum compressive strength of 3000 psi, conforming to requirements of Section 03315 - Concrete for Utility Construction.

2.02 METER BOXES

A. Provide meter boxes of the following materials:

1. Non-traffic bearing locations: Cast iron, concrete or plastic.

2. Traffic bearing locations: Cast iron.

B. Provide a meter box with a reading lid. Provide lids with key-operated, spring-type, locking device. Lids shall contain sufficient metal that meter box can be easily located with metal detector. Cast the words and "WATER METER" into lid with letters of 1/2-inch height and raised 3/32 inch.

C. Meter box dimensions shall conform to the following approximate dimensions:

1. Length: At top - 15-1/2 inches; at bottom 20 inches.

2. Width: At top - 12-1/2 inches; at bottom 14-3/4 inches.

3. Height: 12 inches.

D. Extensions: Meter box extensions 3 inches and 6 inches in height shall be available from the manufacturer as a standard item.

2.03 CAST-IRON METER BOXES

A. Cast-Iron Boxes: Clean and free from sand blowholes or other defects and conform to the requirements of ASTM A 48. Bearing surfaces shall be machined so that covers seat evenly in frames.

B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.

C. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

2.04 CONCRETE METER BOXES

A. Concrete Meter Boxes: Made of Class A concrete, with minimum 3000 psi compressive strength, conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

2.05 PLASTIC METER BOXES

A. Plastic Meter Boxes: Made of high-density polyethylene conforming to the following ASTM standards:

ASTM	Requirement
D 256	Impact Strength = 1.9 ft-lb/inch (Izod, Notched)
D 256	Impact Strength = 6.4 ft-lb/inch (Izod, Un-Notched)
D 638	Tensile Strength (2.0 min.) = 3400 psi
D 648	Deflection Temperature = 170 degrees F
D 676	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160 inch-lb.
D 790	Flexural Modulus = 90,000 psi

B. Meter boxes shall meet the following test requirements:

1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.

2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8 inch.

C. Meter box body, without lid, shall weigh approximately 7 pounds.

2.06 METER VAULTS

A. Meter vaults may be constructed of precast concrete, or cast-in-place concrete unless a specific type of construction is required by Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction with minimum compressive strength of 3000 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Section 03315 Concrete for Utility Construction.

D. Grates and Covers: Conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Obtain approval from Resident Project Representative for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.02 VALVE BOXES

A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. The riser may rest on a valve flange or provide stable foot piece to support riser pipe.

C. After valve box has been set, aligned, and adjusted so that lid is level with final grade, pour a 24-inch by 24-inch by 8-inch-thick concrete block around valve box. Center valve box horizontally within concrete block.

3.03 METER BOXES

A. Install cast iron or plastic boxes in accordance with manufacturers instructions.

B. Construct concrete meter boxes to dimensions shown on Drawings.

C. Adjust the top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.

D. Do not locate under paved areas unless approved by Resident Project Representative. Use approved traffic-type boxes with cast iron lid when meter must be in paved areas.

3.04 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in the presence of water. Make a bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.

B. Precast Meter Vaults:

1. Install precast vaults in accordance with manufacturers' recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to the requirements of Section 02320 - Utility Backfill Materials.

2. Seal lifting holes with non-shrink grout.

C. Meter Vault Floor Slab:

1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center, or install mortar trench for keying walls to floor slab.

2. Precast floor slab elements may be used for precast vault construction.

D. Cast-in-Place Meter Vault Walls:

1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.

2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.

3. Set frame for cover while concrete is still green.

3.05 FRAME AND COVER FOR METER VAULTS

A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:

1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above natural grade.

2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2 inch.

3.06 BACKFILL

A. Provide bank run sand in accordance with Section 02320 - Utility Backfill Materials and backfill and compact in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope not steeper than 5:1 from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION

Section 02221

REMOVING EXISTING PAVEMENTS AND STRUCTURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Removing concrete pavement, asphaltic concrete pavement, and base courses regardless of thickness.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways regardless of thickness.

C. Removing pipe culverts and storm sewers.

D. Removing existing inlets and manholes.

E. Removing miscellaneous structures of concrete or masonry.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include all costs of work performed under this Section in pay items for which this work is a component.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price including but not limited to breaking concrete loading, hauling, salvaging or disposing of the material, equipment, labor, tools and incidentals.

1.03 REGULATORY REQUIREMENTS

A. Determine/Identity and contact property owner, City, County, TxDOT, utility company, before removal.

B. Conform to Section 01576 – Waste Material Disposal, applicable codes, and local laws for disposal of debris.

C. Coordinate clearing work with utility companies.

D. Coordinate replacement of existing parameters and structures with property owner, city, county, Tx DOT or utility company and property replace to their satisfaction.

1.04 SUBMITTALS

A. Conform to the requirements of Section 01330 – Submittal Procedures.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Obtain advance approval from Resident Project Representative for dimensions and limits of removal work. Submit preconstruction photographs in accordance with the applicable portions of Section 01321 – Construction Photographs.

B. Locate and identify buried utilities. Identification shall be by flagging and offset staking.

3.02 PROTECTION

A. Protect the following from damage or displacement:

1. Adjacent public and private property.

2. Trees, plants, and other landscape features designated to remain.

3. Utilities designated to remain.

4. Benchmarks, monuments, and existing structures designated to remain.

3.03 REMOVALS

A. Remove pavement and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of 2-inches.

D. Where street and driveway saw cut locations coincide or fall within 3-feet of existing construction or expansion joints break out to existing joints.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install and 8-in-thick masonry plug in pipe end prior to backfill.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Section 02316 – Excavation and Backfill of Structures.

B. Contact Residence Project Representative prior to backfill to observe/inspect work performed.

3.05 DISPOSAL

A. Disposal shall be in accordance with requirements of Section 01576 – Waste Material Disposal.

B. Remove debris, rubbish, and extracted plant material from the site in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

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SECTION 02222

ABANDONMENT OF SANITARY SEWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Abandonment in place of existing sanitary sewers, junction structures, manholes, and force mains.

1.02 RELATED SECTIONS

A. Section 01270 – Measurement and Payment

B. Section 01330 – Submittal Procedures

C. Section 01576 – Waste Material Disposal

D. Section 02317 – Excavation and Backfill for Utilities

E. Section 02431 – Tunnel Grout

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for grout fill and abandonment of existing sewers, including boxes and elliptical shaped sewers, is on linear foot basis for each diameter of sewer being abandoned. Measurement will be along centerline of sewer from centerline to centerline of manholes.

2. Payment for grout fill and abandonment of sewer manholes or junction structure is by each manhole or junction structure abandoned in conformance with this Section.

3. Payment will be full compensation for all material, equipment, and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, fill lines, excavations, and incidentals.

4. No separate payment will be made for plugging and abandoning sewer force mains. Include cost of such abandonment in related work.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

6. Acceptability of grout material is based on achieving average strength within range of 75 to 150 psi as defined in Paragraph 2.01B.1. Grout that is out of range after placement may be accepted with price adjustment of 1.0 percent price deduction for each psi average compressive strength below 75 psi and 0.5 percent price deduction for each psi average compressive strength above 150 psi, as applicable to material volume represented by test series. Shrinkage in grout material placements shall be remedied by Contractor according to Paragraph 3.04H without additional compensation.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 DEFINITIONS

A. Abandonment. Sewer abandonment consists of demolition and removal of portion of manholes existing within specified depth of surface, and abandonment in place of sewer lines and manholes as specified in this Section.

B. Flowable Fill. 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.

C. Ballast. Large aggregate either replaced with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.

D. Backgrouting. Secondary stage pressure grouting to ensure that voids have been filled within abandoned sewer. Backgrouting will only be required at critical locations indicated on Drawings or if there is evidence of incomplete flowable fill placements.

1.05 REFERENCE STANDARDS

A. ASTM C 150 - Standard Specification for Portland Cement.

B. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

C. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

D. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.

E. ASTM C 940 - Standard Test Method for Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory.

F. ASTM C 1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

G. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Flowable fill mix design report:

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. Use of ballast. Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.

3. Aggregate gradation of fill. Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.

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

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

6. Initial time of set.

7. Bleeding and shrinkage.

8. Compressive strength.

C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.

D. Experience record for proposed crew, showing minimum of 100 cubic yards of flowable fill placed using proposed or similar equipment and methods.

E. At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of work.

PART 2 PRODUCTS

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 Paragraph 1.06B in mix design report including following:

1. Cement: ASTM C 150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.

2. Fly ash: ASTM C 618 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, Nos. 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 of natural aggregate to provide workability.

6. Admixtures: Use admixtures meeting ASTM C 494 and ASTM C 1017 as needed to improve pumpability, to control time of set, and reduce bleeding.

7. Fluidifier: Use fluidifier meeting ASTM C 937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.

8. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, 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 sewers: not to

exceed 2 percent according to ASTM C 940.

5. Minimum wet density: 90 pounds per cubic foot.

2.02 BALLAST

A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24 inches. Maximum dimension shall not be more than 20 percent of minimum dimension of space to be filled.

B. Ballast Composition: Free of regulated waste material.

2.03 PLUGS FOR FORCE MAINS

A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C 1107, Grade B or C.

B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

PART 3 EXECUTION

3.01 PREPARATION

A. Have fill mix design reports and other submittals required by Paragraph 1.06 accepted by Project Manager prior to start of placement. Notify Project Manager 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 portion of work, new or existing.

C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project, and report them to Project Manager. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume. Dispose of waste material in compliance with Section 01576 - Waste Material Disposal.

E. Remove free water prior to starting fill placement.

3.02 EQUIPMENT

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.

3.03 DEMOLITION OF SEWER MANHOLES, PIPELINE STRUCTURES, AND FORCE MAINS PRIOR TO ABANDONMENT

A. Remove manhole frames and covers and castings from other existing pipeline structures. Deliver castings to nearest Port of Brownsville maintenance facility for future use. Alternatively, salvaged castings may be used upon approval by Project Manager, for constructing new manholes on this project.

B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to minimum depth of 4 feet below finished grade. Structure may be removed to greater depth, but not deeper than 18 inches above crown of abandoned sewer.

C. When adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.

D. Excavate overburden from force mains to be abandoned at locations indicated on Drawings, conforming to Section 02317 - Excavation and Backfill for Utilities. Cut existing force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove force main piping material remaining outside of segment to be abandoned.

3.04 INSTALLATION

A. Abandon sewer lines by completely filling sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.

B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.

C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.

D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.

E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sewer from downstream end, to discharge at upstream end.

G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.

H. Remediate placement of flowable fill which does not fill voids in sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface. Pressure grout shall conform to Section 02431 - Tunnel Grout.

I. Plug each end of force main being abandoned.

J. Force main abandonment

a. Clean inside surface of force main at least 12 inches from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.

b. When using grout plug, place temporary plug or bulkhead approximately 12 inches inside pipe. Fill pipe end completely with dry-pack grout mixture.

c. When using manufactured plug or cap, install fitting as recommended by manufacture's instructions, to form water tight seal.

K. Backfill to surface, above pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with Section 02317 - Excavation and Backfill for Utilities.

L. Collect and dispose of excess flowable fill material and other debris in accordance with Section 01576 - Waste Material Disposal.

3.05 FIELD QUALITY CONTROL

A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.

B. Check flow characteristics and workability of fill as placement proceeds.

C. Obtain at least three test cylinders for each placement area for determination of 56-day compressive strength and bleeding. Acceptance of placement will be based on average strength of three tests.

D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.

3.06 PROTECTION OF PERSONS AND PROPERTY

A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.

B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

END OF SECTION

SECTION 02233

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removing surface debris and rubbish.

B. Clearing site of plant life and grass.

C. Removing trees and shrubs.

D. Removing root system of trees and shrubs.

E. Fence removal.

1.02 RELATED SECTIONS

A. Section 01270 – Measurement and Payment

B. Section 01576 – Waste Material Disposal

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for clearing and grubbing is on per acre basis.

2. No separate payment will be made for clearing and grubbing of wastewater projects, include payment in unit prices for related items.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate clearing work with utility companies.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Living trees located 3 feet or more outside of intersection of side slopes and original ground line.

2. Plants other than trees and landscape features designated to remain.

3. Utilities designated to remain.

4. Bench marks, monuments, and existing structures designated to remain.

3.03 CLEARING

A. Remove stumps, main root ball, and root system to:

1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.

2. Depth of 24 inches below finished surface of required cross section for other areas.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse.

3.04 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION

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Section 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Clearing and grubbing, excavation, backfilling, and compaction of backfill for structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for structural excavation and backfill under this Section. Include all costs in unit price or lump sum price for construction of structures.

2. No separate or additional payment will be made for clearing and grubbing, surface water control, ground water control, or for excavation drainage. Include all costs in the unit price or lump sum price for construction of structures.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials meet specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or

cement shall be considered suitable, unless otherwise indicated. Provide independent lab test results to Engineer, stipulating the percentage of lime or cement incorporated into unsuitable materials.

C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.

D. Backfill: Select material meeting specified quality requirements, placed and compacted under controlled conditions around structures.

E. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

F. Foundation Base: For foundation base material, use crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.

G. Foundation Subgrade: Foundation subgrade is the surface of the natural soil which has been excavated and prepared to support the foundation base or foundation backfill, where needed.

H. Ground Water Control Systems: Installations external to the excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower the ground water, intercepting seepage which would otherwise emerge from the side or bottom of the excavation, and depressurization to prevent failure or heaving of the excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from the excavation. Remove rain water and surface water which accidentally enters the excavation as a part of excavation drainage.

J. Excavation Drainage: Removal of surface and seepage water in the excavation by sump pumping and using French drains surrounding the foundation to intercept the water.

K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below the foundation as shown on Drawings, and backfilled with foundation backfill material. No additional payment for over excavated or over backfilled areas or materials complying with the requirements of Section 01561 trench safety systems.

L. Shoring System: A structure that supports the sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.04 REFERENCES

A. ASTM D 558 - Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

B. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb (2.49-kg) Rammer and 12-in. (304.88-mm) Drop.

C. ASTM D 1556 - Density of Soil in Place by the Sand-Cone Method.

D. ASTM D 2487 - Classification of Soils for Engineering Purposes.

E. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

G. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

H. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

I. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

J. Federal Regulations, 29 CFR, Part 1926, Standards - Excavation, Occupational Safety and Health Administration (OSHA)

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit a work plan for excavation and backfill for each structure with complete written description which identifies details of the proposed method of construction and the sequence of operations for construction relative to excavation and backfill activities. The descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to the Engineer that the procedures meet the requirements of the Specifications and Drawings.

C. Submit excavation safety system plan.

1. The excavation safety system plan shall be in accordance with applicable OSHA requirements for all excavations.

2. The excavation safety system plan shall be in accordance with the requirements of Section 01561 - Trench Safety System, for all excavations that fall under State and Federal trench safety laws.

D. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

E. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.06 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Contractor shall perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving the requirements of this Specification at no additional cost to the owner.

B. Use equipment which will produce the degree of compaction specified. Backfill within 3 feet of walls shall be compacted with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to the depth of the fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

C. Use a water truck equipped with sprayer or hose attached as needed to maintain fill material at the required optimum moisture.

2.02 MATERIAL CLASSIFICATIONS

A. Backfill materials shall conform to the classifications and product descriptions of Section 02320 - Utility Backfill Materials. The classification or product description for backfill applications shall be as shown on the Drawings and as specified.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Conduct an inspection to determine the condition of existing structures and other permanent installations.

B. Set up necessary street detours and barricades in preparation for excavation if construction affects traffic. Conform to the requirements of Section 01555 - Traffic Control and Regulation. Always maintain barricades and warning devices for streets and intersections where work is in progress, or were affected by the Work, and is considered hazardous to traffic movements.

C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 01561 - Trench Safety Systems.

D. Project sites, rights-of-way and easements shall be made ready for construction operations in accordance with Section 02233 – Clearing and Grubbing.

E. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

F. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.02 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.

D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.

E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to the Owner.

3.03 EXCAVATION

A. Perform excavation work so that the underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing

surrounding ground and existing facilities and improvements. Keep excavation to the absolute minimum necessary. No additional payment will be made for excess excavation.

B. The use of explosives or headache balls is prohibited.

C. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Resident Project Representative and obtain instructions before proceeding in such areas.

D. Immediately notify the agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Resident Project Representative and agency for any repairs or relocations, either temporary or permanent.

E. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.

F. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.

G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed by the Engineer, replace those which are damaged or destroyed by the Work.

H. Provide sheeting, shoring, and bracing where required to safely complete the Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect the Work and adjacent structures or improvements. Sheeting, shoring, and bracing used to protect workmen, and the public shall conform to requirements of Section 01561 - Trench Safety Systems.

I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, concrete fill, cement stabilized sand, or other material approved by Resident Project Representative.

J. After completion of the structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Engineer in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to the Work and adjacent structures or improvements.

K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or material approved by Resident Project Representative.

3.04 HANDLING EXCAVATED MATERIALS

A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at a sufficient distance from excavation to prevent slides or cave-ins.

3.05 DEWATERING

A. Provide ground water control per Section 01578 - Control of Ground Water and Surface Water.

B. Keep ground water surface elevation at a minimum of 2 feet below the bottom of the foundation base.

C. Maintain ground water control as directed by Section 01578 - Control of Ground Water and Surface Water and until the structure is sufficiently complete to provide the required weight to resist hydrostatic uplift with a minimum safety factor of 1.2.

3.06 FOUNDATION EXCAVATION

A. Notify Resident Project Representative at least 48 hours prior to planned completion of foundation excavations. Do not place the foundation base until the excavation is accepted by the Resident Project Representative.

B. Excavate to elevations shown on Drawings, as needed to provide space for the foundation base, forming a level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or a material as directed by the Resident Project Representative. Prior to placing material over it, recompact the subgrade was indicated on the Drawings, scarifying as needed, to 95 percent of the maximum Standard Dry Density according to ASTM D 698. Assume independent lab performs comparison testing and written results are submitted to Engineer. If the specified level of compaction cannot be achieved, moisture condition the subgrade and recompact until 95 percent is achieved, over-excavate to provide a minimum layer of 24 inches of foundation backfill material, or other means acceptable to the Resident Project Representative.

C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by the Resident Project Representative.

D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in a satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

E. Soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to the required subgrade, shall be removed and replaced with foundation backfill material, as directed by Resident Project Representative, at no additional cost to the Owner.

F. Place foundation base, or foundation backfill material where needed, over the subgrade on same day that excavation is completed to final grade. Where the base of excavations are left open for longer periods, protect them with a seal slab or cement-stabilized sand.

G. Crushed aggregate, and other free draining Class I materials, shall have a filter fabric as specified in Section 02621 - Geotextile, separating it from native soils or select material

backfill. The fabric shall overlap a minimum of 12 inches beyond where another material stops contact with the soil.

H. Crushed aggregate, and other Class I materials, shall be placed in uniform layers of 8-inch maximum thickness. Compaction shall be by means of at least two passes of a vibratory compactor.

3.07 FOUNDATION BASE

A. After the subgrade is properly prepared and tested if required by the specifications, including the placement of foundation backfill where needed, the foundation base shall be placed. The foundation

base shall consist of a 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, a seal slab with a minimum thickness of 4 inches may be placed. The foundation base

shall extend a minimum of 12 inches beyond the edge of the structure foundation, unless shown

otherwise on the Drawings.

B. Where the foundation base and foundation backfill are of the same material, both may be placed in one operation. Contractor shall notify Resident Project Representative prior to placement of foundation base.

3.08 BACKFILL

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Use existing material that qualifies as select material, unless indicated otherwise. Deposit backfills in uniform layers and compact each layer as specified and have been tested and approved by Engineer.

B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that the concrete has reached a minimum of 85 percent of the specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfilling operations until the slab or intermediate walls have been placed and concrete has attained sufficient strength.

C. Remove concrete forms before starting to backfill and remove shoring and bracing as work progresses.

D. Maintain fill material at no less than 2 percent below nor more than 2 percent above optimum moisture content. Place fill material in uniform 8-inch maximum loose layers. Compaction of fill shall be to at least 95 percent of the maximum Standard Dry Density according to ASTM D 698 under paved areas. Compact to at least 90 percent of structures under unpaved areas.

E. Where backfill is placed against a sloped excavation surface, run compaction equipment across the boundary of the cut slope and backfill to form a compacted slope surface for placement of the next layer of backfill.

F. Place backfill using cement stabilized sand in accordance with Section 02321 - Cement Stabilized Sand.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under the provisions of Section 01454 - Testing Laboratory Services.

B. Tests will be performed initially on a minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.

C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions:

1. A minimum of one test for every 100 cubic yards of compacted backfills material.

2. A minimum of three density tests for each full work shift.

3. Density tests will be performed in all placement areas.

4. The number of tests will be increased if inspection determines that soil types or moisture contents are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density.

D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.

E. If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with the requirements of Section 01576 - Waste Material Disposal.

END OF SECTION

Section 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in the unit price for installed underground piping, sewer, conduit, or duct work.

2. No separate or additional payment will be made for surface water control, ground water control, or for excavation drainage. Include in the unit price for the installed piping, sewer, conduit, or duct work.

3. Concrete Encasement shall be measured and paid for by cubic yard, complete in place. Measurement shall be to the neat lines shown on the plans.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at the trench subgrade after excavation to depth of bottom of the bedding as shown on the Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: The portion of trench backfill that extends vertically from top of foundation up to a level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: The material placed on either side of pipe from top of bedding up to spring line of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: The portion of trench backfill that extends vertically from spring line of pipe (top of haunching) up to a level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: The portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: The portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement are considered suitable, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements, placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

K. Surface Water Control: Diversion and drainage of surface water runoff and rainwater away from trench excavation. Rainwater and surface water accidentally entering trench shall be controlled and removed as a part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using a drainage layer, as defined in ASTM D 2321, placed on the foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined regarding the stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement

and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone because of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

   a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.

   b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in the embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in the pipe embedment zone if ground water inflow or high-water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub trench: Sub trench is a special case of benched excavation. Sub trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. The depth of a sub trench depends upon trench stability and safety as determined by the Contractor.

O. Trench Dam: A placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along the trench.

P. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings and backfilled with foundation backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 01561 - Trench Safety Systems.

1. Trench Shield (Trench Box): A portable worker safety structure moved along the trench as work proceeds, used as a protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within the trench. Trench shields may be stacked if so designed or placed in a series depending on depth and length of excavation to be protected.

2. Shoring System: A structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of the ground affecting adjacent installations or improvements.

3. Special Shoring: A shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on the Drawings.

1.04 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipelines.

B. ASTM D 558 - Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.8-mm) Drop.

D. ASTM D 1556 - Test Method for Density in Place by the Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

L. Code of Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.05 SCHEDULING

A. Schedule work so that pipe embedment can be completed on the same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.06 SUBMITTALS

A. Conform to Section 01330 - Submittal Procedures.

B. Submit a written description for information only of the planned typical method of excavation, backfill placement and compaction, including:

1. Sequence of work and coordination of activities.

2. Selected trench widths.

3. Procedures for foundation and embedment placement, and compaction.

C. Submit a ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

D. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

E. Submit a trench excavation safety program in accordance with requirements of Section 01561 - Trench Safety System. Include designs for special shoring meeting the requirements defined in Paragraph 1.08, Special Shoring Design Requirements.

F. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

1.07 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by the Contractor's Professional Engineer to provide support for the sides of the excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a pre-manufactured system selected by the Contractor's Professional Engineer to meet the project site requirements based on the manufacturer's standard design.

PART 2 P R O D U C T S

2.01 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving the requirements of this Section.

B. Use only hand-operated tamping equipment until a minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.09, Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials.

B. Concrete Encasement and Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

B. Install rigid pipe to conform with standard practice described in ASTM C 12, and as described in this Section. Where an apparent conflict occurs between the standard practice and the requirements of this Section, this Section governs.

3.02 PREPARATION

A. Establish traffic control to conform with requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by the Work and is considered hazardous to traffic movements.

B. Perform work to conform with applicable safety standards and regulations. Employ a trench safety system as specified in Section 01561 - Trench Safety Systems.

C. Immediately notify the agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from the Resident Project Representative and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform with requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface water control measures to conform with Section 01578 - Control of Ground Water and Surface Water.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 - Field Surveying.

3.03 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within the grading limits as designated on the Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities are indicated on the Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, recompact, and pave those areas at no additional cost to the Owner.

3.04 EXCAVATION

A. Except as otherwise specified or shown on the Drawings, install underground utilities in open cut trenches with vertical sides. Open cut excavation does not include the use of explosives or headache balls. The use of explosives or headache balls is prohibited.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on the Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using the following schedule as related to pipe outside diameter (O.D.). Maximum trench width shall be the minimum trench width plus 24 inches.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
Greater than 30	O.D. + 36

D. Use sufficient trench width or benches above the embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from the surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify the Resident Project Representative and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with the trench excavation, so that the soils within the full height of the trench excavation walls will remain laterally always supported.

2. For all types of shoring, support trench walls in the pipe embedment zone throughout the installation. Provide trench wall supports sufficiently tight to prevent washing the trench wall soil out from behind the trench wall support.

3. Unless otherwise directed by the Engineer, leave sheeting driven into or below the pipe embedment zone in place to preclude loss of support of foundation and

embedment materials. Leave rangers, walers, and braces in place if required to support sheeting, which has been cut off, and the trench wall in the vicinity of the pipe zone.

4. Employ special methods for maintaining the integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of the pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. The maximum thickness of removable sheeting extending into the embedment zone shall be the equivalent of a 1-inch-thick steel plate. Fill voids left on removal of supports with compacted backfill material.

G. Use of Trench Shields. When a trench shield (trench box) is used as a worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to the trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor the degree of compaction reduced.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath the shield. For backfill above bedding, lift the shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in a safe manner.

3.05 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials which are suitable as defined in this Section and conforming with Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at a distance from the trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming with requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect excess stockpiles for use on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls.

3.06 GROUND WATER CONTROL

A. Implement ground water control according to Section 01578 - Control of Ground Water and Surface Water. Provide a stable trench to allow installation in accordance with the Specifications.

3.07 TRENCH FOUNDATION

A. Excavate the bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Immediately prior to placement of embedment materials, the bottoms and sidewalls of trenches shall be free of loose, sloughing, caving, or otherwise unsuitable soil.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around the pipe to provide uniform bearing and side support when compacted. Do not allow materials to free-fall from heights greater
than 24 inches above top of pipe. Perform placement and compaction directly against the undisturbed soils in the trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of the embedment zone unless means to maintain the density of compacted embedment material are used. If movable supports are used in embedment zone, lift the supports incrementally to allow placement and compaction of the material against undisturbed soil.

E. Place geotextile to prevent particle migration from the in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around the pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside the pipe with sandbags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted

areas. Compact each lift before proceeding with placement of next lift. Neither water tamping nor jetting are allowed.

J. For water line construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material.

K. Place trench dams in Class I embedment's in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

L. The Contractor shall provide whatever means and materials are required to prevent pipe flotation at no separate pay.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only the minimum length of trench open as necessary for construction.

B. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave the sheeting in place. Cut off sheeting 1.5 feet or more above the crown of the pipe. Remove trench supports within 5 feet from the ground surface.

C. When shown on Drawings, a random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

D. Place trench zone backfill in lifts and compact by methods selected by the Contractor. Fully compact each lift before placement of the next lift.

1. Bank run sand.

a. Maximum 9-inches compacted lift thickness.

b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.

c. Moisture content within 3 percent of optimum determined according to ASTM D 698

2. Cement-stabilized sand.

a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but not exceeding 24 inches.

b. Compaction by vibratory equipment to a minimum of 95 percent of the maximum dry density determined according to ASTM D 558.

c. Moisture content on the dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Select fill.

a. Maximum 6-inches compacted lift thickness.

b. Compaction by equipment providing tamping or kneading impact to a minimum of 95 percent of the maximum dry density determined according to ASTM D 698.

c. Moisture content within 2 percent of optimum determined according to ASTM D 698.

E. For trench excavations outside pavements, a random backfill of suitable material may be used in the trench zone.

1. Fat clays (CH) may be used as trench zone backfill outside paved areas at the Contractor's option. If the required density is not achieved, the Contractor, at his option and at no additional cost to the Owner, may use lime stabilization to achieve compaction requirements or use a different suitable material.

2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.

3. Compact to a minimum of 90 percent of the maximum dry density determined according to ASTM D 698.

4. Moisture content as necessary to achieve density.

F. Concrete encasement shall be placed at locations shown on the drawings and as directed by the Resident Project Representative.

G. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES, AND OTHER PIPELINE STRUCTURES

A. Meet the requirements of adjoining utility installations for backfill of pipeline structures, as shown on the Drawings.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.

C. Tests will be performed on a minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is a noticeable change in material gradation or plasticity.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Additional moisture-density relationship tests will be performed whenever there is a noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at the following frequencies and conditions.

1. A minimum of one test for every 100 Linear feet of trench of compacted embedment and compacted trench zone backfill material.

2. A minimum of three density tests for each full shift of Work.

3. Density tests will be distributed among the placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below the fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than the acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at the same frequency as the first test series, including verification tests.

F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with non-conforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal

END OF SECTION

Section 02320

UTILITY BACKFILL MATERIALS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:
- Concrete sand
- Gem sand
- Pea gravel
- Crushed stone
- Crushed concrete
- Bank run sand
- Select backfill
- Random backfill

C. Material Handling and Quality Control Requirements.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for backfill material under this Section. Include all costs associated with Utility Backfill Materials in unit price for applicable utility installation.

2. Payment for backfill material, when included as a separate pay item, is on a cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings. Refer to Section 01255-Change Order Procedures.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to the required density due to either gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, and waste; or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

5. Contractor's responsibility to perform all testing required to determine or differentiate between unsuitable and suitable material.

B. Suitable Material: Suitable soil materials are the following:

1. Those meeting specification requirements.

2. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement.

3. Provide documentation test data to support materials meet or exceed specifications requirements.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I A requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for the structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. The foundation base provides a smooth, level working surface for the construction of the concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for the designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within the embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching, and initial backfill.

G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in the trench zone from top of embedment zone to base course in paved areas or to the surface grading material in unpaved areas.

H. Foundation: Either suitable soil of the trench bottom, or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: A source selected by the Contractor for supply of embedment or trench zone backfill material. A selected source may be the project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Section 02317 - Excavation and Backfill and 01561 trench safety systems for Utilities for other definitions regarding utility installation by trench construction.

1.04 REFERENCES

A. ASTM C 33 - Specification for Concrete Aggregate.

B. ASTM C 40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Test Method for Lightweight Pieces in Aggregate.

D. ASTM C 131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

E. ASTM C 136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Test Method for Amount of Materials in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

J. ASTM D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

K. ASTM D 4643 - Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

L. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

M. TxDOT Tex-104-E - Test Method for Determination of Liquid Limit of Soils (Part 1)

N. TxDOT Tex-106-E - Test Method - Methods of Calculating Plasticity Index of Soils.

O. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit a description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials to comply with Paragraph 2.03, Materials Testing.

D. Before stockpiling materials, submit a copy of temporary easement or approval from landowner for stockpiling backfill material on private property.

E. For each delivery of material, provide a delivery ticket which includes source location.

1.06 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.03.

B. Verification tests of backfill materials may be performed by the Owner in accordance with Section 01454 - Testing Laboratory Services and in accordance with Paragraph 3.03.

C. Random fill obtained from the project excavation as source is exempt from pre-qualification requirements by Contractor but must be inspected by Owner's testing lab for unacceptable materials based on ASTM D 2488. Do not use random fill until results from testing labs have been reviewed by the Engineer.

PART 2 P R O D U C T S

2.01 MATERIAL CLASSIFICATIONS

A. Materials for backfill shall be classified for the purpose of quality control in accordance with the Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:

1. Class IA. Class IA materials shall be manufactured aggregates with an open graduation. Materials shall consist of angular, crushed stone or rock, or crushed gravel. Class IA embedment material shall have a large void content and contain little or no fines. 100% of the material shall pass a 1 ½ " sieve, up to 10% shall pass a No. 4 sieve, and no more than 5% shall pass a No. 200 sieve. Class IA materials used for foundation, replacement of over-excavation, or in the pipe embedment zone shall be wrapped in one layer of geotextile filter cloth when groundwater is present in the excavated trench and the trench walls in the pipe embedment zone are composed of fine granular soils. Filter cloth shall be Poly-Filter GB, Nicolon 70/20, or Nicolon 40/30A.

2. Class IB. Class IB materials shall be manufactured / processed aggregates with a dense graduation. Materials shall consist of angular, crushed stone (or other Class IA materials) and stone/sand mixtures and contain little or no fines. 100% of the material shall pass a 1 ½ " sieve, up to 50% shall pass a No. 4 sieve, and no more than 5% shall pass a No. 200 sieve.

3. Class II. Class II materials shall be clean, coarse-grained soils classified as GW, GP, SW, or SP soil groups under ASTM D 2487 or coarse-grained soils which are borderline clean to with fines classified as GW-GC or SP-SM under ASTM D 2487. 100% of the GW, GP, SW, SP, GW-CC, and SP-SM soils shall pass a 1 ½ " sieve. Up to 50% of the GW and GP coarse fraction (material retained on a No. 200 sieve) shall pass a No. 4 sieve. Up to 5% of the GW, GP, SW, and SP soils shall pass a No. 200 sieve. Between 5% and 12% of the GW-CC and SP-SM soils shall pass a No. 200 sieve.

4. Class III. Class III materials shall be coarse-grained soils with fines. The soils shall be classified as GM, GC, SM, or SC soil groups under ASTM D 2487. 100% of the GM, GC, SM, and SC soils shall pass a 1 ½ " sieve. Up to 50% of the GM and GC coarse fractions (material retained on a No. 200 sieve) shall pass a No. 4 sieve. At least 50% of the SM and SC coarse fractions shall pass a No. 4 sieve. Between 12% and 50% of the GM, GC, SM, and SC soils shall pass a No. 200 sieve.

2.02 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by the Resident Project Representative. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by the applicable backfill

B. installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to the following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.

2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.

3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in the product specification, and approved by Engineer, provided that the physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by the Unified Soil Classification System (ASTM D 2487) meeting the following requirements:

1. Less than 15 percent passing the number 200 sieve when tested in accordance with ASTM D 1140. The amount of clay lumps or balls not exceeding 2 percent.

2. Material passing the number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318:

   a. Liquid limit: not exceeding 25 percent.

   b. Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or a combination of natural and manufactured sand conforming to the requirements of ASTM C 33 and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to the requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2”	100
3/8”	85 to100
No. 4	10 to 30

No. 8	0 to 10
No.16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for the same construction activity from a single source.

2. Non-plastic fines.

3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.

4. Crushed aggregate shall have a minimum of 90 percent of the particles retained on the No. 4 sieve with 2 or more crushed faces as determined by Test Method Tex-460-A, Part I.

5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from a naturally occurring single source. Uncrushed gravel are not acceptable materials for embedment where crushed stone is shown on the applicable utility embedment drawing details.

6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are the same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes		
	>15"	15" - 8"	<8"
1"	95 - 100	100	-
3/4"	60 - 90	90 - 100	100
1/2"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with a plasticity index between 7 and 20.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by the applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

K. Cement Stabilized Sand: Conform to requirements of Section 02321 - Cement Stabilized Sand.

L. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

2.03 MATERIALS TESTING

A. Ensure that material selected, produced and delivered to the project meets applicable specifications and is of sufficient uniform properties to allow practical construction and quality control.

B. Source or Supplier Qualification. Perform testing, or obtain current representative tests by suppliers, for selection of material sources and products. Provide current test results for a minimum of three samples for each source and material type. Tests samples of processed materials from current production representing material to be delivered. Tests shall verify that the materials meet specification requirements. Repeat qualification test procedures each time the source characteristic changes or there is a planned change in source location or supplier. Qualification tests shall include, as applicable:

1. Gradation. Complete sieve analyses shall be reported regardless of the specified control sieves. The range of sieves shall be from the largest particle through the No. 200 sieve.

2. Plasticity of material passing the No. 40 sieve.

3. Los Angeles abrasion wear of material retained on the No. 4 sieve.

4. Clay lumps.

5. Lightweight pieces

6. Organic impurities

C. Production Testing. Provide reports to the Engineer from an independent testing laboratory that backfill materials to be placed in the Work meet applicable specification requirements.

D. Deliver material samples for verification testing to the site of the Work.

E. Stale or outdated material test reports will not be accepted for review by the Engineer.

PART 3 E X E C U T I O N

3.01 SOURCES

A. Use of material encountered in the trench excavations is acceptable, provided applicable specification requirements are satisfied. If excavation material is not acceptable, provide from other approved source.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use and deliver samples for verification testing to the site of the Work.

C. Obtain approval for each material source by the Engineer before delivery is started. If sources previously approved do not produce uniform and satisfactory products, furnish materials from other approved sources. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet the requirements of the specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once a material is approved by the Engineer, expense for sampling and testing required to change to a different material will be credited to the Owner through a change order.

D. Bank run sand, select backfill, and random backfill, if available in the project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete the work from off-site sources.

E. The Owner does not represent or guarantee that any soil found in the excavation work will be suitable or acceptable as backfill material.

3.02 MATERIAL HANDLING

A. When backfill material is obtained from either a commercial or non-commercial borrow pit, open the pit to expose the vertical faces of the various strata for identification and selection of approved material to be used. Excavate the selected material by vertical cuts extending through the exposed strata to achieve uniformity in the product.

B. Establish temporary stockpile locations for practical material handling and control, and verification testing in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near the project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering the drainage system. Resident Project Representative will inspect and approve all stockpiles prior to use.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

A. Quality Control

1. The Resident Project Representative may sample and test backfill at:

   a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.

   b. On-site stockpiles.

   c. Materials placed in the Work.

2. The Resident Project Representative may resample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: The project testing laboratory will provide verification testing on backfill materials, as directed by the Resident Project Representative. Samples may be taken at the source or at the production plant, as applicable.

C. Contractor shall reimburse owner for all failed tests and any multiple tests as determined by Resident Project Representative.

END OF SECTION

SECTION 02321

CEMENT STABILIZED SAND

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cement stabilized sand.

1.02 RELATED SECTIONS

A. Section 01270 – Measurement and Payment

B. Section 01330 - Submittal Procedures

C. Section 01454 – Testing Laboratory Services

D. Section 02320 – Utility Backfill Materials

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring cement stabilized sand.

2. Refer to Paragraph 3.04 for material credit.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.04 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C 150 - Standard Specification for Portland Cement.

H. ASTM D 558 - Standard Test Method for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.

I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory

J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

K. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.

M. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

N. ASTM D 6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

1.06 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.

2. Determine minimum cement content from production data and statistical

history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 02320 - Utility Backfill Materials, and the following requirements:

1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.

2. Deleterious materials:

a. Clay lumps, ASTM C 142 - less than 0.5 percent.

b. Lightweight pieces, ASTM C 123; less than 5.0 percent.

c. Organic impurities, ASTM C 40, color no darker than standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.03 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:

1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.

2. Complete molding of samples within 4 hours after addition of water.

3. Perform strength tests (average of two specimens) at 48 hours and 7 days.

4. Perform cement content tests on each sample.

5. Perform moisture content tests on each sample.

6. Plot average 48-hour strength vs. cement content.

7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test raw sand for following properties at point of entry into pug-mill:

1. Gradation

2. Plasticity index

3. Organic impurities

4. Clay lumps and friable particles

5. Lightweight pieces

6. Moisture content

7. Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:

f'c% 1/2 standard deviation

PART 3 EXECUTION

3.01 PLACING

A. Place sand-cement mixture in maximum 12-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is +3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

C. Where potable water lines cross wastewater line, embed wastewater line with cement stabilized sand in accordance with Texas Administrative Code §290.44(e)(4)(B):

1. Provide minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume. Use at least 2.5 bags of cement per cubic yard of mixture (2 sacks per ton of dry sand).

2. Unless otherwise shown on Drawings, embed wastewater main or lateral minimum of six inches above and below.

3. Use brown coloring in cement stabilized sand for wastewater main or lateral bedding for identification of pressure rated wastewater mains during future construction.

3.02 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabililized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of

strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number 2.

Time material was batched

3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number
8. Indication of compliance / non-compliance
9. Mixture identification
10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.03 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:

1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Project Manager, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at Contractor's own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.

G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2\,(100 \text{ psi} - \text{Actual psi})}{100}$$

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary

work at no cost to City.

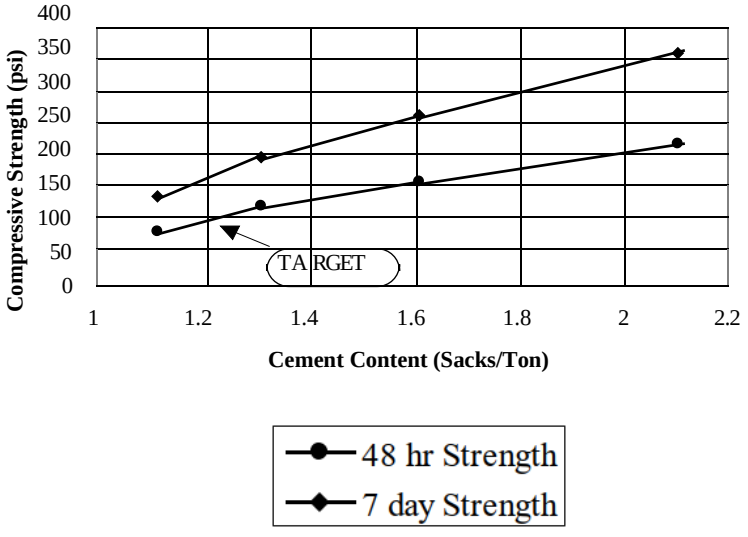
Supplier:	Plant No: 1 - Main Street	Date of Tests: January 1, 1997

Item	Raw Sand	1.1 Sack	100 psi	1.5 Sack	2.0 Sack
Moisture Content	10.9	15.7	14.0	13.8	13.7
Cement Feed Dial Setting	--	2.25	2.5	2.75	3.75
Silo Pressure (psi)	--	4	4	4	4
Batch Time	10:00	10:10	10:15	10:20	10:25
Sample Time	--	10:10	10:15	10:20	10:25
Molding Time	--	12:30	12:45	1:00	1:15
Cement Content (sacks/ton)	--	1.1	1.3	1.6	2.1
Compressive Strength at 48 hrs. (avg of 2)	--	80	120	160	220
Compressive Strength at 7 days (avg of 2)	--	135	200	265	365

Sieve size	Percent Passing	COH Spec. Section 02320
3/8 Inch	100	--
No. 16	100	--
No. 40	100	--
No. 50	99	--
No. 100	41	--
No. 200	11	0 to 15

Raw Sand Tests	Result	City of Houston
Plasticity Index	Non-Plastic	4 Maximum
Organic Impurities	Passing	No Darker Than
Clay Lumps & Friable Parts (%)	0.0	0.5 % Maximum
Lightweight Pieces (%)	0.0	5.0 % Maximum
Classification	SP-SM	SW, SP, SW-SM, SP-SM, SM

Compressive Strength vs Cement Content



END OF SECTION

SECTION 02431

TUNNEL GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mix design requirements, testing, furnishing and production of grout for:

1. Pressure grouting of bolted liner plates for shafts.
2. Pressure grouting of primary tunnel liner.
3. Pressure grouting of jacked-pipe.
4. Annular grouting of cased or uncased sewer pipe.
5. Grouting of annular space between carrier pipe and primary tunnel liner.
6. Grouting voids in ground resulting from caving, loss of ground, or settlement.
7. Grouting of manholes constructed in shafts.

B. Compaction grouting is not part of this specification.

1.02 REALTED SECTIONS

A. Section 01270 – Measurement and Payment

B. Section 01330 – Submittal Procedures

C. Section 02517 – Water Line in Tunnels

D. Section 03315 – Concrete for Utility Construction

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in contract unit prices for work of which it is component part.
2. Refer to Section 01270 - Measurement and Payment for Unit Price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for

work in this Section is included in total Stipulated Price.

1.04 DEFINITIONS

A. Pressure Grouting. Filling void behind liner or pipe with grout under pressure sufficient to ensure void is properly filled but without overstressing temporary or permanent ground support, or causing ground heave to occur.

B. Back Grouting. Secondary pressure grouting to ensure that voids have been filled between primary tunnel or shaft liners and surrounding ground.

C. Annular Grouting. Filling annular space between carrier pipe and primary tunnel liner, casing, or ground, by pumping.

D. Ground Stabilization Grouting. Filling of voids, fissures, or under-slab settlement due to caving or loss of ground by injecting grout under gravity or pressure to fill void.

E. Carrier Pipe. Sanitary or storm sewer or water line installed inside primary tunnel support.

1.05 REFERENCE STANDARDS

A. ASTM C 138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.

B. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar.

C. ASTM C 150 - Standard Specification for Portland Cement.

D. ASTM C 494 - Standard Specification for Chemical Admixture for Concrete.

E. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

F. ASTM C 869 - Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete.

G. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.

H. ASTM C 942 - Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory.

I. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description of materials, grout mix, equipment and operational procedures to accomplish each grouting operation. Description may include sketches as appropriate, indicating type and location of mixing equipment, pumps, injection points, venting method, flow lines, pressure measurement, volume measurement, grouting sequence, schedule, and stage volumes. Tests and certifications shall have been performed within last 12 months prior to date of submittal.

C. Submit grout mix design report, including:

1. Grout type and designation
2. Grout mix constituents and proportions, including materials by weight and volume
3. Grout densities and viscosities, including wet density at point of placement
4. Initial set time of grout
5. Bleeding, shrinkage/expansion
6. Compressive strength
7. Detailed description of grout pressure limiting equipment
8. For annular space grouting, buoyant force calculations and bulkhead designs

(See Section 02517 - Water Line in Tunnel) NOT USED

D. For cellular grout, also submit the following:

1. Foam concentrate supplier's certification of dilution ratio for foam concentrate.
2. A description of proposed cellular grout production procedures.

E. Maintain and submit logs of grouting operations indicating pressure, density, and volume for each grout placement.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grouting materials: Conform to Section 03315 - Concrete for Utility Construction, except as modified in the following paragraphs.

B. Grout Type Applications.

1. Grout for pressure grouting, backfill grouting and annular grouting: Sand-cement mortar mix or cellular grout with minimum 1,500 psi compressive strength and pH in alkaline region.

2. Grout for annular grouting of sanitary sewer: Low density (cellular) grout, unless otherwise approved by Project Manager.

3. Grout for filling space around manholes in shafts: Sand-cement mortar mix.

4. Ground stabilization: Sand-cement mortar mix.

C. Do not include toxic or poisonous substances in grout mix or otherwise inject such substances underground.

2.02 GROUT

A. Employ and pay for commercial testing laboratory, acceptable to Project Manager, to prepare and test grout mix design. Develop one or more mixes based on following criteria as applicable:

1. Size of annular void between sewer pipe and liner, or size of void between primary liner and surrounding soil

2. Absence or presence of groundwater

3. Adequate retardation

4. Non-shrink characteristics

5. Pumping distances

B. Prepare mixes that satisfy required application. Provide materials conforming to the following standards:

1. Cement: ASTM C 150

2. Fly Ash: ASTM C 618

3. Water: Potable

4. Foam: ASTM C 869

5. Slurry: ASTM C 138

6. Cellular Grout: ASTM C 138

7. Sand for sand-cement mortar mix: ASTM C 144

C. Provide grout meeting the following minimum requirements:

1. Minimum 28-day unconfined compressive strength: 1500 psi for water lines, 1000 psi for other carrier pipes for mortar grout and 300 psi for cellular grout.

2. Determine strength by ASTM C 942.

3. Maximum allowable density: Less than 130 pcf.

D. Fluidifier. Provide fluidifier, meeting ASTM C 937 that holds solid constituents of grout in colloidal suspension and is compatible with cement and water used in grouting operations.

E. Admixtures.

1. Use admixtures meeting ASTM C 494 and ASTM C 1017 as required, to improve pump ability, control time of set, hold sand in suspension and reduce segregation and bleeding.

2. For cellular grout, do not use foam or admixtures that promote steel corrosion

3. Ensure that admixtures used in mix are compatible. Provide written confirmation from admixture manufacturers of their compatibility.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Project Manager at least 24 hours in advance of grouting operations.

B. Select and operate grouting equipment to avoid damage to new or existing underground utilities and structures.

C. In selection of grouting placement consider pipe flotation, length of pipe, length of tunnel, depth from surface, and type of sewer pipe, type of pipe blocking and bulkheading, grout volume and length of pipe to be grouted between bulkheads.

D. Operate dewatering systems until grouting operations are complete and grout has reached initial set.

3.02 EQUIPMENT

A. Batch and mix grout in equipment of sufficient size and capacity to provide necessary quality and quantity of grout for each placement stage.

B. Use equipment for grouting of type and size generally used for work, capable of mixing grout to homogeneous consistency, and providing means of accurately measuring grout component quantities and accurately measuring pumping pressures. Use pressure grout equipment which delivers grout to injection point at steady pressure.

3.03 PRESSURE GROUTING FOR PRIMARY TUNNEL AND SHAFT LINER

A. Perform grouting operations to fill voids outside of primary tunnel or shaft liner.

B. For nonexpendable primary liners installed behind shield or tunnel boring machine (TBM), fill voids with sand-cement grout promptly after each ring of liner is out of shield. Keep grout pressure below value that may cause damage or distortion to installed liner plate rings. Provide seals on tail of shield or TBM which will prevent grout from spilling.

C. For nonexpendable primary liners installed by hand mining or in shafts, grout once every 4 feet or more frequently when conditions dictate.

D. Control grout pressures so that tunnel or shaft liner is not overstressed, and ground heave is avoided.

E. For liner requiring grout, perform back grouting once each shift, or more often when required to ensure that all voids are filled.

3.04 ANNULAR GROUTING FOR SEWER LINE IN TUNNELS AND IN CASED OR UNCASED AUGERS

A. Fill annular space between sewer pipe and tunnel primary liner, casing or ground, with grout.

B. Placement

1. Placement Limits: Predetermine limits of each grout placement stage by size and capacity of batching equipment and initial set time of proposed grout. Under no circumstances shall placement continue at grout port longer than that period of time for mix to take initial set. Locate grout hole spacing and locations according to number of stages necessary to grout tunnel liners. Stage or lift cannot be installed on another lift until proper set has been attained. Have placement procedures approved by admixture or additive manufacturer.

2. Limit pressure on annular space to prevent damage or distortion to pipe or liner. Define limiting and estimated required pressure range. Provide an open ended, high point tap or equivalent vent and monitor it at bulkhead opposite to

point of grouting.

3. Pump grout until material discharging is similar in consistency to that at point of injection.

4. In primary lined tunnel, limit length of pipe installed to 200 feet or less before grouting same length of sewer line. Repeat this cycle until all pipe is installed and grouted.

C. Remove temporary bulkheads installed for grouting.

D. Batch and mix cellular grout mechanically to ensure consistency of mix. Wet solids thoroughly before introduction of foaming agent. Operate batching system to maintain slurry weight within 3 percent of design density. Introduce foam into slurry in accordance with manufacturer's recommendations.

3.05 PRESSURE GROUTING FOR JACKED PIPE

A. For jacked pipe 60 inches in diameter or greater, pressure grout annulus after installation, displacing bentonite lubrication. Jacked pipes less than 60-inch diameter may be left ungrouted unless excavated diameter exceeds external pipe diameter by more than one inch.

B. Inject grout through grout holes in sewer pipe. Drilling holes from surface or through carrier pipe walls is not allowed. Perform grouting by injecting it at pipe invert with bentonite displacement occurring through high point tap or vent.

C. Control ground water as necessary to permit completion of grouting without separation of grout materials.

D. Limit pressures to prevent damage or distortion to pipe or to keep flexible pipe within acceptable tolerances.

E. Pump grout until material discharging is similar in consistency to that at point of injection.

3.06 GROUND STABILIZATION GROUTING

A. Completely fill voids outside limits of excavation caused by caving or collapse of ground. Fill with gravity or pressure injected sand-cement grout as necessary to fill void.

B. Take care in grouting operations to prevent damage to adjacent utilities or public or private property. Grout at pressure that will not distort or imperil portion of work or existing installations or structures.

C. Verify that void has been filled by volumetric comparisons and visual inspection. In case of settlement under existing slabs, take cores as directed by Project Manager, at no additional cost to City, to demonstrate that void has been filled.

3.07 FIELD QUALITY CONTROL

A. Pressure Grouting for Primary Tunnel and Shaft Liners.

1. For each shaft, make one set of four compressive test specimens for each 30-foot depth and one set for remaining portion less than 30-foot increment.

2. Make one set of four compressive test specimens for every 200 feet of primary lined, (non-expandable) tunnel requiring grout.

B. Annular Grouting for Sewer Line in Tunnels and in Cased or Uncased Augers.

1. Make one set of four compressive test specimens for every 200 feet of sewer pipe installed in primary lined tunnel.

2. For cased or uncased augers, make one set of four compressive test specimens for each grouting operation, or for each 100 feet of pipe installed, whichever is more frequent.

3. For cellular grout, check slurry density both at point of batching and placement at least twice each hour in accordance with ASTM C 138. Record density, time, and temperature. Density must be within 3 percent of design density at point of batching and 5 percent of design density at point of placement.

C. Pressure Grouting for Jacked Pipe. Make one set of four compressive test specimens for every 400 feet of jacked pipe pressure grouting.

D. Ground Stabilization Grouting. Make one set of four compressive test specimens for every location where ground stabilization grouting is performed.

END OF SECTION

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Section 02447

AUGERING PIPE FOR WATER LINES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installing water pipe by augering.

B. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water mains and large-diameter (greater than 20 inches) water mains. When specifications for large-diameter water mains differ from those for small- diameter water mains, paragraphs for large-diameter mains will govern for large-diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Casing including carrier pipe installed by augering methods will be measured and paid for by the linear foot from end to end of the casing. Casing may be installed, at the Contractor's option, at locations other than shown on the Drawings, at no additional cost to the Owner.

2. Payment will include and be full compensation for labor, equipment, materials and supervision for and construction of the water pipe, complete in place including disposal of excess materials, trench protection, excavation of augering pits, shoring, dewatering, utility adjustments, spacers, grouting, backfill, clean-up, and other related work necessary for construction as indicated on the Drawings and specified in this Section.

3. Cost for pits and other excavations shall be included in the unit price for augering.

4. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Augering: Installation of steel casing by excavating soil at the advancing end of casing and transporting spoil through casing by an auger, while advancing casing by jacking at same rate as auger excavation progresses.

1.04 REFERENCE STANDARDS

A. American Railway Engineering Association (AREA) Manual for Railway Engineering.

B. American Association of State Highway and Transportation Officials (AASHTO).

C. AWWA C200 – Steel Water Pipe, 6-Inch and Larger.

1.05 REGULATORY REQUIREMENTS

A. Conform to Texas State Department of Highways and Public Transportation permit requirements for installations under state highways. Owner will obtain required permits for State Highway crossings.

B. Installations Under Railroads:

1. Secure and comply with requirements of right-of-entry for crossing railroad company's easement or right-of-way from railroad companies affected. Comply with railroad permit requirements. Owner will obtain required permits for railroad crossing.

2. No extra compensation for damages due to delays caused by the railroad requesting work to be done at hours which will not inconvenience the railroad.

C. Trench safety systems for pits reference Section 01561 – Trench Safety Systems.

1.06 SUBMITTALS

A. Make submittals in accordance with requirements of Section 01330 - Submittal Procedures.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Provide casing pipe which is straight, circular in section, painted, welded steel pipe, manufactured in accordance with AWWA C200.

B. Provide water pipe in accordance with Section 02511 – Water Mains.

C. Casing Spacers: As required by Drawings.

D. Casing End Seals: As required by Drawings.

PART 3 E X E C U T I O N

3.01 TRAFFIC CONTROL

A. Conform to applicable provisions of Section 01555 - Traffic Control and Regulation.

B. During construction operations, furnish, and maintain barricades and lights to safeguard traffic and pedestrians, until such time as backfill has been completed and removed from site.

3.02 LOCATION AND SIZE OF AUGER PITS

A. Where possible, locate auger pits and associated work areas to avoid blocking driveways and cross streets and to minimize disruption to business and commercial interests.

B. Provide adequate room to meet Contractor's operational requirements. If the required working room extends beyond the Owner provided right-of-way or easement, acquire additional temporary easement as needed.

C. Provide a full cover or other security fencing for each access pit in which there is no construction activity or which is unattended by Contractor's personnel.

D. Backfill in accordance with Section 02317 – Excavation and Backfill for Utilities.

E. Auger pits that are excavated and backfilled as part of open-cut water line construction shall be in accordance with Section 02316 – Excavation and Backfill for Structures and Section 02317 – Excavation and Backfill for Utilities.

F. Install sheeting, lining, shoring, and bracing required for protection of the workmen and the public in accordance with Section 01561 – Trench Safety Systems.

G. Provide groundwater control and drainage from pits while work is in progress and until pit is properly backfilled. Conform to requirements of Section 01578 – Control Groundwater and Surface Water.

3.03 AUGERING

A. Provide jacks, mounted on a frame or against a backstop, of a capacity suitable for forcing the excavating auger and casing through the soil conditions to be encountered. Operate jacks so that even pressure is applied to the casing.

B. Provide steerable front section of casing to allow grade adjustments. Provide a water level or other means to allow monitoring of the grade elevation of the auger casing.

C. Bentonite slurry may be used only to lubricate the casing during installation. The use of water to facilitate removal of spoil is prohibited. Water jetting for excavation of the soil is prohibited. Auger mechanically with use of a pilot hole entire length of

crossing and check for line and grade on opposite end of bore from work pit. Place excavated material outside working pit and dispose of as specified.

D. Depending on the character of the soil encountered during the augering operation, conduct operations without interruption, insofar as practical, to prevent the hole from collapsing.

E. Tolerances from lines and grades shown on the Drawings for pipe installed in casing are plus or minus 6 inches in horizontal alignment, and plus or minus 1 ½ inches in elevation.

3.04 CASING ADVANCEMENT

A. Use heavy-duty jacks sized for forcing casing through embankment. Use appropriate jacking head and bracing between jacks and jacking head and jacking frame or backstop. Apply jacking pressure uniformly around ring casing and to direct it in proper line and grade. Place jacking assembly in line with direction and grade of casing. Remove embankment material just ahead of casing and pass material through casing. Force casing through embankment with jacks into excavated auger hole.

B. Removal of embankment may extend beyond end of casing depending on character of material, but shall not exceed 2 feet in any case. Decrease advance excavation if character of material being excavated makes it desirable to keep advance excavation closer to end of casing.

C. Jack casing from low or downstream end.

D. Use cutting edge of steel plate around head end of casing extending short distance beyond end of casing with inside angles or lugs to keep cutting edge from slipping back onto casing.

E. Once jacking of casing is begun, carry on without interruption, insofar as practicable, to prevent casing from becoming firmly set in embankment.

F. Remove and replace any casing damaged in jacking operations.

G. Grout annular space between casing and excavated hole when loss of embankment occurs or when clearance of 2 inches is exceeded. Refer to Section 02431 – Tunnel Grout.

3.05 DISPOSAL OF EXCESS MATERIAL

A. Remove and dispose of spoil from the job site in accordance with Section 01576 – Waste Material Disposal.

3.06 CARRIER PLACEMENT

A. Installation of carrier pipe shall begin no sooner than 24 hours after completion of casing installation.

B. Interior of casing shall be jetted and swabbed to remove as much remaining soil as practical.

C. Install spacers on carrier pipe in accordance with manufacturer's instructions and Drawings.

D. Install restraints at each joint of carrier pipe. Follow manufacturer's instructions.

E. Advance carrier pipe through casing in a fashion similar to casing advancement.

F. Seal annulus between casing and carrier as shown on the Drawings.

3.07 TESTING

A. Carrier pipes in casings shall be tested independently of other sections at the Work. Hydrostatic testing shall be in accordance with Section 02515 – Hydrostatic Testing of Pipelines. Testing shall be performed prior to backfilling of pits.

3.08 SETTLEMENT MONITORING

A. Monitor the ground surface elevation along the augering operation. Locate and record settlement monitoring points with respect to construction elevations. Record elevations to an accuracy of 0.01 feet for each monitoring point location. Establish monitoring points at locations and by methods that protect them from damage by construction operations, tampering, or other external influences. As a minimum, locate survey points as follows:

1. For road crossings: Centerline and each shoulder.

2. Railroads: Track subbase at centerline of each track.

3. Utilities and Pipelines: Directly above and 10 feet before and after the utility or pipeline intersection.

4. Long bores under improved areas such as pavements: Ground surface elevations must be recorded on the centerline ahead of augering operations

at locations not to exceed 50 feet apart (including points located for roads, railroads, utilities, and pipelines), or at least three locations per augering drive.

B. Reading Frequency and Reporting. Take settlement survey readings:

1. Prior to the auger excavation reaching the point.

2. After the auger reaches the monitoring point in plan.

3. After grouting of the ground supporting pipe or casing is complete.

C. Immediately report to the Resident Project Representative any movement, cracking, or settlement with is detected.

D. Immediately notify Resident Project Representative of any required repairs due to cracking or settlement

E. Provide action/repair plan prior to repair of any area related to augering.

3.09 CLEANUP

A. Conform to applicable provisions of Section 01576 – Waste Material Disposal.

END OF SECTION

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Section 02448

AUGERING PIPE FOR SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installation of sewer pipe by augering.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Casing, including sewer pipe, installed by augering methods will be measured and paid by the linear foot from end to end of the casing. Casing may be installed, at the Contractor's option, at locations other than shown on the Drawings, at no additional cost to the Owner.

2. Payment will include and be full compensation for labor, equipment, materials and supervision for construction of the sewer pipe, complete in place including disposal of excess materials, trench protection, excavation of augering pits, shoring, dewatering, utility adjustments, spacers, grouting, backfill, traffic control, clean-up, and other related work necessary for construction as indicated on the Drawings and specified in this Section.

3. Cost for pits and other excavations shall be included in the unit price for augering.

4. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Augering: Installation of steel casing by excavating soil at the advancing end of casing and transporting spoil through casing by an auger, while advancing casing by jacking at same rate as auger excavation progresses.

1.04 REFERENCE STANDARDS

A. American Railway Engineering Association (AREA) Manual for Railway Engineering.

B. American Association of State Highway and Transportation Officials (AASHTO).

C. AWWA C 200 - Steel Water Pipe, 6-Inch and Larger.

1.05 REGULATORY REQUIREMENTS

A. Conform to Texas State Department of Highways and Public Transportation permit requirements for installations under state highways. Owner will obtain required permits for State Highway crossings.

B. Installations Under Railroads:

1. Prior to installation secure and comply with requirements of right-of-entry for crossing railroad company's easement or right-of-way from railroad companies affected. Comply with railroad permit requirements. Owner will obtain required permits for railroad crossing.

2. No extra compensation for damages due to delays caused by the railroad requesting work to be done at hours which will not inconvenience the railroad.3

3. Maintain minimum 35-foot cleanup from centerline of tracks.

4. Contractor responsible for all damages and to coordinate, obtain approval for all repairs.

C. Trench safety systems for pits reference Section 01561 – Trench Safety Systems.

1.06 SUBMITTALS

A. Make submittals in accordance with requirements of Section 01330 - Submittal Procedures.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Provide casing pipe which is straight, circular in section, painted, welded steel pipe, manufactured in accordance with AWWA C 200.

B. Provide sewer pipe in accordance with Section 02531 – Gravity Sanitary Sewers.

C. Casing Spacers: As required by Drawings.

D. Casing End Seals: As required by Drawings.

PART 3 E X E C U T I O N

3.01 TRAFFIC CONTROL

B. Conform to applicable provisions of Section 01555 - Traffic Control and Regulation.

B. During construction operations, furnish, and maintain barricades and lights to safeguard traffic and pedestrians, until such time as backfill has been completed and removed from site.

3.02 LOCATION AND SIZE OF AUGER PITS

A. Where possible, locate auger pits and associated work areas to avoid blocking driveways and cross streets and to minimize disruption to business and commercial interests.

B. Provide adequate room to meet Contractor's operational requirements. If the required working room extends beyond the Owner provided right-of-way or easement, acquire additional temporary easement as needed.

C. Provide a full cover or other security fencing for each access pit in which there is no construction activity or which is unattended by Contractor's personnel.

D. Backfill in accordance with Section 02317 – Excavation and Backfill for Utilities.

E. Auger pits that are excavated and backfilled as part of open-cut pipe line construction shall be in accordance with Section 02316 – Excavation and Backfill for Structures and Section 02317 – Excavation and Backfill for Utilities.

F. Install sheeting, lining, shoring, and bracing required for protection of the workmen and the public in accordance with Section 01561 – Trench Safety Systems.

G. Provide groundwater control and drainage from pits while work is in progress and until pit is properly backfilled. Conform to requirements of Section 01578 – Control Groundwater and Surface Water.

3.03 AUGERING

A. Provide jacks, mounted on a frame or against a backstop, of a capacity suitable for forcing the excavating auger and casing through the soil conditions to be encountered. Operate jacks so that even pressure is applied to the casing.

B. Provide steerable front section of casing to allow grade adjustments. Provide a water level or other means to allow monitoring of the grade elevation of the auger casing.

C. Bentonite slurry may be used only to lubricate the casing during installation. The use of water to facilitate removal of spoil is prohibited. Water jetting for excavation of the soil is prohibited. Auger mechanically with use of a pilot hole entire length of

crossing and check for line and grade on opposite end of bore from work pit. Place excavated material outside working pit and dispose of as specified.

D. Depending on the character of the soil encountered during the augering operation, conduct operations without interruption, insofar as practical, to prevent the hole from collapsing.

E. Tolerances from lines and grades shown on the Drawings for pipe installed in casing are plus or minus 6 inches in horizontal alignment, and plus or minus 1 ½ inches in elevation.

3.04 CASING ADVANCEMENT

A. Use heavy-duty jacks sized for forcing casing through embankment. Use appropriate jacking head and bracing between jacks and jacking head and jacking frame or backstop. Apply jacking pressure uniformly around ring casing and to direct it in proper line and grade. Place jacking assembly in line with direction and grade of casing. Remove embankment material just ahead of casing and pass material through casing. Force casing through embankment with jacks into excavated auger hole.

B. Removal of embankment may extend beyond end of casing depending on character of material, but shall not exceed 2 feet in any case. Decrease advance excavation if character of material being excavated makes it desirable to keep advance excavation closer to end of casing.

C. Jack casing from low or downstream end.

D. Use cutting edge of steel plate around head end of casing extending short distance beyond end of casing with inside angles or lugs to keep cutting edge from slipping back onto casing.

E. Once jacking of casing is begun, carry on without interruption, insofar as practicable, to prevent casing from becoming firmly set in embankment.

F. Remove and replace any casing damaged in jacking operations.

G. Grout annular space between casing and excavated hole when loss of embankment occurs or when clearance of 2 inches is exceeded. Refer to Section 02431 – Tunnel Grout.

3.05 DISPOSAL OF EXCESS MATERIAL

A. Remove and dispose of spoil from the job site in accordance with Section 01576 - Waste Material Disposal.

3.06 CARRIER PLACEMENT

A. Installation of carrier pipe shall begin no sooner than 24 hours after completion of casing installation.

B. Interior of casing shall be jetted and swabbed to remove as much remaining soil as practical.

C. Install spacers on carrier pipe in accordance with manufacturer's instructions and Drawings.

D. Install restraints at each joint of carrier pipe. Follow manufacturer's instructions.

E. Advance carrier pipe through casing in a fashion similar to casing advancement.

F. Seal annulus between casing and carrier as shown on the Drawings.

3.07 TESTING

A. Carrier pipes in casings shall be tested independently of other sections at the Work. Pneumatic testing shall be in accordance with Section 02533 – Acceptance Testing for Sanitary Sewers. Testing shall be performed prior to backfilling of pits.

3.08 SETTLEMENT MONITORING

A. Monitor the ground surface elevation along the augering operation. Locate and record settlement monitoring points with respect to construction elevations. Record elevations to an accuracy of 0.01 feet for each monitoring point location. Establish monitoring points at locations and by methods that protect them from damage by construction operations, tampering, or other external influences. As a minimum, locate survey points as follows:

1. For road crossings: Centerline and each shoulder.

2. Railroads: Track subbase at centerline of each track.

3. Utilities and Pipelines: Directly above and 10 feet before and after the utility or pipeline intersection.

4. Long bores under improved areas such as pavements: Ground surface elevations must be recorded on the centerline ahead of augering operations at locations not to exceed 50 feet apart (including points located for roads, railroads, utilities, and pipelines), or at least three locations per augering drive.

B. Reading Frequency and Reporting. Take settlement survey readings:

1. Prior to the auger excavation reaching the point.

2. After the auger reaches the monitoring point in plan.

3. After grouting of the ground supporting pipe or casing is complete.

C. Immediately report to the Resident Project Representative any movement, cracking, or settlement with is detected.

3.09 CLEANUP

A. Conform to applicable provisions of Section 01576 – Waste Material Disposal.

END OF SECTION

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Section 02506

POLYVINYL CHLORIDE PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Polyvinyl chloride (PVC) pressure pipe for water distribution and sanitary sewer force mains in nominal diameters 4 inches through 16 inches.

B. Polyvinyl chloride sewer pipe for gravity sanitary sewers in nominal diameters 4 inches through 48 inches.

C. Polyvinyl chloride pressure pipe for gravity sanitary sewers and force mains in nominal diameters 4 inches through 36 inches.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for PVC pipe under this section. Include all costs in unit price for related work in which it is a component or included as specified in the following sections:

   a. Section 02511 - Water Main

   b. Section 02531 - Gravity Sanitary Sewers

   c. Section 02532 – Sanitary Sewer Force Mains

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ANSI A21.5 (AWWA C 105) - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.

B. ANSI A21.10 (AWWA C 110) - Ductile-Iron and Gray-Iron Fittings, 3 inches through 48 inches for Water and Other Liquids.

C. ANSI A21.11 (AWWA C 111) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

D. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

E. ASTM D 1784 - Standard Specification for Rigid Polyvinyl Chloride Compound and Chlorinated Polyvinyl Chloride Compounds.

F. ASTM D 2241 - Standard Specification for Polyvinyl Chloride Plastic Pipe (SDR-PR).

G. ASTM D 2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

H. ASTM D 2444 - Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

I. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride Sewer Pipe and Fittings.

J. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

K. ASTM D 3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

L. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F 679 - Specification for Polyvinyl Chloride Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

N. ASTM F 794 - Specification for Polyvinyl Chloride Large-Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

O. AWWA C 900 - Polyvinyl Chloride Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.

P. AWWA C 905 - Polyvinyl Chloride Water Transmission Pipe, Nominal Diameters 14 Inches Through 36 Inches.

Q. UNI-B-11 - Recommended Standard Specification for Polyvinyl Chloride Water Transmission Pipe (Nominal Diameters 14 Inches through 36 Inches).

R. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.05 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900 or AWWA C 905 for pressure pipe applications, or the appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe has been hydrostatically tested at the factory in accordance with AWWA C 900 or AWWA C 905 and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in United States.

Certification from any other source is not acceptable. Furnish copies of test reports to Engineer for review. Cost of testing shall be borne by Contractor.

PART 2 P R O D U C T S

2.01 MATERIAL

A. Use PVC compounds in the manufacture of pipe that contain no ingredient in an amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-B virgin PVC compounds as defined In ASTM D 1784. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage. Resident Project Representative may reject all pipes found to have defects or is nonconforming.

C. For PVC pressure pipe used for water mains, provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.

D. Gaskets:

1. Gaskets shall meet the requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.

E. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

F. PVC pipe for water service shall bear National Sanitation Foundation Seal of Approval (NSF-PW).

2.02 WATER SERVICE PIPE

A. Pipe 4-inch through 12-inch: AWWA C 900, Class 150, DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 16-inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Joints: ASTM D 3139; push-on type joints in integral bell or separate sleeve couplings. Do not use socket type or solvent weld type joints.

D. Make curves and bends by deflecting the joints. Do not exceed maximum deflection recommended by the pipe manufacturer. Submit details of other methods of providing curves and bends for review by Engineer.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

F. Detectable underground warning tape shall be 3” wide Magna Tec or approved equal.

2.03 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: Conform to the requirements of Section 02501 – Ductile Iron Pipe and Fittings.

2.04 GRAVITY SANITARY SEWER PIPE

A. PVC gravity sanitary sewer pipe shall be in accordance with the provisions in the following table:

WALL CONSTRUCTION	ASTM DESIGNATION	SDR (MAX.)/ STIFFNESS (MIN.)	DIAMETER SIZE RANGE
Solid	D3034	SDR 26 / PS 115	6" to 15"
	D3034	SDR 35 / PS 46	6" to 15"
	F679	SDR 35 / PS 46	18" to 27"
	AWWA C900	DR 18 / N/A	4" to 12"
	AWWA C905	DR 18 / N/A	14" to 36"
Profile	F794 F794	N/A / 46 psi N/A / 46 psi	12” TO 48” 21” TO 48”

B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-inch-diameter crossing over waterlines, or crossing under waterlines with less than 2 feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings for a minimum of 10 feet each direction from the waterline.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. The manufacturer shall test a sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

2.05 SANITARY SEWER FORCE MAIN PIPE

A. Provide PVC pressure pipe conforming to the requirements for water service pipe, and conforming to the minimum working pressure rating specified in Section 02532 - Sanitary Sewage Force Mains.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting the requirements of ASTM F 477. In designated areas requiring

restrained joint pipe and fittings, use EBAA Iron Series 2000PV, Uniflange Series 1350 restrainer, or equal joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide ductile iron fittings as per Paragraph 2.03, except furnish fittings with one of the following internal linings:

1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to the interior surface of the fitting, as manufactured by American Cast Iron Pipe "Polybond", or U.S. Pipe "Polyline".

2. Nominal 40 mils (35 mils minimum) polyurethane, Corro-pipe II by Madison Chemicals, Inc.

3. Nominal 40 mils (35 mils minimum) ceramic epoxy, Protecto 401 by Enduron Protective Coatings.

D. Exterior Protection: Provide polyethylene wrapping of ductile iron fittings as required by Section 02528 - Polyethylene Wrap.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

PART 3 E X E C U T I O N

3.01 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with the manufacturer's recommendations.

2. 3.02 INSTALLATION

A. Conform to requirements of Section 02511 - Water Mains, Section 02531 - Gravity Sanitary Sewers, and Section 02532 - Sanitary Sewage Force Mains, as applicable.

B. Install PVC pipe in accordance with Section 02317 - Excavation and Backfill for Utilities, ASTM D 2321, and manufacturer's recommendations.

C. Water service pipe 12 inches in diameter and smaller: Installed to clear utility lines and have minimum 4 feet of cover below lowest property line grade of street, unless otherwise required by Drawings.

D. Avoid imposing strains that will overstress or buckle the pipe when lowering pipe into trench.

E. Install 3” wide detectable warning tape approximately 24” below the finished surface above all pipe runs.

END OF SECTION

Section 02511

WATER MAINS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installation of water mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water mains installed by open-cut is on a linear foot basis for each size of pipe installed. Measurement is detailed as follows:

a. Mains: Measured along the centerline axis of the pipe, through fittings and valves.

b. Branch Pipes: Measured from the centerline of the main, through fittings and valves, to the end of the branch.

2. Payment for interconnections made by tapping sleeves and tapping gate valves shall be as covered under separate or related sections. Payment for interconnections made by tapping sleeves and tapping gate valves shall be as covered under separate or related sections.

3. Refer to Section 01270 - Measurement and Payment.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ANSI/NSF Standard 61.

B. ASTM A 126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

C. ASTM B 21 - Specification for Naval Brass Rod, Bar, and Shapes.

D. ASTM B 98 - Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.

E. ASTM B 584 - Specification for Copper Alloy Sand Castings for General Applications.

F. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

G. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Photographs: Prior to commencement of construction, take 35mm color photographs of entire route of project and present one copy of prints and negatives to Engineer. Submit one copy of prints to Resident Project Representative. Required items in photographs include, but are not limited to, the following:

1. Date fixed on negative by calendate attachment in camera (automatically includes date on film).

2. Location of photograph, house numbers and streets, direction of view, along with project numbers on chalkboard in photo.

3. Condition of:

a. Yard (near side and far side of street).
b. House walk and sidewalk.
c. Curb.
d. Area between walk and curb.
e. Particular features (yard light, shrubs, fences, trees, etc.).
f. Street failures.

4. Take sufficient number of photographs to show existence or nonexistence of cracked asphalt, concrete, trees, shrubs, and grass required above. Bind photographs in 3-ring notebook within plastic pockets. No payment will be made for photography under this Section. Include cost in unit price for water mains.

PART 2 P R O D U C T S

2.01 PIPE MATERIALS

A. Install pipe materials which conform to following:

1. Section 02501 - Ductile Iron Pipe and Fittings.

2. Section 02502 - Steel Pipe and Fittings.

3. Section 02506 - Polyvinyl Chloride Pipe.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

2.02 JOINT RESTRAINTS

A. Ductile-Iron Pipe:

1. Series 1100 Megalug Mechanical Joint Restraint by EBAA Iron, Inc.

2. Super-Lock Joint by Clow Corporation.

3. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.

4. TR-Flex or Field-Lok Joint by U.S. Pipe and Foundry Company.

B. PVC Pipe:

1. Fittings: JCM 610 Sur-Grip Fitting Restrainer by JCM Industries, Inc. or Series 2000 PV Mechanical Joint Restraint Gland by EBAA Iron, Inc., or approved equal.

2. Bell and Spigot: JCM 620 or 621 Sur-Grip Bell Joint Restrainer by JCM Industries, Inc. or Series 1600 or Series 2800 Restraint Harness by EBAA Iron, Inc., or approved equal.

2.03 COUPLINGS AND APPURTENANCES

A. Flexible (Dresser-type) Couplings.

1. Install where shown on Drawings or where allowed by Resident Project Representative for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.

2. For steel pipe; sleeve-type flexible couplings, Dresser Style 38, Rockwell Type 411, or equal. Thickness of middle ring equal to or greater than thickness of pipe wall.

3. Flanged adapter couplings for steel pipe; Dresser Style 128, Rockwell Type 913, or approved equal.

4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of T.C. Mastic as manufactured by the Tape Coat Company, Inc., Bitumastic No. 50 as manufacturer by Koppers Company, Inc., or approved equal.

B. Victaulic Joints. Make joint with Victaulic Style 77 coupling fitted with Grade H molded synthetic rubber gasket.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints. Lay pipe with bell ends facing in direction of laying.

C. Lay pipe to lines and grades shown on Drawings. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 50 feet on record drawings.

D. Confirm that separation from gravity sanitary sewers and manholes or from force mains have minimum clearance as specified in this Section or 9 feet in all directions unless a special design is provided on the Drawings.

1. Parallel water line and gravity sanitary sewer, force main or manhole with no leaks: Minimum 4 foot horizontal clearance from outside wall of water line to outside wall of gravity sanitary sewer, force main, or manhole.

2. Water line crossing above a gravity sanitary sewer or force main with no leaks: Minimum 2 foot vertical clearance.

E. Where above clearances cannot be attained, and a special design has not been provided on Drawings, obtain direction from Engineer before proceeding with construction.

F. Keep pipe trenches free of water which might impair pipe laying operations. Prevent pipe bells from coming in contact with subgrade. Grade pipe trenches to provide uniform support along bottom of pipe. Excavate for bell holes for proper sealing of pipe joints after bottom has been graded and in advance of placing pipe. Lay not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

G. If asbestos-cement pipe is encountered, follow safety practices outlined in the Asbestos-Cement Pipe Producers Association publication, Recommended Work Practices for A/C Pipe. Strictly adhere to recommended practices contained in said publication.

3.02 HANDLING, CLEANING AND INSPECTION

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.

2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings.

Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.

4. For large-diameter water mains, handle pipe only by means of a sling of canvas, leather, nylon, or similar material. The sling shall be a minimum 36 inches in width. Do not tear or wrinkle tape layers.

5. Use precautions to prevent injury to pipe, protective linings and coatings.

   a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.

   b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.

   c. Do not lift pipe using hooks at each end of pipe.

   d. Do not place debris, tools, clothing, or other materials on pipe.

6. Repair damage to pipe or protective lining and coating before final acceptance.

7. Permit no visible cracks longer than 6 inches, measured within 15 degrees of a line parallel to pipe longitudinal axis in the cores of finished pipe with the following exceptions:

   a. In the surface laitance of centrifugally cast concrete.

   b. In sections of pipe with steel reinforcing collars or wrappers.

   c. Within 12 inches of pipe ends.

   d. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.03 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities and Section 02447 - Augering Pipe for Water Lines.

B. Bedding: Use bedding materials in conformance with Section 02320 - Utility Backfill Materials.

C. Backfill: Use bank run sand or earth or native soil as specified in Section 02320 - Utility Backfill Materials. Backfill excavated areas in the same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Field density tests may be made at a frequency determined by the Engineer. Water tamping or jetting is not allowed.

3.04 PIPE CUTTING

A. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges in accordance with pipe manufacturers recommendations.

3.05 PIPING INSTALLATION

A. Do not lay pipe unless subgrade is free of water. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material. Wedging or blocking up bell will not be acceptable.

B. Do not install pipe at greater depth than its design allows.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

3.06 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints:

1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.

2. Lubricate gaskets with nontoxic water-soluble lubricant, recommended by pipe manufacturer for potable water use, before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.

4. After the pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary, before remaking joint.

5. Where preventing movement is necessary due to thrust, use joint restraints.

B. Mechanical Joints:

1. Thoroughly clean socket and plain end of all rust or foreign material; slip the gland over plain end with the lip extension toward plain end, followed by the gasket with thick section facing the gland. Gaskets to be installed during very cold weather should be warmed first.

2. Lubricate socket, gasket and plain end with soapy water or an approved pipe lubricant meeting requirements of AWWA C111.

3. Insert plain end into socket and push gasket into position, making sure it is evenly seated in socket.

4. Slide gland into position, insert bolts and run nuts up finger-tight.

5. Using a torque wrench, tighten bolts to draw gland toward the pipe flange evenly, maintaining approximately the same distance between the gland and the face of the flange at all points around the joint. This process shall be repeated until all bolts are within the manufacturer's recommended torque range.

C. Flanged Joints:

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.

2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at the factory to proper dimensions.

3. Use high-strength, low-alloy, corrosion resistant steel conforming to ASTM A325 (Type 3). Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.

4. For in-line flange joints sized between 12 inches in diameter and greater and 24 inches in diameter and smaller, provide Phenolic PSI with nitrile seal, Type E LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal conforming to ANSI 21.11.

D. Welded Joints:

1. Prior to starting work, provide certification of qualification for welders employed on the project for type of work procedures and positions involved.

2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow

or become loose. Do not use mitered joints. Provide adequate working room under and beside pipe. Use exterior welds.

3. Furnish welded joints with trimmed spigots.

4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to 3/4 inch as long as 1-1/2-inch minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 5 degrees.

5. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt-welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, care shall be taken to avoid damage to linings and coatings.

6. Protect coal-tar-epoxy lining during welding by draping an 18-inch-wide strip of heat-resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.

7. Welding rods: Compatible with metal welded to obtain strongest bond, E-70XX.

8. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.

9. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.

10. Do not weld under any weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.

11. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.

12. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.

13. Welded Joints:

    a. Notify engineer in advance details of intended welding work.

    b. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2-1/2 degrees.

    c. Employ an independent certified testing laboratory to perform weld acceptance tests on welded joints. Include cost of such testing in contract

unit price bid for water line. Furnish copies of all test reports to Engineer for review. Test by magnetic particle test method for lap welds or by X-ray methods for butt welds, for 100 percent of all joint welds. Engineer has final decision as to suitability of all welds tested.

E. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by the Engineer. Contractor shall submit details of other methods of providing curves and bends for consideration by Engineer, and if accepted, shall be installed at no additional cost to the Owner.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer.

2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.

3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.

4. Replace, repair, or reapply coatings and linings as required.

5. Assessment of deflection may be measured by Engineer at any location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.

6. When rubber gasketed pipe is laid on a curve, join pipe in a straight alignment and then deflect to curved alignment.

3.07 CATHODIC PROTECTION APPURTENANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water main, access manhole piping and other major openings in water main, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint. No additional bonding required where joints are welded for thrust restraint.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.08 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water main.

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.09 THRUST RESTRAINT

A. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks or provide joints as specified.

B. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer for review by Engineer. Make adjustments in thrust restraint lengths at no additional cost to the Owner.

C. Passive resistance of soil will not be permitted in calculation of thrust restraint.

D. Use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide welded restraint joints for a minimum length of 16 feet on each side of beveled joints.

3.10 POLYETHYLENE WRAP

A. Conform to requirements of Section 02528 - Polyethylene Wrap.

3.11 CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during chlorination, testing, service transfers, abandonment of old mains, backfill and surface restoration.

B. Upon completion of section not exceeding 4000 feet per crew, chlorinate and pressure test. Begin transfer of services no later than 7 calendar days after successful completion of chlorination and pressure testing.

C. After transfer of services, but no later than 21 calendar days after successful completion of chlorination and pressure testing, begin abandonment of old mains, including resodding and placement of sidewalks and pavements.

D. Do not begin construction of additional sections if above conditions are not met.

E. Random stockpiles of excavated materials will not be permitted.

3.12 CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning.

3.13 DISINFECTION OF WATER LINES

A. Conform to requirements of Section 02514 - Disinfection of Water lines.

3.14 FIELD HYDROSTATIC TESTS

A. Conform to requirements of Section 02515 - Hydrostatic Testing of Pipelines.

3.15 LOCATION MARKING

A. Conform to requirements of Section 02535 – Non-Metalic Utility Line Marking and the drawings.

END OF SECTION

Section 02512

WATER SERVICE CONNECTIONS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Tapping mains and furnishing and installing new service lines for water.

B. Relocation of existing small water meters.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water connections is on a per each basis for each installation.

2. Payment for each meter includes all labor, materials, and equipment to relocate the existing meter.

3. No additional payment will be made for excavation, trench protection, augering, bedding, backfill, compaction, etc.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. AWWA C 800 - Underground Service Line Valves and Fittings.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Provide water service as shown on the Drawings.

PART 3 E X E C U T I O N

3.01 APPLICATION

A. Set service connections at right angles to proposed meter location.

B. Use tapping machine manufactured for pressure tapping purposes for 2-inch and smaller service taps on pressurized water mains.

C. Install service lines in open-cut trench in accordance with Section 02317 - Excavation and Backfill for Utilities except that service lines specifically indicated on Drawings shall be augered in accordance with Drawings.

D. Lay service lines with minimum of 30 inches of cover as measured from top of curb or, in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of 18 inches of cover below flow line of ditches to service lines.

E. Maintain service lines free of dirt and foreign matter.

F. Install service lines so that top of meter will be 4 to 6 inches below finished grade.

G. Locate water meters one foot inside street right-of-way, one foot on curbside of sidewalk, or as directed by Resident Project Representative.

H. Crossing of paved surfaces shall be in accordance with Section 02221 – Remove Existing Pavements and Structures, Section 02951 - Pavement Replacement for Utility Construction, and the Drawings.

I. Paved surfaces should be required and/or replaced immediately after specification work is completed. No extended or long period of time should pass.

J. Turf areas crossed or disturbed under this section shall be repaired in accordance with Section 02911 – Topsoil, Section 02922 – Sodding, and the Drawings

END OF SECTION

Section 02513

WET CONNECTIONS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Wet connections for new water mains and service lines to existing water mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Wet Connections.

2. No compensation will be given for extra work or for damages occurring as a result of an incomplete shutoff.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 DEFINITIONS

A. Wet connections consist of using existing valves to isolate sections of pipe to be connected, draining the isolated sections, and completing the connections.

B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of a 2-inch service line.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Sections 02501 through 02528 related to piping materials and to water distribution.

B. Valves shall conform to requirements of Section 02521 - Gate Valves.

PART 3 E X E C U T I O N

3.01 CONNECTION OPERATIONS

A. Plan wet connections in such manner and at such hours as to least inconvenience public. Notify Resident Project Representative at least 48 hours in advance of making connections.

B. Do not operate valves on mains in use by Owner. Owner will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Resident Project Representative is at job site. Connection work shall progress without interruption until complete once existing mains have been cut or plugs has been removed for making connections.

END OF SECTION

Section 02514

DISINFECTION OF WATER LINES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Disinfection of potable water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for disinfection of water lines under this Section. Include all costs in unit price or lump sum price of water lines.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. AWWA C 651 - Disinfecting Water Mains.

B. AWWA B 300 – Hypochlorites

C. NSF Standard 60 – Drinking Water Additives

PART 2 P R O D U C T S

2.01 HYPOCHLORITE

A. Dry hypochlorite: Dry hypochlorite shall be granular type and meet the requirements of AWWA B300 and NSF 60.

B. Hypochlorite solution: Solution prepared on – site from dry hypochlorite and potable water.

PART 3 E X E C U T I O N

3.01 CONDUCTING DISINFECTION

A. Water lines constructed shall be promptly disinfected after pressure tests are conducted. An acceptable bacteriologic test shall be obtained before water lines are connected to Owner's

water distribution system.

B. Water for disinfection and flushing shall be purchased from the Owner.

C. Coordinate chlorination operations through Resident Project Representative.

D. Provide test schedule to include test reports, test results and overall status of disinfection and pressure testing station to station, line by line.

3.02 PREPARATION

A. Use required temporary blind flanges, sleeves, plugs, and other items needed to facilitate disinfection of new mains. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Fire hydrants may be used as blow-offs to flush newly constructed water lines above. Where fire hydrants are not available, locations and designs for blow-offs shall be as indicated on Drawings. Install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Very slowly fill each section of pipe with water in a manner approved by Resident Project Representative. Before beginning disinfection operations, expel air from pipeline.

D. Install blow-off valves at end of main to facilitate flushing of dead-end water mains. Install permanent blow-off valves according to Drawings.

E. Excavations shall be backfilled immediately after installation of risers or blow-offs.

F. Correct problems that may prevent disinfection operations.

G. Notify and coordinate with Resident Project Representative a minimum of 48 hours before disinfection work is to be performed.

H. The following procedure may be used:

1. Introduce chlorinating material into water line in accordance with AWWA C 651.

2. If dry hypochlorite is used, it shall be placed in newly laid pipe as construction progresses.

3. Use sufficient quantities of chemicals to produce a concentration of 100 ppm of chlorine. Concentration shall be checked at point of pipeline filling. Concentration check shall be witnessed by Resident Project Representative.

4. Open and close valves in section being disinfected during contact period.

5. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 ppm. Concentration check shall be witnessed by Resident Project Representative.

3.03 BACTERIOLOGICAL TESTING

A. Microbiological sampling shall be done after disinfecting flush, but prior to connecting the new main into the existing distribution system in accordance with AWWA C651. Two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,000 linear feet of the new water main, plus one set from the end of the line. Samples for bacteriologic analysis shall be collected in sterile bottles. No hose or fire hydrant shall be used in the collection of samples.

B. If test results indicate need for additional disinfection of water lines based on Texas Commission on Environmental Quality, flush section and begin disinfection procedure again document and log all disinfection efforts and provide to engineer upon request.

3.04 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly, and as per specification.

END OF SECTION

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Section 02515

HYDROSTATIC TESTING OF PRESSURE PIPELINES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Field hydrostatic testing of newly installed pipelines.

B. Specifications identify requirements for both small-diameter (less than or equal to 20 inches) pipeline and large-diameter (greater than 20 inches) pipelines. When specifications for large-diameter pipelines differ from those for small- diameter pipelines, paragraphs for large-diameter pipelines will govern for large-diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for hydrostatic testing of pipelines under this Section. Include all costs in unit price of pressure pipelines being constructed.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. AWWA C 600 – Installation of Ductile – Iron Water Mains and Their Appurtenances.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Hydrostatically test newly installed pressure sewage pipelines before connecting to collection / treatment system.

B. Hydrostatically test newly installed water pipelines before disinfection, and before connecting to water distribution system.

C. For large-diameter pipelines, test in lengths between valves/plugs, not more than 2500 feet.

D. Small-diameter pipelines test lengths between valves/plugs, not more than 1500 feet.

E. Conduct hydrostatic tests in presence of Resident Project Representative.

3.02 TEST PROCEDURES

A. Furnish, install, operate connections, pump, meter/gages necessary for hydrostatic testing.

B. Allow filled pipeline to sit a minimum of 24 hours before testing begins.

C. For small-diameter pipelines, expel air and apply a minimum test pressure of 150% of design pressure rating of the pipe measured at the lowest point of the test section.

D. Begin test by 9:00 a.m. unless otherwise approved by Resident Project Representative. Maintain test pressure within 5 psi for 8 hours. Record initial pressure, initial water meter reading, and starting time. Record pressure at midpoint of test period. Record final pressure, final water meter reading, and ending time. Readings shall be taken in the presence of the Resident Project Representative.

1. If a large quantity of water is required to maintain pressure during test, testing shall be discontinued until cause of water loss is identified and corrected.

2. Failure to maintain test pressure within limit specified shall be cause for test rejection.

E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

F. Provide project documents or records of hydrostatic pressure test results to Resident Project Representative by line and stationing.

3.03 ALLOWABLE LEAKAGE FOR PIPELINES

A. During hydrostatic tests, no leakage will be allowed for sections of pipelines consisting of welded joints.

B. Allowable leakage for pipelines with rubber gasket joints: Pipeline installation shall not be accepted if leakage exceeds the amount determined by the following formula:

$$L = \frac{SD\,P^{0.5}}{133{,}200}$$

Where: L = The allowable leakage, gallons/hour
S = Length of pipeline tested, feet
D = Nominal diameter of pipe, inches

P = Average test pressure, pounds per square inch, gauge

3.04 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove any cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Failed water lines shall be disinfected after repair and retesting.

C. Repeat test until satisfactory results are obtained.

D. Log all tests and note corrections needed or made.

3.05 COMPLETION

A. Upon satisfactory completion of testing, dispose of test water in a legal and proper manner.

B. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

Section 02516

CUT, PLUG, AND ABANDONMENT OF PIPELINES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Cut, plug, and abandonment of pipelines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made to cut, plug, and abandon pipelines under this Section. Include payment in unit price for Section 02511-Water Mains or other related sections of which this work is a component.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed plugs and clamps for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete for reaction blocks: Class B conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Plugs and clamps: Applicable for type of pipe to be plugged.

PART 3 E X E C U T I O N

3.01 APPLICATION

A. Do not begin cut, plug and abandonment operations until replacement pipeline has been constructed, and accepted by the Owner and Resident Project Representative.

B. Install plug, clamp, and concrete reaction block, make cut at location shown on Drawings.

C. Pipeline to be abandoned shall not be valved off and shall not be cut or plugged other than at supply main or as shown on Drawings.

D. After pipeline to be abandoned has been cut and plugged, check for other sources feeding abandoned line. If sources are found, notify Resident Project Representative immediately. Cut and plug abandoned pipeline at point of other feed as directed by Resident Project Representative.

E. Plug or cap ends or openings in abandoned pipeline in manner approved by Resident Project Representative.

F. Remove and dispose of surface identifications such as valve boxes and fire hydrants. Valve boxes in improved streets may be filled with concrete after removing cap.

G. Backfill excavations in accordance with Section 02317 - Excavation and Backfill for Utilities.

H. Repair street surfaces in accordance with Section 02951- Pavement Replacement for Utility Construction.

END OF SECTION

Section 02520

FIRE HYDRANTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Fire hydrants.

B. Adjustment of fire hydrants and gate valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on a per each basis for each fire hydrant completed installed in place under this Section.

2. No separate payment will be made for fire hydrant leads (branches) under this Section. Include payment in unit price for water mains.

3. No separate payment will be made for salvage of fire hydrants under this Section. Include payment in unit price bid for fire hydrants.

4. No separate payment will be made for gate valves under this Section. Include payments in unit price for gate valves.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. AWWA C 502- Dry-Barrel Fire Hydrants

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

PART 2 P R O D U C T S

2.01 HYDRANTS

A. Fire hydrants shall be furnished as shown on the Drawings.

2.02 LEADS

A. Leads (Branches): Conform to requirements of Section 02501 - Ductile-Iron Pipe and Fittings, and Section 02506 - PVC Pipe.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place a 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.

B. Locate nozzle center line minimum 18 inches above finish grade.

C. Place 12-inch x 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Resident Project Representative) on pumper nozzles of new or relocated fire hydrants installed on new mains not in service. Remove indicators after new main is tested and approved by Resident Project Representative.

D. Do not cover drain ports when placing concrete thrust block.

E. Obtain Resident Project Representative approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water main flow line or fire hydrant barrel length caused by such obstructions. Record all changes onto “as-built” drawings.

F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed and / or salvaged. Existing fire hydrants shown to be salvaged on the Drawings are to be removed from the project site and delivered to the Owner’s Public Works Storage Facility. Salvaged fire hydrants shall not be incorporated into the project.

G. Install leads (branches) in accordance with Section 02511 - Water Mains.

H. Remove, dispose unsuitable materials and debris (Section 01576 - Waste Material Disposal)

I. Protect fire hydrants until acceptance of all work.

J. Consider safety of traveling public when hydrants are located near roadway.

END OF SECTION

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Section 02521

GATE VALVES

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Gate valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on a per each basis for each size valve installed under this Section.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM A 307 - Carbon Steel Externally Threaded Standard Fasteners.

B. ASTM B 62 - Composition Bronze or Ounce Metal Casting.

C. ASTM D 429 - Test Methods for Rubber Property-Adhesion to Rigid Substrates.

D. ASTM B 763 - Copper Alloy Sand Casting for Valve Application.

E. AWWA C 500 – Metal Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Resilient-seated Gate Valves for Water Supply Service.

G. AWWA C 550 - Protective Epoxy Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval by engineer.

C. Provide serial number of approved gate valves to Resident Project Representative prior to

installation.

1.05 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, and this Section, and that they have been satisfactorily tested in accordance with AWWA C 500 and AWWA C 509 as appropriate.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, additional requirements of this Section and as shown on the Drawings. Direct bury valves and those in subsurface vaults open counter clockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes less than 16-inches. If type of valve is indicated, no substitute is allowed.

C. Coatings for Valves: Interior and exterior surfaces shall be protected with a fusion bonded epoxy coating complying with AWWA C550. Coating shall be 10 mil dry film thickness.

D. Gate Valves 1-1/2 Inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends.

E. Gate Valves 2 Inches to 12 Inches in Diameter: Bi-directional, resilient seated (AWWA C 509) 200 psig, bronze mounting, mechanical joint ends with rubber joint rings, and nut-operated unless otherwise specified or shown on the Drawings. Comply with details in the Drawings and the following requirements:

1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.

2. Body: Ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.

3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.

4. Stems: ASTM B 763 bronze, alloy number 995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.

5. O-rings: AWWA C 509, sections 2.2.6 and 4.8.2.

6. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar.

7. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

8. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

9. Bolts: AWWA C 509 Section 4.4; stainless steel.

F. Gate Valves 14 Inches to 24 Inches in Diameter: AWWA C 500; mechanical joint ends with rubber rings and nut-operated unless otherwise specified or shown on the Drawings, double disc, 150 psi, and comply with the details in the Drawings and the following:

1. Body: Ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body. Equip with rollers, tracks, and scrapers.

2. Stems: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.

3. Stem Seals: Consist of one O-ring above and one O-ring below thrust collar with anti-friction washer located above thrust collar for operating torque.

3. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

4. Discs: Cast iron with bronze disc rings securely peened into machined dovetailed grooves.

5. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.

6. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.

7. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.

8. Stuffing Boxes: Located on top of bonnet and outside gear case.

G. Gate Valves 14 Inches and Larger: Furnish and equip with bypass valves.

1. Sizes: Provide 3-inch bypass valves for 14-inch through 20-inch gate valves. Provide 4-inch bypass valves for 24-inch gate valves.

H. Gate Valves Installed at Greater than 4-foot Depth: Provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Earthwork. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities.

3.02 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Poly-wrap valves in accordance with Section 02528 – Polyethylene Wrap.

C. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face if less than 4 feet. Install valves completely closed when placed in water line.

D. For pipe section of each valve box, use only cast iron, ductile iron, or DR18 PVC pipe cut to proper length. Size to allow future operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.03 DISINFECTION AND TESTING

A. Disinfect valves and appurtenances as required by Section 02514 - Disinfection of Waterlines and test as required by Section 02515 - Hydrostatic Testing of Pipelines.

END OF SECTION

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Section 02531

GRAVITY SANITARY SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pipe installation is on a linear foot basis. Measurement will be taken along the center line of the pipe from center line to center line of manholes. Payment will be made for each linear foot installed complete in place including clearing and grubbing, sewer pipe, excavation, bedding, backfill and special backfill, shoring, earthwork, connections to existing manholes and pipe, clean-outs, accessories, acceptance testing, and post TV inspection.

2. For sewer pipe of sizes 12 – inches and smaller, excavation and backfill will not be paid for separately. Excavation and backfill will be separated for payment according to the depth of trench as set forth in the proposal.

3. For sewer pipe sizes 15 – inches and larger, excavation and backfill will not be paid for separately. Payment will be made according to the separate depths of trench as set forth in the proposal.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section.

D. Final “as-built” coordinates and elevations.

1.04 QUALITY ASSURANCE

A. Install a sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 02533 - Acceptance Testing for Sanitary

Sewers.

B. Regulatory Requirements.

1. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.
2. Make notification to the Resident Project Representative if water lines are uncovered during sanitary sewer installation where the minimum separation distance cannot be maintained.
3. Where a gravity sanitary sewer is to be installed under an existing water line with a separation distance of at least 2 feet and less than 9 feet, install the new sewer pipe so that one full joint length of pipe is centered on the water line crossing. Embed the sewer pipe in cement stabilized sand or a Class B concrete for a minimum distance of 9 feet on each side of the crossing.
4. Where a gravity sanitary sewer is to be installed under an existing water line with a separation distance of less than 2 feet, install the new sewer using pressure-rated pipe as shown on the Drawings. Maintain a minimum 6-inch separation distance.
5. Lay gravity sewer lines in straight alignment and grade.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at the job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along the ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around the outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with the interior surface of the pipe to lift or move lined pipe.

PART 2 P R O D U C T S

2.01 PIPE

A. Provide piping materials for gravity sanitary sewers of the sizes and types indicated on the Drawings or as specified.

B. Unlined reinforced concrete pipe is not acceptable.

2.02 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on the Drawings, use pipe materials and fittings that conform to requirements specified in one or more of the following Sections:

1. Section 02501 - Ductile - Iron Pipe and Fittings.
2. Section 02506 - PVC Pipe.

B. Where shown on the Drawings, provide pipe meeting the minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.03 APPURTENANCES

A. Stacks. Conform to the requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

B. Service Connections. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Roof, street or other type of surface water drains shall not be connected or reconnected to the sanitary sewer lines.

2.04 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Install bedding and backfill to depths and types shown on drawings and related sections of the whole specifications. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Material, and Section 02321 - Cement Stabilized Sand.

B. Topsoil: Install topsoil to depths and type as shown on related specifications section of the work. Conform to requirements of Section 02911 - Topsoil.

C. Final backfill shall be mechanically compacted to a density no less then 98% at or no more than 3% above optimum moisture of Standard Proctor ASTM D-698.

D. Density tests shall be required and performed at pre-determined lifts and distances.

E. Failed tests shall be charged to contractor by the owner.

F. All bedding backfill work shall be observed and inspected by Resident Project Representative.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected by the work.

C. Project sites, rights-of-way and easements shall be made ready for construction operations in accordance with Section 02233 – Clearing and Grubbing.

D. Perform work in accordance with OSHA standards. Employ a trench safety system as specified in Section 01561 - Trench Safety System for excavations over 5 feet deep.

E. Immediately notify the agency or company owning any utility line which is damaged, broken or disturbed. Obtain approval from Resident Project Representative and agency or utility company for any repairs or relocations, either temporary or permanent.

F. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

G. Install, operate, and maintain dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

H. Do not allow sand, debris or runoff to enter sewer system.

3.02 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Resident Project Representative.

B. Design piping, joints and accessories to withstand twice the maximum system pressure or 50 psi, whichever is greater.

C. No sewage shall be diverted into any area outside of the sanitary sewer.

D. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up and disinfect spillage. Promptly notify Resident Project Representative so that required reporting can be made to the Texas Natural Resources Conservation Commission and the Environmental Protection Agency by the Owner.

3.03 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding and backfill as indicated on Drawings.

B. Line and Grade. Establish the required uniform line and grade in the trench from survey control points identified by the Engineer. Maintain this control for a minimum of 100 feet behind and ahead of the pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of the work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect the boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to widths and depths shown on Drawings and as specified in Section 02317 - Excavation and Backfill for Utilities.

3.04 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with the pipe manufacturer's recommendations, referenced sections and as specified in the following paragraphs.

B. Install pipe only after excavation is completed, the bottom of the trench fine graded, bedding material is installed, and the trench has been approved by the Resident Project Representative.

C. Install pipe to the line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in the trench so the interior surfaces of the pipe follow the grades and

alignment indicated. Provide bell holes where necessary.

D. Install pipe with the spigot ends toward the direction of flow.

E. Form a concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep the interior of pipe clean as the installation progresses. Where cleaning after laying the pipe is difficult because of small pipe size, use a suitable swab or drag in the pipe and pull it forward past each joint immediately after the joint has been completed. Remove foreign material and debris from the pipe.

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Resident Project Representative.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover the exposed ends of pipes with an approved plug to prevent foreign material from entering the pipe.

J. Where the length of stubs is not indicated, install a 4-foot length and seal the free end with an approved plug.

K. Pipe installation by open cut should adhere to TxDOT requirements.

3.05 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections as shown on drawings and conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

B. Stacks. Construct stacks to conform to requirements of 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Construct manholes to conform to requirements of Section 02081 - Cast-in-Place concrete Manholes and Section 02082 - Precast Concrete Manholes as applicable. Install frames, rings, and covers to conform to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

D Adjust manhole covers to grade. Adjustments to manhole rings and covers made after final paving shall be at contractor’s expense.

3.06 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Section 02533 – Acceptance Testing for Sanitary Sewers.

B. Mandrel Testing. Use a Mandrel Test to test flexible pipe for deflection. Refer to Section 02533 - Acceptance Testing for Sanitary Sewers.

C. Pipe Leakage Test. After backfilling a line segment and prior to tie-in of service connections, visually

inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers. Maintain piezometer installed to conform with Section 01578 - Control of Ground Water and Surface Water, until acceptance testing is completed.

3.07 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil as show in drawings and in accordance with Section 02317 – Excavation and Backfill for Utilities and Section 02533 - Acceptance Testing for Sanitary Sewer.

B. Backfill the trench in specified lifts only after pipe installation is approved by the Resident Project Representative.

C. Repair and replace removed or damaged pavement, curbs, gutters, driveways and sidewalks at no additional cost to owner and as specified in Section 02951 - Pavement Replacement for Utility Construction.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over the surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at a uniform slope to natural grade as indicated on the Drawings. Provide a minimum of 4 inches of topsoil as specified in Section 02911 - Topsoil and apply hydromulch according to requirements of Section 02921 - Hydromulch Seeding.

E. Provide sodding in areas of residential land use over the surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at a uniform slope to natural grade as indicated on the Drawings. Provide a minimum of 4 inches of topsoil per Section 02911 - Topsoil. Sod disturbed areas in accordance with Section 02922 - Sodding.

F. Backfill and site cleaning shall be preformed to the satisfaction of the Resident Project Representative.

3.08 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Cleaning shall include utilizing variable pressure water nozzles and collection, removal, transportation and disposal of any sand, debris, and liquid wastes to legal disposal sites.

B. Select and use closed-circuit television equipment that will produce a color video tape. Produce a video tape using a pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use a camera with an accurate footage counter which displays on the monitor the exact distance of the camera from the starting manhole. Use a camera with camera height adjustment so that the camera lens is always centered at one-half the inside diameter, or higher, in the pipe being televised. Provide a lighting system that allows the features and condition of the pipe to be clearly seen. A reflector in front of the camera may be necessary to enhance lighting in dark or large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:

1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and areas where sewer transitions from one pipe material to another.

2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in the video taping of a segment between manholes and do not show a single segment on more than one video tape.

3. No flow is allowed in the gravity sanitary sewer while performing post-installation television inspection.

D. Provide video tapes in the VHS format, recorded at Standard Play (SP). Two labels are required. One label shall be placed on the spine and the other on the face of each video tape. Permanently label each video tape with the following information.

Spine of Tape

Wastewater File No.:_____Contractor's Name:_____
Inspection Type: [ ] Survey [ ] Pre-Installation [ ] Post-Installation
Tape No.:_____Date Televised:_____Date Submitted:_____
Basin No:_____

Face of Tape

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street

E. For each video tape provide a completed TV Inspection Report. The TV Inspection Report is a written/narrated log of pipe conditions and service connections, indexed to a footage counter.

F. Upon completion of video tape reviews by Engineer, the Contractor will be notified regarding final acceptance of the sewer segment.

3.09 LOCATION MARKING

A. Conform to the requirements of Section 02535 – Non-metalic Utility Line Marking and the Drawings.

END OF SECTION

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Section 02533

ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Acceptance testing of sanitary sewers including:

1. Visual inspection of sewer pipes
2. Mandrel testing for flexible sewer pipes.
3. Leakage testing of sewer pipes.
4. Leakage testing of manholes.
5. Smoke testing of point repairs.

B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Acceptance testing for sanitary sewers. No payment will be made for acceptance testing under this Section. Include the cost for acceptance testing for sanitary sewers in the unit price for work in related sections requiring acceptance testing.
2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM C 828 - Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.

B. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

C. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

D. ASTM F 794 - Specification for Polyvinyl Chloride Large-Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

E. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

F. 30 TAC 317.2 - Design Criteria for Sewage Systems.

G. Uni-Bell UNI-B-3 Polyvinyl Chloride (PVC) Pressure Pipe (Complying with AWWA C 900).

1.04 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have a straight alignment and uniform grade between manholes as shown on the Drawings.

B. Flexible pipe, including “semi-rigid” pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of a line segment but prior to final acceptance using a standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. All new sanitary sewers shall be mandrel tested. If mandrel test is failed, the pipe shall be televised at no additional cost to owner.

D. Maximum allowable leakage for Infiltration or Exfiltration

1. The total exfiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at a minimum test head of 2 feet above the crown of the pipe at the upstream manhole or 2 feet above the groundwater elevation, whichever is greater.

2. When pipes are installed more than 2 feet below the groundwater level, an infiltration test shall be used in lieu of the exfiltration test. The total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above the crown of the pipe at the upstream manhole.

3. Refer to Table 02533-1, Water Test Allowable Leakage, at the end of the Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.

E. Perform air testing in accordance with requirements of this Section. Refer to Table 02533-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 02533-3, Minimum Testing Times for Low Pressure Air Test, and Table 02533-4, Vacuum Test Time Table, at the end of this Section.

F. Inspection logs/reports shall be submitted/signed by Resident Project Representative.

G. Include the following:

1. Project title
2. Time of day
3. System number
4. Manhole to manhole pipe section/station
5. Pipe segment Length
6. Line to line
7. Compass direction of viewing
8. Pipe depth
9. Foreman name and signature
10. Results. Maintain logs and reports for duration of work and warranty period.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Test Plan: Test plan shall be submitted to the Engineer for review two (2) weeks prior to when testing begins to obtain approval through the submittal process. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from the Drawings and Specifications. Plan should include testing procedures, methods, equipment, and tentative schedule.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

D. Maintain schedule and update as needed; be prepared to submit to Engineer on monthly basis at the monthly program meetings.

1.06 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested with no additional cost to owner.

B. Promptly provide testing reports and video tape of television inspection records for each test on each segment of sanitary sewer to the Engineer on DVD medium.

C. Upon completion of tape reviews by Engineer, Contractor will be notified regarding final acceptance of the sewer segment.

1.07 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1,000 linear feet of installed sewer remains untested at any one time.

B. Coordinate testing schedules with Resident Project Representative. Perform testing under observation of Resident Project Representative.

C. Provide updated testing schedule with line ID, station to station, results of test, date of test at each of the scheduled monthly progress meetings.

PART 2 P R O D U C T S

2.01 DEFLECTION MANDREL

A. Mandrel Sizing. The rigid mandrel shall have an outside diameter (O.D.) equal to 95 percent of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

B. Mandrel Design. The rigid mandrel shall be constructed of a metal that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75 percent of the inside diameter of the pipe. The rigid mandrel shall not have adjustable or collapsible legs which would allow a reduction in mandrel diameter during testing. A proving ring shall be provided and used for modifying each size mandrel.

C. Proving Ring. Furnish a "proving ring" with each mandrel. Fabricate the ring of 1/2-inch-thick, 3-inch-wide bar steel to a diameter 0.02 inches larger than approved mandrel diameter. Alternatively, provide an approved factory manufactured ring.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 02533-5, Pipe vs. Mandrel Diameter, at the end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in the table may be used when approved by the Engineer.

2.02 EXFILTRATION TEST

A. Water Meter: Obtain a transient water meter from the Owner for use when water for testing will be taken from the Owner's system. Conform to Owner requirements for water meter use.

B. Test Equipment:

1. Pipe plugs.

2. Pipe risers where the manhole cone is less than 2 feet above highest point in pipe or service lead.

2.03 INFILTRATION TEST

A. Test Equipment:

1. Calibrated 90 degree V-notch weir.

2. Pipe plugs.

2.04 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:

1. Control panel.

2. Low-pressure air supply connected to control panel.

3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.

4. Air hoses from control panel to:

a. Air supply.

b. Pneumatic plugs.

c. Sealed line for pressuring.

d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place a pneumatic plug in each end of a length of pipe on the ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable if they remain in place against the test pressure without external aids.

2.05 GROUND WATER DETERMINATION

A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.06 SMOKE TESTING

A. Equipment:

1. Pneumatic plugs.

2. Smoke generator as supplied or an approved equal.

3. Blowers producing 2,500 scfm minimum.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

B. The selection of test methods and pressures for gravity sanitary sewers shall be determined based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01578 - Control of Ground Water and Surface Water.

3.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing a light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of the line segment.

B. Pull the approved mandrel by hand through sewer sections. Replace any section of sewer not passing the mandrel. Mandrel testing is not required for stubs.

C. Retest repaired or replaced sewer sections no sooner than 30 days after completion of repairs.

D. Plan, schedule, log all mandrel testing by line and station to station. Provide form with Resident Project Representative and foreman signatures.

3.04 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

A. Test Options:

1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.

2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air prior to backfilling. Manholes tested with low pressure air shall undergo a physical inspection prior to testing.

3. Leakage testing shall be performed after backfilling of a line segment, and prior to tie-in of service connections.

4. If no installed piezometer is within 500 feet of the sewer segment, Contractor shall provide a temporary piezometer for this purpose.

B. Compensating for Ground Water Pressure:

1. Where ground water exists, install a pipe nipple at the same time sewer line is placed. Use a 1/2-inch capped pipe nipple approximately 10 inches long. Make the installation through manhole wall on top of the sewer line where line enters manhole.

2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect a clear plastic tube to nipple. Support tube vertically and allow water to rise in the tube. After water stops rising, measure height in feet of water over invert of the pipe. Divide this height by 2.3 feet/psi to determine the ground water pressure to be used in line testing.

C. Exfiltration test:

1. Determine ground water elevation.

2. Plug sewer in downstream manhole.

3. Plug incoming pipes in upstream manhole.

4. Install riser pipe in outgoing pipe of upstream manhole if highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.

5. Fill sewer pipe and manhole or pipe riser, if used, with water to a point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.

6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over a one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure the quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 02533-1 at the end of this Section.

D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).

1. Determine ground water elevation.

2. Plug incoming pipes in upstream manhole.

3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.

4. Allow water to rise and flow over weir until it stabilizes.

5. Take five readings of accumulated volume over a period of 2 hours and use average for infiltration. The average must not exceed that calculated for 2 hours from allowable leakage according to the Table 02533-1 at the end of this Section.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 02533-2.

1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.

2. Lines 36-inch average inside diameter and larger shall be tested at each joint. The minimum time allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during a joint test shall be 10 seconds, regardless of pipe size.

3. For pipe sections less than 36-inch average inside diameter:

a. Determine ground water level.

b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.

c. After a manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.

d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 02533-2 at the end of this Section.

e. To determine air loss, measure the time interval for pressure to drop to 2.5 psig. The time must exceed that listed in the Table 02533-2 at the end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.

F. Retest: Any section of pipe which fails to meet requirements shall be repaired and retested.

3.05 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 02533-1, Water Test Allowable Leakage, at the end of this Section.

B. Low Pressure Air Test:

1. Times in Table 02533-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at the end of this Section.

$$T = 0.0850(D)(K)/(Q)$$

where:

T	=	time for pressure to drop 1.0 pounds per square inch gauge in seconds
K	=	0.000419 DL, but not less than 1.0
D	=	average inside diameter in inches
L	=	length of line of same pipe size in feet
Q	=	rate of loss, 0.0015 ft^3/min./sq. ft. internal surface

2. Since a K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 02533-3, Minimum Testing Times for Low Pressure Air Test.

Notes:
1. When two sizes of pipe are involved, the time shall be computed by the ratio of lengths involved.
2. Lines with a 27-inch average inside diameter and larger may be air tested at each joint.
3. Lines with an average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4. If the joint test is used, a visual inspection of the joint shall be performed immediately after testing.
5. For joint test, the pipe is to be pressurized to 3.5 psi greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the

minimum times allowable for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.06 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs a minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged if lines entering manhole have not been backfilled.

C. Vacuum testing:

1. Install vacuum test head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to the recommended maximum inflation pressure; do not over-inflate.

2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for the time period specified in Table 02533-4, Vacuum Test Time Table.

   If the drop in vacuum exceeds 1 inch Hg over the specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Hydrostatic exfiltration testing shall be performed as follows:

1. Seal lines coming into the manhole with an internal pipe plug. Then fill the manhole with water and maintain it full for at least one hour.

2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.

3. If water loss exceeds amount above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.07 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.

2. Determine if point repairs are properly made.

3. Determine if service connections have been reconnected to the rehabilitated sewer.

4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in a single manhole section at any one time. Keep the number of open excavations to a minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, no more than 7 days, prior to proposed testing. Also give notice to local Police and Fire Departments 24 hours prior to actual smoke testing. Coordinate with Resident Project Representative as necessary.

D. Isolate Section: Isolate the manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal the annular space at manhole for sliplined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer's recommendation and as approved by Resident Project Representative.

2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for a minimum of 5 minutes.

3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor the tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace any taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at a time. If repair or replacement, testing or retesting, and backfilling of the excavation is not completed within one work day, properly barricade and cover each excavation as approved by Resident Project Representative.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to the newly installed liner pipe, perform a dye test to confirm reconnection. Introduce dye into the service line through a plumbing fixture inside the structure or a sewer cleanout immediately outside the structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms a reconnection.

Table 02533-1
WATER TEST ALLOWABLE LEAKAGE

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100 FT.
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	10	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1" diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

Table 02533-2
ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Diam. (in)	Min. Time (min:sec)	Length for Min. Time (ft)	Time for Longer Length (sec)	**Specification Time for Length (L) Shown (min:sec)**										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	19:50	26:11	34:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91;10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	43:06	64:38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

Table 02533-3
MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

PIPE DIAMETER (INCHES)	MINIMUM TIME (SECONDS)	LENGTH FOR MINIMUM TIME (FEET)	TIME FOR LONGER LENGTH (SECONDS)
			0.855 (L)
6	340	398	1.520 (L)
8	454	298	2.374 (L)
10	567	239	3.419 (L)
12	680	199	5.342 (L)
15	850	159	7.693 (L)
18	1020	133	10.471 (L)
21	1190	114	13.676 (L)
24	1360	100	17.309 (L)
27	1530	88	21.369 (L)
30	1700	80	25.856 (L)
33	1870	72	

Table 02533-4
VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY MANHOLE DIAMETER		
	48"	60"	72"
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0

*Add T times for each additional 2-foot depth.
(The values listed above have been extrapolated from ASTM C 924-85)

Table 02533-5
PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches)	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
	12	11.770	11.182
PVC-Solid (SDR 35)	4	3.975	3.776
	6	5.915	5.619
	8	7.920	7.524
	10	9.900	9.405
	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125

Section 02534

SANITARY SEWER SERVICE CONNECTIONS OR RECONNECTIONS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Installation of service connections in sanitary sewers serving areas where sanitary sewer service did not previously exist.

B. Reconnection of existing service connections along parallel, replacement, or rehabilitated sanitary sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for sanitary sewer service connections or service reconnections without stacks (standard) is on a unit price basis for each connection or reconnection. Payment will be made for each service connection or reconnection installed complete in place, including service connections, couplings, adapters disconnecting existing services, reconnecting new service, fittings, clean-outs, excavation, and backfill.

2. Payment for sanitary sewer service connections or service reconnections with stacks (deep-cut) is on a unit price basis for each connection or reconnection. Payment will be made for each service connection or reconnection installed complete in place, including service connections, couplings, adapters disconnecting existing services, reconnecting new service, fittings, clean-outs, excavation, and backfill.

3. Payment for sanitary sewer service lines from the sewer main is on a linear foot basis. Measurement will be taken along the centerline of the pipe from the centerline of the lateral connection or stack to the end of the service for service connections laid in open-cut excavation. Payment will be made for each linear foot of pipe installed, complete in place, including sewer pipe, excavation, shoring, bedding, backfill, and accessories. Augered pipe for service connections will be paid as provided in Section 02448 – Augering Pipe for Sewers.

4. One or more connections discharging into a common point are considered one service connection. The Contractor shall not add service reconnections without approval of the Resident Project Representative. The Resident Project Representative may require connections to be relocated to avoid having more than one service connection per reconnection.

5. Protruding service connections which must be removed to allow liner insertion are paid as a service reconnection when connected. If abandoned, they will be paid as an abandoned connection.

6. Payment for abandonment of service connection is on a unit price basis for each abandoned connection. No separate payment will be made for abandonment of service connection unless excavation is required. No separate payment will be made for excavation of sanitary sewer services within the new or replacement sewer trench.

7. No separate payment will be made for removal of existing sanitary sewer service connections.

8. No separate payment will be made for an abandoned service connection if the service to be abandoned is within 4 feet of an active connection. Payment for only one abandoned service connection will be allowed when a second abandoned connection is within 4 feet of the first.

9. If a faulty remote cut is later corrected using the procedures specified for reconnection by excavation, only one reconnection will be allowed for payment.

10. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM D 1784 - Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

B. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

C. ASTM D 3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

1.04 PERFORMANCE REQUIREMENTS

A. Accurately locate in the field all proposed service connections along the new sanitary sewer main.

B. Accurately locate in the field existing service connections and proposed service connections along the alignment of the new parallel or replacement sewer main.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for each pipe product, fitting, coupling and adapter.

C. Show reconnected services on record Drawings. Give the exact distance from each service connection to the nearest downstream manhole.

PART 2 P R O D U C T S

2.01 PVC SERVICE CONNECTION

A. Use PVC sewer pipe of 4-inch through 6-inch diameter, conforming to ASTM D 1784 and ASTM D 3034, with a cell classification of 12454-B. The SDR (ratio of diameter to wall thickness) shall be 35.

B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D 3212.

C. Provide service connection pipe in sizes shown on the Drawings. For reconnection of existing services, select service connection pipe diameter to match existing service diameter. Reconnections to rehabilitated sanitary sewer mains shall be limited to the following maximum service connection diameter:

Sewer Diameter	Maximum Service Connection Diameter
8" or less	4"
10" or greater	6"

D. Connect service pipes to new, parallel or replacement sewer mains with prefabricated, full-bodied wye fittings conforming to specifications for sewer main pipe material as specified in other Sections for sewers up to 18 inches in diameter.

E. Where sewers are installed using pipe augering or tunneling, or where the sewer is greater than 18 inches in diameter, use Fowler “Inserta-Tee” to connect the service to sewer main.

2.02 PIPE SADDLES

A. Use pipe saddles only on rehabilitated sanitary sewer mains. Comply with Paragraph 2.01D for new parallel and replacement sanitary sewer mains.

B. Supply one-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish a complete seal. Use a saddle fabricated to fit the outside diameter of the connecting pipe. The protruding lip of the saddle must be at least 5/8-inch long with grooves or ridges to retain the stainless steel band clamps.

C. Use 1/2-inch stainless steel band clamps for securing saddles to liner pipe.

2.03 COUPLINGS AND ADAPTERS

A. For connections between new PVC pipe connectionouts and existing service, 4- or 6-inch diameter, use a flexible adapter coupling consisting of a neoprene gasket and stainless steel shear rings with 1/2-inch stainless steel band clamps.

B. For connections between new PVC pipe connectionout and new service, use rubber-gasketed adapter coupling.

2.04 STACKS

A. Provide stacks for service connections wherever the crown of the sewer is 7 feet or more below finished grade at main.

B. Construct stacks of the same material as the sanitary sewer and as shown on the Drawings.

C. Provide stacks of the same nominal diameter at the sanitary service line.

2.05 PLUGS AND CAPS

A. Seal the upstream end of unconnected sewer service connections with rubber gasketed plugs or caps of the same pipe type and size. Provide plugs or caps by GPK Products, Inc., or approved equal.

PART 3 E X E C U T I O N

3.01 PERFORMANCE REQUIREMENTS

A. Provide a minimum of 72 hours notice to customers whose sanitary sewer service will potentially be interrupted.

B. Accurately field locate service connections, whether in service or not, along the rehabilitated sanitary sewer main. For new, parallel and replacement sewers, service connections may be located as pipe laying progresses from downstream to upstream.

C. Properly disconnect existing connections from the sewer and reconnect to the rehabilitated liner, as described in this Section.

D. Reconnect service connections, including those that go to unoccupied or abandoned buildings or to vacant lots, unless directed otherwise by Resident Project Representative.

E. Complete reconnection of service lines within 24 hours after cured-in-place liner installation and within 72 hours after disconnection for sliplining, parallel, or replacement sanitary sewer mains.

F. Reconnect services on cured-in-place liner at 12 feet depth or less by the excavation method. The Resident Project Representative reserves the right to require service connections by excavation when a remote cut service connection damages the lines.

G. Reconnection by the excavation method shall include the stack and fittings and required pipe length to reconnect service line.

H. Connect services 8 inches in diameter and larger to the sewer by construction of a manhole. Refer to the appropriate Section on manholes for construction and payment.

3.02 PROTECTION

A. Provide barricades, warning lights, and signs for excavations created for service connections. Conform to requirements of Section 01555 – Traffic Control and Regulation.

B. Do not allow sand, debris, or runoff to enter sewer system.

3.03 PREPARATION

A. Determine the existing sewer locations and number of existing service connections from closed-circuit television (CCTV) inspection tapes or from field survey. Accurately field locate existing service connections, whether in service or not. Use existing service locations to connect or reconnect service lines or liner.

B. For rehabilitated sanitary sewer mains, allow liner to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured.

C. For new parallel and replacement sanitary sewer mains, complete testing and acceptance of downstream sewers as applicable. Provide for compliance with requirements of Paragraph 3.01E.

3.04 EXCAVATION AND BACKFILL

A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Perform work in accordance with OSHA standards. Employ a Trench Safety System as specified in Section 01561 - Trench Safety System for excavations requiring trench safety.

C. Install and operate necessary ground water and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.05 RECONNECTION BY EXCAVATION METHOD

A. Remove a portion of existing sanitary sewer main or carrier pipe to expose the liner pipe. Provide sufficient working space for installing a prefabricated pipe saddle.

B. Carefully cut the liner pipe making a hole to accept the connectionout protruding from the underside of the saddle.

C. Strap on the saddle using a stainless steel band on each side of the saddle. Tighten the bands to produce a watertight seal of the saddle gasket to the liner pipe.

D. Remove and replace cracked, offset, or leaking service line for up to the right-of-way line.

E. Make up the connection between liner and service line using PVC sewer pipe and approved fittings and couplings.

F. Encase the entire service connection in cement stabilized sand or Class “B” concrete as shown on Drawings.

G. Test the service connections before backfilling.

3.06 RECONNECTION BY REMOTE METHOD

A. Make service reconnections using remote-operated cutting tools on cured-in-place liners at depths greater than 12 feet.

B. Employ method and equipment that restore the service connection capacity to not less than 90 percent of original capacity.

C. Immediately open any missed connections and repair any holes drilled in error using a method approved by Resident Project Representative.

3.07 RECONNECTION ON NEW, PARALLEL OR REPLACEMENT SEGMENTS

A. Install service connections on the sewer main.

B. Remove and replace cracked, offset or leaking service line to the easement or right-of-way line.

C. Make up the connection between the main and the existing service line using PVC sewer pipe and approved couplings, as shown on the Drawings.

D. Test service connections before backfilling.

E. Embed the service connection and service line as specified for the sanitary sewer main as shown on the Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities.

3.08 INSTALLATION OF NEW SERVICE CONNECTIONS

A. Install service connections in accordance with the details shown on the Drawings. Provide the length of connection indicated on the Drawings. Install plug or cap and service marker on the upstream end of the service connection as needed.

B. Test service connections before backfilling.

C. Embed the service connection and service line as specified for sanitary sewer main, and as shown on the Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities. Install a minimum 2-foot length of magnetic locating tape along the axis of the service connection and 9 inches to 12 inches above the crown of the pipe, at the end of the connection.

3.09 TESTING

A. Test service reconnections and service connections. Follow applicable procedures given in Section 02533 - Acceptance Testing for Sanitary Sewers.

B. Perform a post installation CCTV inspection as specified in Section 02531 - Gravity Sanitary Sewers to show locations of service connection.

3.10 CLEANUP

A. Backfill the excavation as specified in Section 02317 - Excavation and Backfill for Utilities.

B. Replace pavement or sidewalks removed or damaged by excavation in accordance with Section 02951 - Pavement Replacement for Utility Construction. In unpaved areas, bring surface to grade and slope surrounding the excavation. Replace a minimum of 4 inches of topsoil and seed according to requirements of Section 02921 - Hydromulch Seeding or Section 2922 - Sodding.

END OF SECTION

Section 02741

ASPHALTIC CONCRETE PAVEMENT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Surface courses of compacted mixture of coarse and fine aggregates and asphaltic material.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for asphaltic concrete pavement is on square yard basis. Separate pay items are used for each different required thickness of pavement.

2. Payment for asphaltic concrete pavement includes payment for associated work performed in accordance with Section 02743 - Tack Coat.

3. Payment for asphaltic concrete in miscellaneous areas is on a square yard basis. Miscellaneous areas include tie-in to existing driveways.

4. No separate payment will be made under this section for asphaltic concrete provided for Section 02951-Pavement Replacement for Utility Construction

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

6. Refer to Paragraph 3.08 for unit price adjustments and Article 9 of General Conditions.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

D. TxDOT Tex-126-E - Molding, Testing, and Evaluation of Bituminous Black Base Material.

E. TxDOT Tex-106-E - Method of Calculating the Plasticity Index of Soils.

F. TxDOT Tex-203-F - Sand Equivalent Test.

G. TxDOT Tex-204-F - Design of Bituminous Mixtures.

H. TxDOT Tex-207-F - Determination of Density of Compacted Bituminous Mixtures.

I. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

J. TxDOT Tex-217-F - Determination of Deleterious Material and Decantation Test for Coarse Aggregates.

K. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates and test data that asphaltic materials and aggregates meet requirements of Article 2.01, Materials, of this Section prior to beginning work.

C. Submit proposed design mix and current test data for each type and strength of surface course in the Work.

D. Submit manufacturer's description, characteristics, and certifications of mixing plant for approval.

E. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Coarse Aggregate: Gravel or crushed stone, or combination thereof, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic or other injurious matter occurring either free or as coating on aggregate. Aggregate shall conform to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

B. Fine Aggregate: Sand or stone screenings or combination of both passing No. 10 sieve. Aggregate shall conform to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by Tex-106-E. Sand equivalent shall have a minimum value of 45 when tested by Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with ASTM C 136.

GRADUATION OF COMPOSITE AGGREGATE	
Sieve Size	**Percent Passing**
1/2"	100
3/8”	85 to 100
#4	50 to 70
#10	32 to 42
#40	11 to 26
#80	4 to 14

#200	1 to 6*
*2 to 8 when Test Method Tex – 200 - F, Part II (Washed Sieve Analysis) is used	

D. Asphaltic Material: Moisture-free homogeneous material which will not foam when heated to 347 degrees F, meeting following requirements:

VISCOSITY GRADE				
TEST	AC-10		AC-20	
	Min.	Max.	Min.	Max.
Viscosity, 140º F stokes	1000	± 200	2000	± 400
Viscosity, 275º F stokes	1.9	-	2.5	-
Penetration, 77º F, 100g, 5 sec.	85	-	55	-
Flash Point, C.O.C., F.	450	-	450	-
Solubility in trichloroethylene, percent	99.0	-	99.0	-
Tests on residues from thin film oven tests:				
Viscosity, 140º F stokes		3000	-	6000
Ductility, 77º F, 5 cms per min., cms	100	-	70	-
Spot tests	Negative for all grades			

1. Material shall not be cracked.

2.02 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuously mixtures meeting specifications. Plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device.

2. Dryer.

3. Screens.

4. Aggregate weight box and batching scales.

5. Mixer.

6. Asphalt storage and heating devices.

7. Asphalt measuring devices.

8. Truck scales.

B. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix.

2.03 MIXES

A. Employ a certified testing laboratory to prepare design mixes. Test in accordance with Tex-126-E or Tex-204-F and Tex-208-F.

B. Density and Stability Requirements:

Percent Density		Percent	HVEEM Stability Percent
Min.	Max.	Optimum	Not Less Than
94.5	97.5	96	35

C. Proportions for Asphaltic Material: Provide 4 to 8 percent of mixture by weight. Aggregate by weight shall not contain more than 1.0 percent by weight of fine dust, clay-like particles, or silt when tested in accordance with Tex-217-F, Part II.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify compacted base course is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Prime Coat: If indicated on the Drawings, apply a prime coat conforming to requirements of Section 02742 - Prime Coat. Do not apply a tack coat until primed base has cured to satisfaction of Resident Project Representative.

B. Tack Coat: Conform to requirements of Section 02743 - Tack Coat.

C. Prepare subgrade in advance of asphaltic concrete paving operation.

D. Do not use cutback asphalt during the period of April 16 to September 15.

E. Remove all loose asphalt, rocks, dirt, clogs, and be prepared to sweep if requested by Resident Project Representative.

3.03 PLACEMENT

A. Do not place asphaltic mixture when air temperature is below 50 degrees F and falling. Mixture may be placed when air temperature taken in shade and away from artificial heat is above 40 degrees F and rising.

B. Haul prepared and heated asphaltic concrete mixture to the project in tight vehicles previously cleaned of foreign material. Mixture shall be at temperature between 250 degrees F and 325 degrees F when laid.

C. Spread material into place with approved mechanical spreading and finishing machine of screening or tamping type.

D. Surface Course Material: Surface course 2 inches or less in thickness may be spread in one lift. Spread lifts in such manner that, when compacted, finished course will be smooth, of uniform density, and will be to section, line and grade as shown. Place construction joints on surface courses to coincide with lane lines or as directed by Resident Project Representative.

E. Place courses as nearly continuously as possible. Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

F. When new asphalt is laid against existing or old asphalt, existing or old asphalt shall be saw cut full depth to provide straight smooth joint.

G. In restricted areas where use of paver is impractical, spread and finish asphalt by mechanical compactor. Use wood or steel forms, rigidly supported to assure correct grade and cross section. Carefully place materials to avoid segregation of mix. Do not broadcast material. Remove any lumps that do not break down readily. Place asphalt courses in same sequence as if placed by machine.

3.04 COMPACTION

A. Begin rolling while pavement is still hot and as soon as it will bear roller without undue displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water. Keep roller fond wheals clean, remove any dirt, dust, film, or loss materials.

B. Compress surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing from 8 to 10 tons. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mixture temperature drops below 175 degrees F.

C. Use tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.

D. Along walls, curbs, headers and similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

E. Compact binder course and surface course to density not less than 94 percent nor more than 98 percent of the maximum possible density of voidless mixture composed of same materials in like proportions.

3.05 TOLERANCES

A. Furnish templates for checking surface in finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/8 inch.

B. Completed surface, when tested with 10-foot straightedge laid parallel to center line of pavement, shall show no deviation in excess of 1/8 inch in 10 feet. Correct any surface not meeting this requirement. Contractor shall provide straightedge and notify Resident Project Representative when testing. Contractor shall provide straightedge and notify Resident Project Representative when testing.

3.06 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Minimum of one core will be taken at random locations per 1000 feet per lane of roadway or 500 square yards of base to determine in-place depth and density.

C. In-place density will be determined in accordance with Tex-207-F and Tex-227-F from cores or sections. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Engineer.

D. Contractor may, at his own expense, request three additional cores in vicinity of cores indicating nonconforming in-place depths. In-place depth at these locations shall be average depth of four cores.

E. Fill cores and density test sections with new compacted asphaltic concrete.

3.07 NONCONFORMING PAVEMENT

A. Remove and replace any non – conforming pavement.

B. Remove and replace areas of asphalt found deficient in thickness by more than 10 percent. Use new asphaltic base of thickness shown on Drawings.

C. Replace nonconforming pavement sections immediately upon notification by Owner, Engineer or Resident Project Representative.

3.08 UNIT PRICE ADJUSTMENT

A. Unit price adjustments shall be made for in-place depth determined by cores as follows:

1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price bid.

2. Adjustment shall apply to lower limit of 90 percent and upper limit of 105 percent of unit price.

3. Average depth below 90 percent may be rejected by Engineer.

3.09 PROTECTION

A. Do not open pavement to traffic until 12 hours after completion of rolling, or as shown on Drawings.

B. Maintain asphaltic concrete pavement in good condition until completion of Work at contractor’s own expense.

C. Repair defects immediately by replacing asphaltic concrete pavement to full depth at contractor's own expense.

END OF SECTION

Section 02742

PRIME COAT

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Prime coat for asphaltic concrete paving

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for prime coat under this Section. Include all costs of prime coat payment in unit price for material being primed.
2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit current product data for proposed prime coat.

C. Submit current report of recent calibration of distributor.

PART 2 P R O D U C T S

A. Cutback Asphalt
B. Provide moisture-free homogeneous material which will not foam when heated to 347 degrees F and which meets following requirements:
C. Asphalt material for prime coat shall be MC-30 or MC-70 and shall meet following requirements:

PROPERTIES	TYPE - GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
Water, Percent	---	0.2	---	0.2
Flash Point, T.O.C., °F	100	---	100	---
Kinematic Viscosity at 140°F, cst	30	60	70	140

2. Distillate shall be as follows, expressed as percent by volume of total distillate to 680 degrees F:

TEMPERATURE	TYPE-GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
to 437°F	---	25	---	20
to 500°F	40	70	20	60
to 600°F	75	93	65	90
Residue from 680ºF Distillation, Volume, Percent	50	---	55	---

3. Tests on Distillation Residue:

TEST	TYPE-GRADE			
	MC-30		MC-70	
	MIN.	MAX.	MIN.	MAX.
Penetration at 77°F, 100g, 5 sec., cm	120	250	120	250
Ductility at 77°F, 5 cm/min., cm	100*	---	100*	---
Solubility in Trichloroethylene, %	99	---	99	---
Spot Test	All Negative			

*If penetration of residue is more than 200 and ductility at 77 degrees F is less than 100 cm, material will be acceptable if its ductility at 60 degrees F is more than 100 cm.

2.02 EMULSIFIED PETROLEUM RESIN

A. EPR-1 Prime: Slow curing emulsion of petroleum resin and asphalt cement conforming to the following requirements:

PROPERTIES	MIN.	MAX.
Fural Viscosity at 77°F, Sec	14	40
Residue by Evaporation, % by Weight	60	-
Sieve Test, %	-	0.1

Particle Charge Test	Positive	
Tests on the Distillation Residue:		
Flash Point, COC (F)	400	-
Kinematic Viscosity @ 140 F (cst)	190	350

B. For use, EPR-1 may be diluted with water up to a maximum three parts water to one part EPR-1 in order to achieve desired concentration of residual resin/asphalt to facilitate application.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course surface of loose material by brooming prior to application of prime coat.

B. Prepare sufficient base in advance of paving for efficient operations.

3.03 APPLICATION, BASIC

A. Apply prime coat with approved type of self-propelled pressure distributor. Distribute prime coat evenly and smoothly under pressure necessary for proper distribution.

B. Keep storage tanks, piping, retorts, booster tanks, and distributors used in handling asphaltic materials clean and in good operating condition. Conduct operations so that asphaltic material does not become contaminated.

C. If yield of asphaltic material appears to be in error, recalibrate distributor prior to continuing work.

D. Maintain the surface until Work is accepted by Owner.

3.04 APPLICATION, CUTBACK ASPHALT

A. Do not place prime coat when air temperature is below 60 degrees F and falling. Materials may be placed when air temperature taken in shade and away from artificial heat is above 50 degrees F and rising.

B. Distribute at rate of 0.25 to 0.35 gallons per square yard.

C. Equipment shall be capable of reporting temperature of asphaltic material in heating equipment and in distributor, for determining rate of application, and for obtaining uniformity at junction of two distributor loads. Maintain in accurate working order, including recording thermometer at storage heating unit at all times.

D. Temperature of application shall be based on temperature-viscosity relationship that will permit application of asphalt with viscosity of 100 to 125 centistokes. Maintain asphalt within 15 degrees F of temperature required to meet viscosity. Selected temperature shall be within following range.

Prime Coat Type	Minimum (°F)	Maximum (°F)
MC-30	70	150
MC-70	125	175

E. Do not allow temperature of MC-30 to exceed 175 degrees F at any time.

F. Do not allow temperature of MC-70 to exceed 200 degrees F at any time.

3.05 APPLICATION, EMULSIFIED PETROLEUM RESIN

A. Do not place prime coat when air temperature is below 36 degrees F and falling.

B. Distribute at rate of 0.15 to 0.25 gallons per square yard.

3.06 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied prime coat until authorized by Resident Project Representative.

END OF SECTION

Section 02754

CONCRETE DRIVEWAYS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Portland cement concrete driveways.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for concrete driveways is on linear foot basis.
2. Approved widths of driveways for bidding purposes calculated as shown on detail sheets form.
3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ASTM A 82- Standard Specifications for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 185- Standard Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM C 131- Standard Specification for Ready-Mixed Concrete.

D. ASTM C 150- Standard Specification for Portland cement.

1.04 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330-Submittal Procedures.

B. Comply with corresponding requirements of division.

C. Concrete for form work, joints, finish and curing

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Section 02752 – Concrete Pavement Joints.

E. Subgrade Materials: Conform to subgrade material requirements of Section 02316 – Excavations and Backfill for Structures or Section 0321- Cement Stabilized Sand and other related specification sections.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable specifications of Section 02316 – Excavations and Backfill for Structures, Section 0321–- Cement Stabilized Sand, and Section 02751– Concrete Paving and details shown on plans.

3.02 PLACEMENT

A. Place and finish concrete primarily in accordance with applicable portions of Section 02751 – Concrete Paving.

B. Replace and restore driveways to original type of concrete, gravel, or asphalt as shown on pre-construction photos or as shown on plans.

3.03 JOINTS

A. Install joints in concrete driveway in accordance with Section 02752 - Concrete Pavement Joints.

B. Also comply with details shown on plans.

3.04 CONCRETE CURING

A. Cure concrete driveway in accordance with Section 02753 - Concrete Pavement Curing.

3.05 PROTECTION

A. Conform to applicable requirements of Section 02753 - Concrete Pavement Curing.

3.06 Backfill and compact when necessary or at request of Resident Project Representative.

Section 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for curbs and for curbs and gutter is on linear foot basis measured along face of curb.

2. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to streets.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit details of proposed formwork for approval.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Section 02751 - Concrete Paving.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 02751 - Concrete Paving.

C. Grout: Nonmetallic, nonshrink grout containing no chloride producing agents conforming to the following requirements.

1. Compressive strength
   a. at 7 days: 3500 psi
   b. at 28 days: 8000 psi

2. Initial set time: 45 minutes

3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Section 02752 - Concrete Pavement Joints.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Section 02752 - Concrete Pavement Joints.

F. Mortar: Mortar finish composed of one part Portland cement and 1-1/2 parts of fine aggregate. Use only when approved by Resident Project Representative.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.02 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Section 02752 - Concrete Pavement Joints. Place dummy groove joints at 6-foot centers at right angles to curb lines. Cut dummy grooves 1/4 inch deep using an approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.03 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10-foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4-inch edger. Finish edges with tool having 1/4-inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.04 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods. Use of mechanical methods shall provide specified curb design and finish.

3.05 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 - Concrete Pavement Curing.

3.06 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them.

3.07 PROTECTION

A. Maintain curbs and gutters in good condition until completion of the Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION

Section 02911

TOPSOIL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for topsoil under this Section. Include payment in Section 02921 - Hydromulch Seeding or Section 02922 - Sodding.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 P R O D U C T S

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having the following characteristics:

1. pH value of between 5.5 and 6.5

2. Liquid limit: 50 or less

3. Plasticity index: 20 or less.

4. Gradation: maximum of 10 percent passing the No. 200 sieve.

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 E X E C U T I O N

3.01 EXAMINATION

A. Verify that excavation and embankment operations have been completed to correct lines and grades.

3.02 TOPSOIL EXCAVATION

A. Strip off topsoil from the area to be excavated to a minimum depth of 6-inches, unless indicated otherwise on the Drawings.

B. Place Topsoil in stockpile for reuse. Cover stockpile to prevent erosion.

3.03 PLACEMENT

A. For areas to be seeded or sodded, scarify or plow existing material to a minimum depth of 4 inches, or as indicated on the Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with an appropriate lawn roller to consolidate topsoil.

B. Increase depth of topsoil to 6 inches when placed over sand bedding and backfill materials specified in Section 02320 - Utility Backfill Material.

C. For areas to receive shrubs or trees, excavate existing material and place topsoil to the depth and dimensions shown on the Drawings.

D. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Section 01576 - Waste Material Disposal.

3.04 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

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Section 02921

HYDROMULCH SEEDING

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Seeding, fertilizing, mulching, and maintenance of areas indicated on Drawings.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hydromulch seeding is on a square yard basis.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 SUBMITTALS

A. Submittals shall conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification from supplier that each type of seed conforms to these specifications and the requirements of the Texas Seed Law. Certification shall accompany seed delivery.

C. Submit a certificate stating that fertilizer complies with these specifications and the requirements of the Texas Fertilizer Law.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Topsoil: Conform to material requirements of Section 02911 - Topsoil.

B. Seed: Conform to U.S. Department of Agriculture rules and regulations of the Federal Seed Act and the Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet the following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.

2. Bermuda: Extra-fancy, treated, lawn type common bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.

3. Wet, moldy, or otherwise damaged seed will not be accepted.

4. Seed requirements, application rates, and planting dates are:

TYPE	APPLICATION RATE POUNDS/A	PLANTING DATE
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88	40 40	Jan 1 to Mar 31
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88 Annual Rye Grass (Gulf)	40 40 30	Oct 1 to Dec 31

C. Fertilizer: Dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers which bear the manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of the following elements:

1. Nitrogen: 10 Percent

2. Phosphoric Acid: 20 Percent

3. Potash: 10 Percent

D. Mulch:

1. Virgin wood cellulose fibers from whole wood chips having a minimum of 20 percent fibers 0.42 inches in length and 0.01 inches in diameter.

2. Cellulose fibers manufactured from recycled newspaper and meeting the same fiber content and size as for cellulose fibers from wood chips.

3. Mulch shall be dyed green for coverage verification purposes.

E. Soil Stabilizer: "Terra Tack 1" or approved equal.

F. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Place and compact topsoil in accordance with requirements of Section 02911 - Topsoil

B. Dispose of Objectionable and Waste Materials in accordance with Section 01576 - Waste Material Disposal.

3.02 APPLICATION

A. Seed: Apply uniformly at rates given in Paragraph 2.01 B for type of seed and planting date.

B. Fertilizer: Apply uniformly at a rate of 500 pounds per acre.

C. Mulch: Apply uniformly at a rate of 50 pounds per 1000 square feet.

D. Soil Stabilizer: Apply uniformly at a rate of 40 pounds per acre.

E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydromulching.

F. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Engineer approval before resuming operations.

3.03 MAINTENANCE

A. Maintain grassed areas a minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in the fall, continue maintenance the following spring until an acceptable lawn is established.

B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.

C. Repair areas damaged by erosion by regrading, rolling and replanting.

END OF SECTION

Section 02951

PAVEMENT REPLACEMENT FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Repairing and resurfacing streets, highways, driveways, sidewalks, and other pavements that have been cut, broken, or otherwise damaged during construction.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pavement replacement for utility construction will be made per linear foot along the utility centerline. Payment will be full compensation for saw cutting, backfill compaction, base material, surface material and all incidentals required for a complete installation as shown on the Drawings.

2. Refer to Section 01270 - Measurement and Payment for other unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Base: Provide base material as indicated on the Drawings.

B. Pavement: Provide paving materials as required by applicable portions of Section 02741 - Asphaltic Concrete Pavement, Section 02751- Concrete Paving, Section 02754 - Concrete Driveways, and Section 02771 - Curb, Curb and Gutter, and Headers, and Section 02775 - Concrete Sidewalks.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Saw cut pavement 24 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.

B. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, leave and protect minimum of 12 inches of undisturbed subgrade on each side of trench to support replacement slab.

3.02 INSTALLATION

A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.

B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.

C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings. Place types and spacing of joints to match existing or as indicated on Drawings.

D. Repair State highway crossings in accordance with TxDOT permit and within 1 week after utility work is installed.

3.03 WASTE MATERIAL DISPOSAL

A. Dispose of waste material in accordance with requirements of Section 01576 - Waste Material Disposal.

3.04 PROTECTION

A. Maintain pavement in good condition until completion of the Work.

B. Replace damaged pavement.

END OF SECTION

Section 03211

REINFORCING STEEL

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Structural concrete reinforcement and grouting of reinforcement dowel bars into hardened concrete.

1.02 UNIT PRICES

A. No separate payment will be made for reinforcing steel or grouting that is part of the Work as bid. Include payment in unit price for structural concrete or related specification sections.

B. Measurement for reinforcing steel installed as extra work is on a per-pound basis.

C. Refer to Section 01270 - Measurement and Payment for unit price procedures.

1.03 REFERENCES

A. ACI 315 - Details and Detailing of Concrete Reinforcement.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ASTM A 36 - Standard Specification for Structural Steel.

D. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

E. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

F. ASTM A 497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

G. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

H. ASTM A 675 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.

I. ASTM A 775/A 775M - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

J. ASTM C 881 - Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

K. AWS D 1.4 - Structural Welding Code - Reinforcing Steel.

L. WRI - Manual of Standard Practice for Welded Wire Fabric.

M. CRSI MSP-1 - Manual of Standard Practice.

1.04 SUBMITTALS

A. Conform to Section 01330 – Submittal Procedures.

B. Shop Drawings:

1 Submit shop drawings detailing reinforcement fabrication, bar placement location, splices, spacing, bar designation, bar type, length, size, bending, number of bars, bar support type and other pertinent information, including dimensions. Provide sufficient detail for placement of reinforcement without use of Contract Drawings. Information shall correspond directly to data listed on bill of materials.

2 Use of reproductions of Contract Drawings by Contractor, Subcontractor, erector, fabricator or material supplier in preparation of shop drawings (or in lieu of preparation of shop drawings) signifies acceptance by that party of information shown thereon as correct, and acceptance of obligation to pay for any job expense, real or implied, arising due to errors that may occur thereon. Remove references to Design Engineer, including seals, when reproductions of Contract Drawings are used as shop drawings.

3 Detail shop drawings in accordance with ACI 315, Figure 6.

4 Submit shop drawings showing location of proposed additional construction joints as required under Section 03151 - Joints in Concrete Structures, and obtain approval of Engineer, prior to submitting reinforcing steel shop drawings.

C. Bill of Materials: Submit with shop drawings.

D. Product Data:

1 Mechanical Bar Splices: Submit manufacturer's technical literature, including specifications and installation instructions.

2 Epoxy grout proposed for anchoring reinforcing dowels to hardened concrete: Submit manufacturer's technical literature including recommended installation procedures.

E. Certificates:

1 Submit steel manufacturer's certificates of mill tests giving properties of steel proposed for use. List manufacturer's test number, heat number, chemical analysis, yield point, tensile strength and percentage of elongation. Identify proposed location of steel in work.

2 Foreign-manufactured reinforcing bars shall be tested for conformance to ASTM requirements by a certified independent testing laboratory located in United States. Certification from any other source is not acceptable. Submit test reports for review. Do not begin fabrication of reinforcement until material has been approved.

1.05 HANDLING AND STORAGE

A. Store steel reinforcement above ground on platforms, skids or other supports. Protect reinforcing from mechanical injury, surface deterioration and formation of excessive, loose or flaky rust caused by exposure to weather. Protect epoxy-coated reinforcing from formation of any amount of rust.

1.06 QUALITY ASSURANCE

A. Notify Resident Project Representative at least 48 hours before concrete placement so that reinforcement may be inspected, and errors corrected, without delaying Work.

PART 2 P R O D U C T S

2.01 MATERIAL

A. Reinforcing Bars: Deformed bars conforming to ASTM A 615, grade as indicated on Drawings, except column spirals and those shown on Drawings to be smooth bars. Where grade is not shown on Drawings, use Grade 60.

B. Smooth Bars: Where indicated on Drawings, use smooth bars conforming to ASTM A 36; ASTM A 615, Grade 60; or ASTM A 675, Grade 70.

C. Column Spirals: Bars conforming to ASTM A 615, Grade 60, or wire conforming to ASTM A 82.

D. Epoxy-Coated Deformed Bars, Column Spirals and Smooth Bars: Conform to ASTM A 775/A 775M.

E. Welded Wire Fabric:

1. Welded Smooth Wire Fabric: Conform to ASTM A 185.

2. Welded Deformed Wire Fabric: Conform to ASTM A 497.

3. Provide wire size, type and spacing as shown. Where type is not shown on Drawings, use welded smooth wire fabric.

4. Furnish welded wire fabric in flat sheets only.

F. Tie Wire: 16-1/2 gage or heavier annealed steel wire. Use plastic-coated tie wire with epoxy-coated reinforcing steel.

G. Bar Supports: Provide chairs, riser bars, ties and other accessories made of plastic or metal, except as otherwise specified. Use bar supports and accessories of sizes required to provide required concrete cover. Where concrete surfaces are exposed to weather, water or wastewater, provide plastic accessories only; do not use galvanized or plastic-tipped metal in such locations. Provide metal bar supports and accessories rated Class 1 or 2 conforming to CRSI MSP-1 Manual of Standard Practice. Use epoxy-coated bar supports with epoxy-coated reinforcing bars.

H. Slabs on Grade: Provide chairs with sheet metal bases or provide precast concrete bar supports 3 inches wide, 6 inches long, and thick enough to allow required cover. Embed tie wires in 3-inch by 6-inch side.

I. Mechanical Bar Splices:

1. Conform to ACI 318; use where indicated on Drawings.

a. Compression splices shall develop ultimate stress of reinforcing bar.

b. Tension splices shall develop 125 percent of minimum yield point stress of reinforcing bar.

2. Regardless of chemical composition of steel, any heat effect shall not adversely affect performance of reinforcing bar.

J. Welded Splices:

1. Provide welded splices where shown and where approved by the Engineer. Welded splices of reinforcing steel shall develop a tensile strength exceeding 125 percent of the yield strength of the reinforcing bars connected.

2. Provide materials for welded splices conforming to AWS D1.4.

K. Epoxy Grout: High-strength rigid epoxy adhesive, conforming to ASTM C 881, Type IV, manufactured for purpose of anchoring dowels into hardened concrete and the moisture condition, application temperature and orientation of the hole to be filled. Unless otherwise shown, depth of embedment shall be as required to develop the full tensile strength (125 percent of yield strength) of dowel, but not less than 12 diameters.

2.02 FABRICATION

A. Bending: Fabricate bars to shapes indicated on Drawings by cold bending. Bends shall conform to minimum bend diameters specified in ACI 318. Do not straighten or rebend bars. Fabricate epoxy-coated reinforcing steel to required shapes in a manner that will not damage epoxy coating. Repair any damaged epoxy coating with patching material conforming to Item 4.4 of ASTM A 775/A 775M.

B. Splices:

1. Locate splices as indicated on Drawings. Do not locate splices at other locations without approval of Engineer. Use minimum number of splices located at points of minimum stress. Stagger splices in adjacent bars.

2. Length of lap splices: As shown on Drawings.

3. Prepare ends of bars at mechanical splices in accordance with splice manufacturer's requirements.

C. Construction Joints: Unless otherwise shown, continue reinforcing through construction joints.

D. Bar Fabrication Tolerances: Conform to tolerances listed in ACI 315, Figures 4 and 5.

E. Standard Hooks: Conform to the requirements of ACI 318.

F. Marking: Clearly mark bars with waterproof tags showing number of bars, size, mark, length and yield strength. Mark steel with same designation as member in which it occurs.

PART 3 E X E C U T I O N

3.01 PREPARATION

A. Clean reinforcement of scale, loose or flaky rust and other foreign material, including oil, mud or coating that will reduce bond to concrete.

3.02 INSTALLATION

A. Placement Tolerances: Place reinforcement within tolerances of Table 03210A at the end of this Section. Bend tie wire away from forms to maintain the specified concrete coverage.

B. Interferences: Maintain 2-inch clearance from embedded items. Where reinforcing interferes with location of other reinforcing steel, conduit or embedded items, bars may be moved within specified tolerances or one bar diameter, whichever is greater. Where greater movement of bars is required to avoid interference, notify Engineer. Do not cut reinforcement to install inserts, conduit, mechanical openings or other items without approval of Engineer.

C. Concrete Cover: Provide clear cover measured from reinforcement to face of concrete as listed in Table 03210B at the end of this Section, unless otherwise indicated on Drawings.

D. Placement in Forms: Use spacers, chairs, wire ties and other accessory items necessary to assemble, space and support reinforcing properly. Provide accessories of sufficient number, size and strength to prevent deflection or displacement of reinforcement due to construction loads or concrete placement. Use appropriate accessories to position and support bolts, anchors and other embedded items. Tie reinforcing bars at each intersection, and to accessories. Blocking reinforcement with concrete or masonry is prohibited.

E. Placement for Concrete on Ground: Support bar and wire reinforcement on chairs with sheet metal bases or precast concrete blocks spaced at approximately 3 feet on centers each way. Use minimum of one support for each 9 square feet. Tie supports to reinforcing bars and wires.

F. Vertical Reinforcement in Columns: Offset vertical bars by at least one bar diameter at splices. Provide accurate templates for column dowels to ensure proper placement.

G. Splices:

1. Do not splice bars, except at locations indicated on Drawings or reviewed shop drawings, without approval of Engineer.

2. Lap Splices: Unless otherwise shown or noted, Class B, conforming to ACI 318-89, Section 12.15.1. Tie securely with wire prior to concrete placement, to prevent displacement of splices during concrete placement.

3. Mechanical Bar Splices: Use only where indicated on Drawings or approved by the Engineer. Install in accordance with manufacturer's instructions.

a. Couplers located at a joint face shall be of a type which can be set either flush or

recessed from the face as shown. Seal couplers prior to concrete placement to completely eliminate concrete or cement paste from entering.

b. Couplers intended for future connections: Recess 1/2 inch minimum from concrete surface. After concrete is placed, plug coupler and fill recess with sealant to prevent contact with water or other corrosive materials.

c. Unless noted otherwise, match mechanical coupler spacing and capacity to that shown for the adjacent reinforcing.

H. Construction Joints: Place reinforcing continuous through construction joints, unless noted otherwise.

I. Welded Wire Fabric: Install wire fabric in as long lengths as practicable. Unless otherwise indicated on Drawings, lap adjoining pieces at least 6 inches or one full mesh plus 2 inches, whichever is larger. Lace splices with wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps. Conform to WRI - Manual of Standard Practice for Welded Wire Fabric.

J. Field Bending: Shape reinforcing bent during construction operations to conform to Drawings. Bars shall be cold-bent; do not heat bars. Closely inspect reinforcing for breaks. When reinforcing is damaged, replace, Cadweld, or otherwise repair, as directed by Engineer. Do not bend reinforcement after it is embedded in concrete.

K. Epoxy-coated Reinforcing Steel: Install in accordance with Paragraph 3.02J, Field Bending, and in a manner that will not damage epoxy coating. Repair damaged epoxy coating with patching material as specified in Paragraph 2.02A, Bending.

L. Field Cutting: Cut reinforcing bars by shearing or sawing. Do not cut bars with cutting torch.

M. Welding of reinforcing bars is prohibited, except where shown on Drawings.

3.03 GROUTING OF REINFORCING AND DOWEL BARS

A. Use epoxy grout for anchoring reinforcing and dowel steel to existing concrete in accordance with epoxy manufacturer's instructions. Drill hole not more than 1/4 inch larger than steel bar diameter (including height of deformations for deformed bars) in existing concrete. Just before installation of steel, blow hole clean of all debris using compressed air. Partially fill hole with epoxy, using enough epoxy so when steel bar is inserted, epoxy grout will completely fill hole around bar. Dip end of steel bar in epoxy and twist bar while inserting into partially-filled hole.

Table 03210A
REINFORCEMENT PLACEMENT TOLERANCES

PLACEMENT	TOLERANCE IN INCHES
Clear Distance -	
To formed soffit:	-1/4
To other formed surfaces:	"1/4
Minimum spacing between bars:	-1/4
Clear distance from unformed surface to top reinforcement -	
Members 8 inches deep or less:	"1/4
Members more than 8 inches deep but less than 24 inches deep:	
Members 24 inches deep or greater:	-1/4, +1/2
Uniform spacing of bars (but the required number of bars shall not be reduced):	-1/4, +1
Uniform spacing of stirrups and ties (but the required number of stirrups and ties shall not be reduced):	"2
	"1
Longitudinal locations of bends and ends of reinforcement -	
General:	"2
Discontinuous ends of members:	"1/2
Length of bar laps:	-1-1/2
Embedded length -	
For bar sizes No. 3 through 11:	-1
For bar sizes No. 14 and 18:	-2

Table 03210B
MINIMUM CONCRETE COVER FOR REINFORCEMENT

SURFACE	MINIMUM COVER IN INCHES
Slabs and Joists - Top and bottom bars for dry conditions - No. 14 and No. 18 bars: No. 11 bars and smaller:	 1-1/2 1
Formed concrete surfaces exposed to earth, water or weather; over, or in contact with, sewage; and for bottoms bearing on work mat, or slabs supporting earth cover - No. 5 bars and smaller: No. 6 through No. 18 bars:	 1-1/2 2
Beams and Columns - For dry conditions - Stirrups, spirals and ties: Principal reinforcement: Exposed to earth, water, sewage or weather - Stirrups and ties: Principal reinforcement:	 1-1/2 2 2 2-1/2
Walls - For dry conditions - No. 11 bars and smaller: No. 14 and No. 18 bars: Formed concrete surfaces exposed to earth, water, sewage or weather, or in contact with ground - Circular tanks with ring tension: All others:	 1 1-1/2 2 2
Footings and Base Slabs - At formed surfaces and bottoms bearing on concrete work mat: At unformed surfaces and bottoms in contact with earth: Over top of piles: Top of footings -- same as slabs	 2 3 2

END OF SECTION

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Section 03315

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.

2. Obtain the services of and pay for a certified testing laboratory to prepare design mixes.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.03 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Batch Plant Inspection and Field Testing of Ready Mixed Concrete.

H. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures.

I. ACI 318 - Building Code Requirements for Reinforced Concrete.

J. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

K. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

L. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

M. ASTM A 767 - Standard Specifications for Zinc-coated (Galvanized) Bars for Concrete Reinforcement.

N. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

O. ASTM A 884 - Specification for Epoxy-coated Steel Wire and Welded Wire Fabric for Reinforcement.

P. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

Q. ASTM C 33 - Standard Specification for Concrete Aggregates.

R. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

S. ASTM C 42 - Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

T. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

U. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

V. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

W. ASTM C 150 - Standard Specification for Portland Cement.

X. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

Y. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

Z. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

AA. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

AB. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

AC. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

AD. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

AE. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

AF. ASTM C 1017 - Chemical Admixtures for Use in Producing Flowing Concrete.

AG. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AH. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for use in Construction and Criteria for Laboratory Evaluation.

AI. ASTM D 746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

AJ. CRSI MSP-1 - Manual of Standard Practice.

AK. CRSI - Placing Reinforcing Bars.

AL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

AM. NRMCA - Concrete Plant Standards.

1.04 SUBMITTALS

A. Conform to Section 01330 - Submittal Procedures.

B. Provide copy of current Texas Department of Transportation (TxDOT) Plant Certification.

C. Submit proposed mix design and test data for each type and strength of concrete in the Work.

D. Submit laboratory reports prepared by an independent testing laboratory stating that materials used comply with requirements of this Section.

E. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by the Resident Project Representative.

F. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

G. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

H. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.05 HANDLING AND STORAGE

A. Cement: Store cement off of the ground in a well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to the coating.

PART 2 P R O D U C T S

2.01 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless the use of Type III is authorized by the Engineer; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in the form of $Na_2O + 0.658K_20$.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use the following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of the narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.

2. Fine Aggregate: ASTM C 33.

3. Determine the potential reactivity of fine and coarse aggregate in accordance with the appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures: The use of chemical admixtures is not an acceptable substitute for proper mix proportioning, mix material quality control, or handling of wet concrete. If, based on site-specific project conditions, the Contractor deems that there is no practical alternative to meet the required quality constraints of this Section, he may request permission to use admixtures. Requests shall be made in writing and submitted to the Engineer for approval. Requests shall contain sufficient information to determine whether or not a change in the mix design is warranted. Submission of a request is not an approval. Each proposed addition of chemical admixture(s) must be approved by the Engineer prior to use. Only the following admixtures may, in accordance with the foregoing, be requested for use:

1. Water Reducers: ASTM C 494, Type A.

2. Water Reducing Retarders: ASTM 494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply the gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A 82. Use 16-1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.02 FORMWORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for

bottoms of caps: At least 2-inch (nominal) lumber, or 3/4-inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Formwork for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4-inch minimum thickness, preferably oiled at the mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in a gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

B. The concrete mixing plant shall be certified to supply concrete to TxDOT.

2.04 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

A. Use design mixes prepared by a certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this Section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to the Engineer for review.

C. Proportioning on the basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, if approved by the Engineer.

D. Classification:

CLASS	TYPE	MINIMUM COMPRESSIVE STRENGTH (LBS/SQ. IN.)		MAXIMUM W/C RATIO; GAL/SACK	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP (INCHES)
		7-DAY	28-DAY			
A	Structural	2400	3000	6.5	4±1	2 to 4*
B	Pipe Block Fill, Thrust Block	----	2000	8.0	4±1	5 to 7
*When ASTM C 494, Type F or Type G admixture is used to increase workability, this range may be 6 to 9.						

E. Add steel or polypropylene fibers only when called for on the Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on the Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.06 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that the material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:

1. Thickness: not less than 3/8 inch

2.07 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on the Drawings; either a bentonite- or adhesive-type material.

B. Bentonite Waterstop:

1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.

2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.

3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch.

4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:

1. Preformed plastic adhesive waterstop at least 1inch by ¾ inch.

2. Meets or exceeds requirements of Federal Specification SS-S-210A.

3. Supplied wrapped completely by a 2-part protective paper.

4. Submit independent laboratory tests verifying that the material seals joints in concrete against leakage when subjected to a minimum of 30 psi water pressure for at least 72 hours.

5. Provide primer, to be used on hardened concrete surfaces, from the same manufacturer who supplies the waterstop material.

PART 3 E X E C U T I O N

3.01 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back formwork with a sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer the liner on the job before using. Facing may be constructed of 3/4-inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4-inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Resident Project Representative, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by the Resident Project Representative and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on the Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of the Engineer. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.04 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using an automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of the Engineer before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to the site shall be accompanied by batch tickets providing the information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing the information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in the shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until the concrete has cured for a minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by the Engineer.

3.05 PLACING CONCRETE

A. Give sufficient advance notice to the Resident Project Representative (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to the Resident Project Representative's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, if necessary to continue after daylight hours, light the site as required. If rainfall occurs after placing operations are started, provide covering to protect the work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after

concrete has taken an initial set; do not place any strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for the size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move the vibrator vertically through the layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.06 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

C. Splicing PVC Waterstops:

1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.

2. Butt end-to-end joints of two identical waterstop sections may be made in the forms during placement of waterstop material.

3. Prior to placement in formwork, prefabricate waterstop joints involving more than two ends to be joined together, an angle cut, an alignment change, or the joining of two dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Resident Project Representative, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of waterstop in the forms.

D. Setting PVC Waterstops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete and to prevent folding over of the waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying to the Specifications.

F. Resilient Waterstop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.

2. When requested by the Engineer, provide technical assistance by manufacturer's representative in the field at no additional cost to the Owner.

3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.

5. At the free top of walls without connecting slabs, stop the resilient waterstop and grooves (where used) 6 inches from the top in vertical wall joints.

6. Bentonite Waterstop:

a. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1-1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.

c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.

d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

e. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.

7. Adhesive Waterstop:

a. With a wire brush thoroughly clean the concrete surface on which the waterstop is to be placed and then coat with primer.

b. If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.

c. Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1 inch and cover back over with protective paper.

d. Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.07 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Engineer. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.08 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for a period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from the concrete surface after placing and finishing. A curing day is any calendar day in which the temperature is above 50 degrees F for at least 19 hours. Colder days may be counted if air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at the end of calendar days equal to twice the required number of curing days. However, leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for the full curing period. Keep wood forms wet during the curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging the surface.

2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received a final finish and surplus water sheen has disappeared, immediately seal surface with a uniform coating of approved curing compound, applied at the rate of coverage recommended by manufacturer or as directed by the Resident Project Representative. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of the compound.

2. Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to a dry surface. If concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or if rain falls on a newly coated surface before film has dried sufficiently to resist damage, apply an additional coat of compound at the specified rate of coverage.

3.09 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for the required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

3.10 DEFECTIVE WORK

A. Immediately repair any defective work discovered after forms have been removed. If concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace the entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use a stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with the surface.

B. Apply a rubbed finish to exposed surfaces of formed concrete structures. After pointing has set sufficiently, wet the surface with a brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce a smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on the surface to reset; then wash surface with clean water. Leave structure with a clean, neat and uniform-appearing finish.

C. Apply a wood float finish to concrete slabs unless shown otherwise.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Unless otherwise directed by Engineer, the following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by an approved independent testing agency, and conform to the requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.

2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test the specimens in accordance with ASTM C 31 and ASTM C 39.

3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.

4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing Type III Cement Concrete: When Type III cement is used in concrete, the specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resume curing on those portions of structure represented by test specimens may be required. If additional curing fails to produce the required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by the Engineer, at no additional cost to the Owner.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by the Owner.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic, and whenever such precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Engineer.

END OF SECTION

SECTION 09901

PROTECTIVE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preparing surfaces, providing adequate conditions for proper workmanship, and furnishing and applying the protective coating materials required for metallic, concrete, masonry and plastic surfaces.

B. Color code painting of piping and piping identification signs and markers.

C. Refer to Section 09900 – Painting for Decorative and Protective Coatings to be used on Interior and Exterior Architectural Surfaces, such as wood, gypsum board and masonry.

D. Refer to Section 09971 – Painting and Protective Coatings for Potable Water Storage Tanks for painting and protective coatings to be used on potable water storage tanks.

1.02 RELATED SECTIONS

A. Document 00410 – Bid Form

B. Document 00700 – General Conditions

C. Section 01270 – Measurement and Payment

D. Section 01330 – Submittal Procedures

E. Section 01630 – Product Substitution Procedures

F. Section 09900 – Painting for Decorative and Protective Coatings

1.03 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for protective coatings unless specifically listed in Document 00405 – Schedule of Unit Price Work. Include payment for protective coatings in unit prices for items to which coatings are applied.

2. Measurement for protective coatings, when included as a separate pay item, is on a square-foot basis for completed protective coating systems. Refer to Section 01270 – Measurement and

Payment

1.04 REFERENCES

A. ANSI A13.1 – Color Schedule

B. ANSI/AWWA C213 – Fusion-bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

C. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

D. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

F. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.

G. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

H. ASTM D 2240 - Standard Test Method for Rubber Property—Durometer Hardness.

I. ASTM D 2990 - Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.

J. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

K. ASTM D 7234 - Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

L. ASTM G 20 - Standard Test Method for Chemical Resistance of Pipeline Coatings.

M. Federal Specification TT-P-28 – Paint, Aluminum, Heat Resisting 1200 degrees F

N. Federal Standard 595A – Federal Standard Colors

O. Military Specification DOD-P-23236 – Paint Coating Systems, Steel Ship Tank, Fuel and Salt Water Ballast, Class 2

P. NSF Standard 61 – Drinking Water System Components – Health Effects

Q. SSPC-PA 1 – Paint Application Specification No. 1 - Shop, Field and Maintenance Painting

R. SSPC-PA 2 – Paint Application Specification No. 2 – Measurement of Dry Paint Thickness with Magnetic Gages

S. SSPC-Paint 16 – Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint

T. SSPC-SP 1 – Solvent Cleaning

U. SSPC-SP 2 – Hand Tool Cleaning

V. SSPC-SP 3 – Power Tool Cleaning

W. SSPC-SP 5/NACE 1 – White Metal Blast Cleaning

X. SSPC-SP 6/ NACE 3 – Commercial Blast Cleaning

Y. SSPC-SP 7/NACE 4 - Brush-Off Blast Cleaning

Z. SSPC-SP 10/NACE 2 – Near White Metal Blast Cleaning

AA. SSPC-SP 11 – Power Tool Cleaning to Bare Metal

BB. SSPC-VIS 1-89 – Visual Standard for Abrasive Blast Cleaned Steel

CC. SSPC-VIS 3 – Visual Standard for Power-and Hand-Tool Cleaned Steel

DD. SSPC-QP 1 – Standard Procedure for Evaluating Qualifications of Painting Contractors

EE. SSPC-QP 2 - Standard Procedure for Evaluating Qualifications of Painting Contractors to Remove Hazardous Paint

FF. SSPC-SP12/NACE 5 – Surface Preparation and Cleaning of Steel and Other Hard Materials by High-and Ultrahigh-Pressure Water Jetting Prior to Recoating

1.05 DEFINITIONS

A. Paint, coatings, or finishes as used in this Section include surface treatments, emulsions, enamels, paints, epoxies, polyurethanes, acrylics, zincs, and other protective coatings with the exceptions of galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat.

B. DFT means minimum dry film thickness.

C. VOC means Volatile Organic Components

1.06 PERFORMANCE REQUIREMENTS

A. See the Drawings and other Specifications to determine how coatings under this Section will be applied. Paint or coat new and modified surfaces in conformance with this Section.

B. Coating system schedules summarize surfaces to be coated, required surface

preparation, and coating systems to be applied. Coating notes on Drawings are used to show exceptions to schedules, to show or extend limits of coating systems, or to clarify or show details for application of coating systems.

C. Do not apply protective coatings to the following surfaces unless specifically named or shown to be coated:

1. Concrete
2. Stainless steel, bronze, or brass
3. Machined surfaces
4. Grease fittings
5. Glass
6. Equipment nameplates
7. Platform gratings, stair treads, door thresholds, and other walk surfaces
8. Galvanized steel electrical conduit and associated galvanized and factory-coated junction boxes and electrical panels
9. Galvanized surfaces inside buildings and not exposed to view
10. Manhole and valve covers and rings, storm water inlet gratings, covers, and frames

D. Provide decorative and protective coatings for interior architectural surfaces such as wood, gypsum board, and masonry in accordance with Section 09900 – Painting.

1.07 SUBMITTALS

A. Make submittals in accordance with Section 01330 – Submittal Procedures.

B. Submit the following information at least 10 days prior to protective coating work:

1. Coating Materials List: Eight copies of a coating materials list naming the manufacturer and the coating number, keyed to the coating systems described in this Section. Submit the list prior to or at the time of sample submittal.
2. Paint Manufacturer's Information: For each coating system to be used, submit the following data:
   a. Paint manufacturer's Product Data Sheet for each product proposed, including statements on the suitability of the material for the intended use.

b. Technical and performance information that demonstrates compliance with the system performance and material requirements.

c. Paint manufacturer's instructions and recommendations on surface preparation, application and curing.

d. Colors available for each product, where applicable.

e. Compatibility of shop and field applied coatings, where applicable.

f. Material Safety Data Sheets for each product used.

g. VOC of each paint or coating proposed, stated in grams per litre.

3. Samples

a. Submit color samples of paint, finishes, and other coating materials on 8-1/2 inch by 11-inch sheet metal or heavy cardstock. Have each sheet completely coated over its entire surface with one protective coating material, type, and color.

b. Provide two sets of color samples to match each color selected by the Engineer from the manufacturer's standard color sheets. If custom-mixed colors are indicated, prepare color samples using color formulations prepared to match the color samples furnished by the Engineer.

c. Submit one 15-pound sample of each abrasive proposed to be used for surface preparation for submerged and severe service coating systems.

1.08 QUALIFICATIONS

A. Submit five (5) references which show that the painting Contractor has previous successful experience with the indicated or comparable coating systems. Include the name, address, and the telephone number for the owner of each installation for which the painting Contractor provided the protective coating. As an alternative, submit proof of certification in accordance with SSPC-QP 1.

B. For any project which involves removal or repair of lead based paints, submit proof of certification in accordance with SSPC-QP 2.

1.09 ENVIRONMENTAL RESTRICTIONS

A. Ventilate area where coating is being applied. Post and enforce NO SMOKING OR OPEN FLAME signs until coating has cured.

B. Provide lighting level of 80-foot candles (860 1x) measured mid-height at substrate surface.

C. Restrict worker access and construction traffic from area where coating is being applied or is curing.

D. Comply with Port of Brownsville and all applicable OSHA confined space entry regulations including but not limited to OSHA Permit-Required Confined Space Standard 1910.146.

1.10 WARRANTY INSPECTION AND MAINTENANCE

A. Warranty Inspection:

1. A warranty inspection may be conducted during the eleventh month following completion of coating and painting. The Contractor and a representative of the coating material manufacturer must attend the inspection. At the option of the Port of Brownsville, the Port of Brownsville may be represented by a NACE certified coating inspector.

2. The Engineer may, by written notice to the Contractor, reschedule the warranty inspection to another date within the one-year correction period, or may cancel the warranty inspection altogether. Cancellation of the warranty inspection does not relieve the Contractor of the Contractor's responsibilities under the Contract Documents.

3. Repair defective work discovered during the warranty inspection in accordance with these Specifications.

B. Extended Maintenance of Chemical Tank Lining Systems: Promptly repair defects in the chemical resistant sheet lining system for a period of 2 years after the lining has been placed into service. Such maintenance includes repair of the chemical tank and any equipment or facilities damaged by the corrosive action of the chemicals.

PART 2 PRODUCTS

2.01 COATINGS CRITERIA

A. Suitability: Use suitable coating materials as recommended by the manufacturer. Recommendations must be accompanied by test methods used to determine suitability and results of these tests.

B. Compatibility: In any coating system, use only compatible materials from a single manufacturer. Give particular attention to compatibility of primers, intermediate coats and finish coats. If necessary, apply a barrier coat or tie coat between existing prime coat and subsequent field coats to ensure compatibility.

C. Containers: Supply coating materials in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, and name of manufacturer, all plainly legible at the time of use.

D. Colors: Use colors and shades of colors of all coats of paint as indicated on the coating schedules or as selected by the Engineer. Make each coat a contrasting shade to the previous and following coats to facilitate inspection of surface coverage of each coat. The Engineer will select finish colors from the manufacturer's standard color samples.

E. Substitute or Equal Products:

1. To establish equality under Section 01630 – Product Substitution Procedures, furnish satisfactory documentation from the manufacturer of the proposed substitute product that the material meets the indicated requirements and is equivalent to or better in the following properties:

   a. Resistance to abrasion and physical damage.

   b. Resistance to chemical attack.

   c. Life expectancy.

   d. Ability to recoat in the future.

   e. Solids content by volume.

   f. Dry film thickness per coat.

   g. Compatibility with other coatings.

   h. Suitability for the intended service.

   i. Temperature limitations in service and during application.

   j. Type and quality of recommended undercoats and topcoats.

   k. Ease of application.

   l. Ease of repairing damaged areas.

   m. Stability of colors.

   n. VOC content expressed in grams per liter.

2. For substitutions, submit protective-coating materials which are standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, provide the City Engineer with the names of not less than 10 successful applications of the proposed manufacturer's products, which comply with these requirements. Applications must be in similar service

environments to the job being contracted.

2.02 INDUSTRIAL COATING SYSTEMS

A. Material Sources: Each of the following manufacturers is capable of supplying many of the specified industrial coating materials. Manufacturers and specific paint designations (numbers) are listed to indicate the required type and quality of coating. Contractors are to base their bid on the use of products supplied by one of the named manufacturers. These named manufacturers are designated to establish a level of acceptable product quality or manufacturing experience and are not to be construed as the only manufacturers of products acceptable for use. Other manufacturers will be considered on an individual basis, and may be submitted for consideration in accordance with Document 0700 General Requirements, Article 3.8, Product Options and Substitutions (excluding 3.8.3), Section 01330 – Submittal Procedures, Section 01630 – Products Substitution Procedures, and this Section.

1. AKZO/International Coatings
2. Ameron International
3. Carboline Coatings Company
4. Hempel Coatings USA, Inc.
5. ICI/Devoe Coatings
6. Sigma Coatings USA, Inc.
7. Tnemec Company
8. Sherwin Williams Co.

B. System 1 – Aliphatic Polyurethane Finish Coat: Use a two-component aliphatic acrylic polyurethane coating that provides superior color and gloss retention, resistance to splash from acid and alkaline chemicals, resistance to chemical fumes and severe weathering, and has a minimum solids content of 58 percent by volume. As primer, use a rust inhibitive 2- component epoxy coating with minimum solids content of 66 percent by volume.

1. Prime Coat:
   a. DFT = 4-6 mils (100-150 microns).
   b. Products: Ameron 385, Carboline 893, Tnemec 69, VyGuard V75, SW Macropoxy 646 FC Epoxy, or equal.
2. Finish Coats (one or more):

a. DFT = 2-4 mils (50-100 microns).

b. Products: Ameron 450 GL, Carboline 134 HG, Tnemec 74, VyGuard V54, Sherwin Williams Hi-Solids Polyurethane, or equal.

3. Total System = 6-10 mils (150-250 microns).

4. Apply more than one finish coat as necessary to produce a finish with uniform color and texture.

C. System 2 – Inorganic Zinc/Epoxy Polyurethane: For prime coat, use a 2-component water or solvent-based inorganic zinc silicate which contains at least 85 percent of metallic zinc by weight in the dried film, and is recommended by the coating manufacturer as a primer for this system. As intermediate coat, use a high-build, 2-component epoxy with a solids content of at least 70 percent by volume. For finish coat, use a 2-component aliphatic acrylic or polyester polyurethane coating material that provides superior color and gloss retention, resistance to chemical fumes and severe weathering, and has a minimum solids content of 58 percent by volume.

1. Prime Coat:

a. DFT = 2.5-4.0 mils (65-100 microns).

b. Products: Ameron Dimetcote 21-5 or 21-9, Carbozinc 11 or D7WB, VyGuard 13F6 or 13F7, SW Zinc Clad II L.V. or equal.

2. Intermediate Coat:

a. DFT = 4-6 mils (100-150 microns).

b. Ameron 385, Carboline 893, VyGuard V75, or equal.

3. Finish Coats (one or more):

a. DFT = 2.5 to 4.0 mils (65-100 microns).

b. Ameron 450 GL, Carboline 134 HG, VyGuard V54, Sherwin Williams Hi-Solids Polyurethane, or equal.

4. Total System DFT = 9-14 mils (225-600 microns).

5. Apply intermediate coat in excess of 4 mils (100 microns) DFT using the mist coat/full coat technique to completely cover the inorganic zinc primer and prevent bubbling of the epoxy or polyurethane finish coat.

6. Apply more than one finish coat as necessary to produce a finish with uniform color and texture.

7. If inorganic zinc primer is used as a pre-construction or shop-applied primer,

and there are damaged or uncoated areas, spot blast the damaged areas with abrasive to an SSPC-SP 10 Near White Metal Standard and then coat with the specified material.

D. System 3 – Inorganic Zinc: Use a 2-component water-based inorganic zinc silicate which contains at least 85 percent of metallic zinc by weight in the dried film.

1. Prime Coat and Finish Coat (one).

a. DFT = 2.5 to 4.0 mils (65-100 microns).

b. Products: Ameron Dimetcote 21-5, Carbozinc D7WB, VyGuard 13F6 or 13F7, S.W. Zinc Clad XI, or equal.

2. Total System DFT = 2.5 to 4.0 mils (65-100 microns).

E. System 4 – Acrylic Latex: Use a single component, water-based acrylic latex with a fungicide additive having a minimum solids content of 35 percent by volume. Apply a prime coat as recommended by manufacturer. Select coating material, which is available in ANSI safety colors.

1. Prime Coat

a. DFT = 2-3 mils (50-75 microns).

b. Products: Carboline D3358, Ameron 148, Hemucryl 1803, Sherwin Williams DTM Primer/Finish.

2. Finish Coats (2 or more):

a. DFT = 6-8 mils (150-200 microns).

b. Products: Carboline D3359, Ameron 220, Hemucryl 4803, Sherwin Williams DTM Acrylic Coating or equal.

3. Total System DFT = 8-11 mils (200-275 microns).

F. System 5 – Epoxy: Use a two-component, rust inhibitive, polyamide-cured epoxy coating material with a recoatable finish that is available in a wide selection of colors. Use a coating with a minimum solid content of 66 percent by volume and resistant to service conditions of condensing moisture, splash and spillage of lubricating oils, and frequent washdown and cleaning.

1. Prime Coat:

a. DFT = 3-5 mils (75-125 microns).

b. Products: Ameron 385PA, Carboline 193, Tnemec 69, VyGuard V75,

Sherwin Williams Macropoxy 646 FC, or equal.

2. Prime Coat (where shop applied):

a. DFT = 3-5 mils (75-125 microns).

b. Products: Ameron 370, Carboline 193, Tnemec 161, VyGuard V75, Sherwin Williams Recoatable Epoxy Primer, or equal.

3. Finish Coats (2 or more):

a. DFT = 5- 7 mils (125-175 microns).

b. Products: Ameron 385, Carboline 893, Tnemec 69, VyGuard V75, Sherwin Williams Macropoxy 646 FC, or equal.

4. Total System DFT = 8-12 mils (200-300 microns).

G. System 6 – Aliphatic Polyurethane, Fiberglass: Use a two-component aliphatic polyurethane coating material with superior color and gloss retention, resistance to splash from acid and alkaline chemicals, and resistance to chemical fumes and severe weathering. Use a primer, tie coat, or mist coat as recommended by the manufacturer.

1. Prime Coat (Tie Coat): Ameron 385, Carboline 893, Tnemec P66, VyGuard V75, Macropoxy 646 FC, or equal.

2. Finish Coats (2 or more):

a. DFT = 2-4 mils (50-75 microns).

b. Products: Ameron Amershield, Carbothane 134 HG, Tnemec 74, VyGuard V54, or equal.

H. Section 7 – Alkyd Enamel: Use a high quality, gloss, or semi-gloss, medium long oil alkyd finish with a minimum solids content of 49 percent by volume. Apply primer as recommended by manufacturer.

1. Prime Coat:

a. DFT = 2-3 mils (50 to 75 microns).

b. Products: Ameron 5105, Carboline AD29, Tnemec P4-55, VyGuard 13R29, kem Kromik Universal, or equal.

2. Finish Coats (2 or more):

a. DFT = 2-4 mils (50-75 microns).

b. Products: Ameron 5401HAS, Carboline GP62, Tnemec 2H, VyGuard V20, Sherwin Williams Indusrial Enamel, or equal.

3. Total System DFT = 4-7 mils (100-175 microns).

I. System 8 – Aluminum Metal Isolation: Use one coat of a high-build polyamide epoxy paint.

1. Products: Tnemec P66, Ameron 385, Carboline 893, Tnemec P66, VyGuard V75, Sherwin Williams Macropoxy 646 FC, or equal.

2. Total System DFT = 6-8 mils (150-200 microns).

J. System 9 – Aluminum Silicone Resin: Use an aluminum silicone resin material suitable for a service temperature of up to 1000 degrees F (538 degrees C). Coating must comply with Federal Specification DOD-P-28.

1. Prime Coat and Finish Coat (2 or more):

a. DFT = 2-4 mils (50-100 microns)

b. Products: Tnemec 39-1061, Ameron 878, Carboline 4631, VyGuard V437A1, Sherwin Williams Steel Master 9500, or equal

c. Total System DFT = 2-4 mils (50-100 microns)

K. System 10 – Zinc Rich Epoxy: Use a polyamide Epoxy resin material that contains at least 76 percent zinc in the dried film.

1. Prime Coat and Finish Coat (2 or more):

a. DFT = 3-5 mils (75-125 microns)

b. Products: Ameron 68HS, Carboline 858, VyGuard 13F4, Sherwin Williams Zinc Clad III, or equal

c. Total System DFT = 3-5 mils (75-125 microns)

2.03 SUBMERGED AND SEVERE SERVICE COATING SYSTEMS

A. Material Sources: The manufacturers listed in this paragraph are materials, which satisfy the material descriptions of this paragraph and have a documented successful record for long- term submerged or sever service conditions. Proposed substitute products will be considered as indicated under paragraphs 2.01.5.

B. System 100 – Amine-Cured Epoxy: Use a high-build amine-cured epoxy with a solids content of at least 80 percent by volume. Use a coating suitable for long-term

immersion in potable water. For potable water service, select a coating material listed in the NSF 61 Standard.

1. Prime Coat and Finish Coats (3 or more):

   a. DFT = 16-19 mils (400 to 475 microns).

   b. Products: Ameron Amercoat 395, Carboline 891, Tnemec 139, Sherwin Williams Tank Clad H.S,or equal.

2. For coating of valves and non-submerged equipment, DFT = 12-14 mils (300-350 microns).

C. System 101 – Polyamide Cured Epoxy: Use a high-build, polyamide epoxy resin with a solids content of at least 56 percent by volume. Use a coating suitable for long-term immersion in potable water. For potable water service, select a coating material listed under NSF 61 Standard.

1. Prime Coat and Finish Coats (3 or more):

   a. DFT = 12-14 mils (300-350 microns).

   b. Products: Tnemec 20, VyGuard 78PR, Sherwin Williams Macropoxy 646 NSF,or equal.

D. System 102 – Coal Tar Epoxy: Use a high-build, 2-component amine or polyamide-cured coal tar epoxy with a solids content of at least 68 percent by volume. Use a coating suitable for long-term immersion in wastewater or for coating of buried surfaces. Coating must conform to Mil Spec DOD-P-23236, or to SSPC Paint 16. Prime coats are for use as a shop primer only. Omit prime coat when both surface preparation and coating are performed in the field.

1. Prime Coat: DFT = 1.5-2.5 mils (38-65 microns).

   a. Products: Ameron Amercoat 83HS, Tnemec P66, VyGuard V75, Sherwin Williams Copoxy Primer, or equal.

2. Finish Coats (2 or more):

   a. DFT = 14-18 mils (350-450 microns).

   b. Products: Ameron 78HB, Carbomastic 14, Tnemec 46H413, VyGuard 64, Sherwin Williams Targuard Coal Tar Epoxy,or equal.

   c. Total System DFT = 15.5-20.5 mils (387-513 microns).

E. System 103 – Fusion Bonded Epoxy: Use a 100 percent powder epoxy applied in accordance with ANSI/AWWA C213, except prepare surface as specified in the

coating system schedule in this Section. Apply the coating using the fluidized bed process.

1. Liquid Epoxy: For field repairs, use a 100 percent solids liquid epoxy as recommended by the powder epoxy manufacturer to provide a DFT of 15-17 mils (375-425 microns).

2. Powder Coating:

   a. DFT = 15-17 mils (375-425 microns).

   b. Products: Scotchkote 134 or 206N, Napgard 7-0008 or 7-2500, or equal.

   c. Total System DFT = 15-17 mils (375-425 microns).

   d. For coating of valves, DFT =11-12 mils (275-300 microns).

F. System 104 – Chemical Resistant Sheet Lining:

1. Materials: Use natural rubber, chlorobutyl rubber, ethylene propylene diene monomer (EPDM) rubber, chloroprene polymer (neoprene) rubber, or chlorosulfonated polyethylene (Hypalon) rubber sheet lining material. Submit shop drawings containing technical information that confirms the suitability of the lining material system for long-term immersion in each chemical to be stored. Service temperatures are expected to be up to 1500 F (650 C).

   a. Neoprene Sheet Lining Material: Use a synthetic rubber formulated for steam curing at atmospheric pressure. Provide a minimum lining thickness of 3/16 inch. Supply B.F. Goodrich compound 59688, or equal.

   b. Chlorobutyl Sheet Lining Material: Use a synthetic rubber formulated for steam curing at atmospheric pressure. Supply B.F. Goodrich compound 60924, or equal.

   c. Natural Rubber (soft) Sheet Lining Material: Use a soft natural rubber formulated for steam curing at atmospheric pressure. Provide a minimum lining thickness of 3/16 inch. Supply B.F. Goodrich compound 83160, or equal.

   d. Natural Rubber (hard) Sheet Lining Material: Use a hard, natural rubber resistant to oxidizing agents and formulated for autoclave curing. Provide a minimum lining thickness of 3/16 inch. Supply B.F. Goodrich compound 8631, or equal.

   e. EPDM Sheet Lining Material: Use synthetic rubber suitable for use as a lining for 50 percent sulphuric acid solution and formulated for

autoclave or steam curing under pressure.

f. Hypalon Sheet Lining Material: Use synthetic rubber suitable for use as a lining for 50 percent sulfuric acid solution.

2. Primers: Use primers, adhesives, activators, accelerators, and other necessary materials as recommended by the sheet material manufacturer.

3. Metal Surface Preparation: Prior to abrasive blast cleaning, prepare the base metal as required by the sheet lining material manufacturer's installation instructions. If the instructions differ from these specifications, provide the highest degree of cleaning and surface preparation required by either instructions or specifications. Perform abrasive blast cleaning in accordance with this section.

4. Installation: Install lining materials in accordance with the material manufacturer's written installation instructions. Line interior surfaces including piping, vents, fittings, flange faces, manhole covers, and blind flanges.

5. Testing: Test the lining system for holidays in accordance with this Section before and after curing.

6. Curing: Cure the lining system by steam using the time and temperature as required by the material manufacturer.

G. System 105 – Vinyl Ester: Use vinyl ester resin coating material with an inert flake pigment that is suitable for immersion service in 30 percent hydrochloric acid and 30 percent sulfuric acid solutions.

1. Coating (2 or more coats):

a. DFT = 40-45 mils (1000-1125 microns).

b. Products: Plasite 4100, Sherwin Williams Magnalux 304 FF,or equal.

c. Prime Coat: As recommended by the material manufacturer.

H. System 106 – 100% Solids Epoxy: Use a solventless epoxy resin coating suitable for severe service areas subject to splash, spillage or intermittent immersion in wide range of industrial chemicals and wastewater. Coating to resist normal abrasion from rolling vehicles.

1. Coating (2 or more coats):

a. DFT = 15-20 mils (325-500 microns).

b. Products: Ameron, Carboline, Sherwin CorCote HCR.

c. Prime Coat: As recommended by manufacturer.

I. System 107 – 100% solids Epoxy Sealer: Use a clear, unpigmented solventless epoxy suitable for application over marginal surfaces, including damp surfaces, tight rust and tight old coatings. Coating serves as primer for alkyd, acrylic, epoxy, and polyurethane finish coats.

1. Coating (1 coat only):

a. DFT = 1-2 mils (25-50 microns).

b. Products: ICI/Devoe 167 PrePrime, Carboline Rust Bond, Sherwin Williams 920 PrePrime, or equal.

J. System 108 - 100% Solids, Isocyanate-Free, Solvent-Free, High Build Epoxy Coating for Wastewater applications only, to be spray applied in one or more coats to all interior surfaces of exposed concrete above the spring line or as otherwise detailed.

1. Product Characteristics:

a. Product: 100% solids, solvent-free high-build epoxy system

b. Product Type: amine cured epoxy

c. VOC Content (ASTM D3960): 0%

d. Compressive Strength, psi (ASTM D695): 10,500 (minimum)

e. Tensile Strength, psi (ASTM D638): 4,500 (minimum)

f. Flexural Strength, psi (ASTM D790): 7,500 (minimum)

g. Adhesion to Concrete, psi/mode of failure (ASTM D7234): 350 psi (minimum)/with substrate (concrete) failure

h. Chemical Resistance, pH>0.5 (ASTM G20): 60% Sulfuric Acid

2. In all cases the coating product(s) shall be applied to a minimum dry film thickness of 80 mils to surface profiles of CSP-4 to CSP-5 or 125 mils minimum DFT to surface profiles of CSP-6 or greater.

3. When the wall of the liner is to be structurally designed to withstand the hydraulic load generated by the groundwater table the long-term (50yr) value of the flexural modulus of elasticity will be utilized to calculate the thickness of the structural line. The initial flexural modulus of elasticity (short term) of the submitted resin material will be utilized with the long-term deformation percentage as determined by ASTM D2990 in the design equation outlined in ASTM 1216-09, Appendix XI. The value of the long-term flexural modulus of the proposed product will be certified by an independent, certified, third party

testing lab, independent of the Manufacturer. [The definition of long-term value will be identified as initial flexural modulus of elasticity less the reduction in value caused by Creep over a fifty (50) year minimum period and verified by third party testing (ASTM D2990).]

4. Subsequent top-coating or additional coats of the coating product(s) shall occur within the product recoat window or 24 hours whichever is less. Additional surface preparation procedures will be required if this recoat window is exceeded.

K. System 109 - 100% Solids, Solvent-Free, Multi-Layered Polymer Lining System (Polyurea and Polyurethane) for Wastewater applications only, to be spray applied in three layers to all interior surfaces of exposed concrete above the spring line or as otherwise detailed.

1. Product Characteristics:

   a. Product: 100% solids, solvent-free, polyuria (two layers) and polyurethane (one layer) system

   b. Product Type: Self-curing polymer lining

   c. VOC Content (ASTM D3960): 0%

   d. Tensile Strength, psi (ASTM D412): 2,400 (minimum)

   e. Elongation % (ASTM D412): 200 (minimum)

   f. Tear Strength, pli (ASTM D624): 300 (minimum)

   g. Shore D Hardness, (ASTM 2240): 45 (minimum)

   h. Adhesion to Concrete, psi/mode of failure (ASTM D7234): 350 psi (minimum)/with substrate (concrete) failure

   i. Chemical Resistance, pH>0.5 (ASTM G20): 30% Sulfuric Acid

2. In all cases the coating product(s) shall be applied to a minimum thickness of 500 mils total.

3. For resistance to ground water head pressure the coating shall be a minimum of 500 mils thick for depths up to 32 feet. For depths greater than 32 feet consult the coating manufacturer for recommendations.

4. Subsequent top-coating or additional coats of the coating product(s) shall occur within the product recoat window or 24 hours whichever is less. Additional surface preparation procedures will be required if this recoat window is exceeded.

L. System 110 – 100% Solids, High Build Polyurethane Coating for Wastewater

applications, to be spray applied in one or more coats to all interior surfaces of exposed concrete above the spring line or as otherwise detailed.

1. Product Characteristics:
    a. Product: 100% solids, high-build polyurethane system
    b. Product Type: Catalyzed, two component, polyurethane
    c. VOC Content (ASTM D3960): 0%
    d. Compressive Strength, psi (ASTM D695): 18,000 (minimum)
    e. Tensile Strength, psi (ASTM D638): 7,450 (minimum)
    f. Flexural Strength, psi (ASTM D790): 14,000 (minimum)
    g. Flexural Modulus, psi (ASTM D790): 735,000 (minimum)
    h. Adhesion to Concrete, psi/mode of failure (ASTM D7234): 200 psi (minimum) with substrate (concrete) failure
    i. Chemical Resistance, pH 0.5 (ASTM G20): 20% Sulfuric Acid
2. In all cases the coating product(s) shall be applied to a minimum dry film thickness of 80 mils to surface profiles of CSP-4 to CSP-5 or 125 mils minimum DFT or surface profiles of CSP-6 or greater.
3. When the wall of the resin based liner is to be structurally designed to withstand the hydraulic load generated by the groundwater table the long-term (50yr) value of the flexural modulus of elasticity will be utilized to calculate the thickness of the structural line. The initial flexural modulus of elasticity (short term) of the submitted resin material will be utilized with the long-term deformation percentage as determined by ASTM D2990 in the design equation outlined in ASTM 1216-09, Appendix XI. The value of the long-term flexural modulus of the proposed product will be certified by an independent, certified, third party testing lab, independent of the Manufacturer. [The definition of long-term value will be identified as initial flexural modulus of elasticity less the reduction in value caused by Creep over a fifty (50) year minimum period and verified by third party testing (ASTM D2990).]
4. Polyurethane product characteristics allow high build thicknesses to be achieved in one application without additional surface preparation. However, if installation requires applications outside of the recoat window, additional surface preparation may be necessary by using a primer or abrading the previously coating surface area.

PART 3 EXECUTION

3.01 MANUFACTURER'S SERVICES

A. Require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable to or associated with manufacturer's products.

B. For submerged and severe service coating systems, require the paint manufacturer to furnish the following services:

1. Provide at least 6 hours of on-site instruction on the proper surface preparation, use, mixing, application, and curing of the coating systems.

2. Observe the start of surface preparation, mixing, and application and curing of the coating systems.

3. Provide the services of a NACE Certified Coating Inspector at all times during the surface preparation, mixing, application, curing and testing of all coatings applied in submerged or acid spill areas.

3.02 WORKMANSHIP

A. Use skilled craftsmen and experienced supervision. For all jobs involving lead based paint removal or repair, require the presence of a certified Competent Person, Lead per OSHA requirements.

B. Apply coating to produce an even film of uniform thickness. Give special attention to edges, corners, crevices, and joints. Ensure thorough cleaning and an adequate thickness of coating material. Apply coatings to produce finished surfaces free from runs, drips, ridges, waves, laps, brush marks, and variations in color, texture and finish. Effect complete hiding so that the addition of another coat would not increase the hiding. Give special attention to ensure that edges, corners, crevices, welds, and similar areas receive a film thickness equivalent to adjacent areas. Apply a brushed stripe coat to all edges and welds after priming submerged or severe service areas.

C. Remove, mask or otherwise protect hardware, lighting fixtures, switch plates, machined surfaces, couplings, shafts, bearings, name plates on machinery, and other surfaces not to be painted. Provide drop cloths to prevent coating materials from falling on or marring adjacent surfaces. Protect the working parts of mechanical and electrical equipment from damage during surface preparation and coating operations. Mask openings in motors to prevent entry of coating or other materials.

D. Do not damage adjacent work during blast cleaning operations. Perform spray painting under carefully controlled conditions. Promptly repair any damage to adjacent work or adjoining property occurring from blast cleaning or coating operations.

E. Coordinate cleaning and coating so that dust and other contaminants from the

cleaning process will not fall on wet, newly-coated surfaces.

3.03 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation standards of the Society for Protective Coatings (SSPC) form a part of this Specification:

1. Solvent Cleaning (SSPC-SP1): Removal of oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces by cleaning with solvent, vapor degreasing, emulsion or alkaline cleaners, or steam.

2. Hand Tool Cleaning (SSPC-SP2): Removal of all loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3): Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by rotary or impact power tools, power wire brushing, or power abrading.

4. White Metal Blast Cleaning (SSPC-SP5/NACE 1): Removal of all visible oil, grease, soil, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6/NACE 3): Removal of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, except limit random staining to no more than 33 percent of each unit area of surface.

6. Brush-Off Blast Cleaning (SSPC-SP7/NACE 4): Removal of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating, all of which are considered tightly adherent if they cannot be removed by lifting with a dull putty knife.

7. Near-white Blast Cleaning (SSPC-SP10/NACE 2): Removal of all visible oil, grease, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter, except limit random staining to no more than 5 percent of each unit area of surface.

3.04 METAL SURFACE PREPARATION (UNGALVANIZED)

A. Provide the minimum abrasive-blasted surface preparation as indicated in the coating system schedules at the end of this Section. Where there is a conflict between these specifications and the coatings manufacturer’s printed recommendations for the intended service, the higher degree of cleaning applies.

B. Perform metal surface preparation in conformance with the current SSPC/NACE Standards and this Section. Blast cleaned surfaces must match standard samples in SSPC-VIZ 1.

C. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning using solving cleaning as per SSPC-SP1.

D. Round or chamfer sharp edges. Grind to smooth finish burrs, surface defects, and weld splatter prior to blast cleaning.

E. Select the type and size of abrasive to produce a surface profile that meets the coating manufacturer's recommendation for the particular coating and service conditions. As abrasives for submerged and severe service coating systems use clean, hard, sharp cutting crushed slag. Do not use automated blasting systems and metal shot or grit for surfaces that will be in submerged service, even if subsequent abrasive blasting is planned with hard, sharp-cutting slag.

F. Do not reuse abrasive except when an automated blasting system is used for surfaces that will be in non-submerged service. For automated blasting systems, use clean, oil-free abrasives. In the abrasive mix, use at least 50 percent steel grit. Replenish abrasive mix with new shot/grit combination as necessary to maintain the anchor profile within ½ mil (13 microns) of the specified profile.

G. Comply with the applicable federal, state, and local air pollution control regulations for blast cleaning.

H. For air-blast cleaning, supply compressed air at adequate pressure from well-maintained compressors equipped with oil and a moisture separator which delivers oil and water-free air as checked with white blotter, white cloth, or plastic sheets at the beginning of each blasting sequence.

I. Clean surfaces of dust and residual particles of the cleaning operation using dry air-blast cleaning, vacuuming, or another approved method prior to painting. Vacuuming must be the final cleaning method immediately prior to painting areas that will go into submerged service.

J. In enclosed areas and other areas where dust may settle, vacuum the surface clean and wipe it with a tack cloth.

K. Remove damaged or defective coating by the specified blast or power tool cleaning to meet the clean surface requirements before recoating.

L. If the specified abrasive blast cleaning will damage adjacent work, the area to be cleaned is less than 100 square feet, and the coated surface will not be in submerged service, then SSPC-SP2 – Hand Tool Cleaning or SSPC-SP3 – Power Tool Cleaning, may be used. If the coated area to be cleaned is less than 100 square feet, and will be in submerged service, then SSPC-SP11 Power Tool Cleaning to Bare Metal may be used.

M. Completely remove shop-applied coatings of unknown composition before the specified coatings are applied. Examine valves, castings, ductile or cast iron pipe, and fabricated pipe or equipment for the presence of shop-applied temporary coatings. Completely remove temporary coatings by solvent cleaning per SSPC-SP1 method

before starting abrasive blast cleaning. Alternate cleaning methods such as Baking Soda Blasting or Sponge Jet Blasting may be used as appropriate.

N. Use the solvent cleaning method (SSPC-SP1) to clean shop-primed equipment in the field before finish coats are applied.

3.05 SURFACE PREPARATION FOR GALVANIZED FERROUS METAL

A. For galvanized ferrous metal, use the alkaline cleaning method per SSPC-SP1 to remove oil, grease, and other contaminants detrimental to adhesion of protective coatings. Alternate methods with biodegradable surfactant type cleaners followed by fresh water washing may be used as appropriate.

B. Apply pretreatment coatings of surfaces in accordance with the printed recommendations of the coating manufacturer.

3.06 SURFACE PREPARATION OF FERROUS SURFACES WITH EXISTING COATINGS

A. Remove grease, oil, heavy chalk, dirt, or other contaminants by solvent or detergent cleaning prior to abrasive blast cleaning. Determine the generic type of the existing coatings by laboratory testing.

B. Provide the degree of cleaning specified in the coating system schedule for the entire surface to be coated. If the degree of cleaning is not indicated in the schedule, remove deteriorated coatings by abrasive blast cleaning to meet the requirements of SSPC-SP6 Commercial Blast Cleaning. Clean areas of tightly adhering coatings to meet the requirements of SSPC-SP7 Brush-Off Blast Cleaning, with the remaining thickness of pre-existing coating not to exceed 3 mils.

C. If coatings to be applied are not compatible with existing coatings, apply intermediate coatings conforming to the paint manufacturer's recommendation for the indicated coating system or completely remove the existing coating prior to abrasive blast cleaning. Make a small trial application for compatibility prior to painting large areas. Allow the trial application to cure for 7 days at 50º F (10º C) or higher before determining compatibility.

D. Completely remove coatings of unknown composition prior to application of new coatings.

E. Where specified or where job site conditions do not permit dry-abrasive blasting for industrial coating systems due to dust or air pollution considerations, water jetting or wet- abrasive blasting may be used. In both methods, use inhibitors approved by the manufacturer of the coating system, which will be applied over the cleaned area. Begin the coating application as soon as the surface has dried, and before the formation of any flash rusting. Perform water jetting with or without abrasive injection, as appropriate, to achieve the specified degree of surface cleanliness. Do not use water-jetting methods for submerged or severe-service coating systems, unless specified for that area.

3.07 PLASTIC, FIBERGLASS, AND NONFERROUS METALS SURFACE PREPARATION

A. Unless otherwise indicated, for equipment or parts of equipment which are not submerged in service, shop-prime, and then finish-coat in the field after installation. For methods, materials, application equipment, and other details of shop painting, comply with this Section. If the shop primer requires topcoating within a specified period of time, apply the finish coating in the shop and then touch-up the paint after installation.

B. Perform surface preparation and coating work in the field for equipment, or parts and surfaces of equipment which are submerged or inside an enclosed hydraulic structure when in service, with the exception of pumps and valves.

C. For certain pieces of equipment, it may be undesirable or impractical to apply finish coatings in the field. Such equipment may include engine generator sets, equipment such as electrical control panels, switch gear or main control boards, submerged parts of pumps, ferrous metal passages in valves, or other items where it is not possible to obtain the required quality in the field. For such equipment, prime and finish-coat in the shop and touch-up in the field after installation. Use the identical material for touch-up that was used for shop painting. Require the manufacturer of each such piece of equipment to certify as part of its shop drawings that the surface preparation is in accordance with these specifications. Submit the coating material product data sheet with the shop drawings for the equipment.

D. For certain small pieces of equipment, the manufacturer will have a standard coating system, which is suitable for the intended service conditions. In such cases, the final determination of suitability will be made during review of the shop drawing submittals. Equipment of this type generally includes only indoor equipment such as instruments, small compressors, and chemical metering pumps.

E. Protect shop-painted surfaces during shipment and handling. Protect surfaces with padding or blocking. Lift equipment with canvas or nylon slings. Before being topcoated, do not expose primed surfaces to the weather for more than 2 months or less when recommended by the coating manufacturer.

F. Repair damage to shop-applied coatings in accordance with this Section and the coating manufacturer's printed instructions.

G. Make certain that the shop primers and field topcoats are compatible and meet the requirements of this Section. Submit copies of applicable coating manufacturer's product data sheets with equipment shop drawings.

3.08 APPLICATION OF COATINGS

A. Apply protective coatings to steel substrates in accordance with SSPC-PA1 – Paint Application Specification No. 1. Shop, Field and Maintenance Painting.

B. Inspect cleaned surfaces and each coat prior to succeeding coats. Schedule inspections with the City Engineer in advance.

C. Paint blast-cleaned ferrous metal surfaces before rusting or other deterioration of the surface occurs. Limit blast cleaning to only those surfaces that can be coated in the same working day unless the area to be coated is protected by humidity control equipment set to maintain humidity below 50 percent at all times.

D. Apply coatings in accordance with the manufacturer's instructions and this Section, whichever has the most stringent requirements.

E. Give special attention to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thickness is likely to occur. Use stripe painting by brush, after application of the primer, for these areas.

F. Give special attention to materials, which will be joined so closely that proper surface preparation and application are not possible. Coat such contact surface prior to assembly or installation. Use only inorganic zinc primers on faying surfaces.

G. Apply finish coats, including touch-up and damage repair coats, in a manner which will present uniform texture and color-matched appearance.

H. Do not apply coatings under the following conditions:

1. Temperature outside of the manufacturer's recommended minimum and maximum range.
2. Dust or smoke laden atmosphere.
3. Substrate or air temperature less than 5º F (3º C) above the due point.
4. Air temperature is expected to drop below 40ºF (14º C) or less than 5º F (3º C) above the dew point within 8 hours after application of the coating.
5. Wind conditions in excess of 15 MPH or dust laden.

I. Determine the dew point by use of a sling psychrometer in conjunction with the U.S. Department of Commerce, Weather Bureau psychometric tables.

J. For steel piping which will not be buried, have the surface abrasive blast cleaned and primed before installation.

K. Apply finish coats after concrete, masonry, and equipment installation is complete and the work areas are clean and dust free. Concrete must have cured for a minimum of 28 days @ 75º F (24º C) unless an approved epoxy sealer has been applied to green concrete within 12 hours of finishing the concrete.

3.09 CURING OF COATINGS

A. Maintain curing conditions in accordance with the recommendations of the coating

material manufacturer and this Section, whichever is the most stringent. Complete curing before placing the coating systems into service.

B. In the case of enclosed areas, forced air ventilation using heated air may be required until the coatings have fully cured.

C. Forced air ventilation is required for the application and curing of coatings on the interior surfaces of enclosed hydraulic structures. During application and curing periods, continuously exhaust air from the lowest level of the structure using portable ducting to force air into all compartments and around baffles. After interior coating operations have been completed, provide a final curing period that meets the minimum temperature and time requirements of the manufacturer of the coating system being applied, while operating the forced air ventilation system continuously.

3.10 SHOP AND FIELD INSPECTION AND TESTING

A. Give the City Engineer a minimum of 3 days advance notice of the start of any field surface preparation work or coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

B. Perform surface preparation and coating applications in the presence of the City Engineer, or City Engineer's appointed NACE certified coating inspector, unless the City Engineer has granted prior approval to perform the work in their absence.

C. Inspection by the City Engineer or the NACE certified inspector, or the waiver of inspection of any particular portion of the work, does not relieve the Contractor of the Contractor's responsibility to perform the Work in accordance with these Specifications.

D. Erect and move scaffolding where requested by the City Engineer to facilitate inspection. Provide additional illumination to light areas to be inspected. Remove or grind smooth all scaffolding clips welded to the structure prior to surface preparation of the structure.

E. Until final acceptance of the coatings, furnish inspection devices in good working condition for the detection of holidays and measurement of dry-film thickness (DFT) of protective coatings. Make DFT gauges available for the City Engineer's use throughout the coating process until final acceptance of the coatings. Provide the services of a NACE certified coating inspector for all holiday detection work until the final acceptance of the coatings. Operate holiday inspection devices in the presence of the City Engineer.

F. Perform holiday tests on coated ferrous surfaces inside a steel reservoir, other surfaces that will be submerged in water or other liquids, or surfaces which are enclosed in a vapor space in such structures. Perform holiday tests on surfaces coated with any of the submerged and severe service coating systems. Mark and repair or recoat areas which contain holidays in accordance with the coating manufacturer's printed instructions and then retest. DO NOT PERFORM HOLIDAY TESTING AFTER STRUCTURE HAS BEEN SUBMERGED.

1. Coatings with Thickness Exceeding 20 mils (500 microns): For surfaces having a total DFT exceeding 20 mils (500 microns); use a pulse-type holiday Detector such as Elcometer 136, or equal. Adjust and operate in accordance with NACE RP0188.

2. Coatings with Thickness of 20 mils (500 microns) or Less: For surfaces having a total DFT of 20 mils or less, use Elcometer 269 non-destructive type holiday detector, or equal. Instrument must operate at less than 75 volts. For thicknesses between 10 and 20 mils (250 and 500 microns), a non-sudsing type wetting agent such as Kodak Photo-Flo, or equal, may be added to the water prior to wetting the detector sponge. For submerged or severe service areas, the residue of the wetting agent must be removed with clean, fresh water prior to application of any additional coats.

G. On ferrous metals, measure the DFT in accordance with SSPC-PA2 Measurement of Dry Film Thickness with magnetic gauges using either a pull-off type gauge (Elcometer 211) or constant pressure gauge (Elcometer 345F), or equal. Test each coat for the correct thickness. Calibrate the DFT gauge at the beginning of each workday or shift in accordance with the directions of the manufacturer of the gauge. Do not take measurements until at least 8 hours after coating application. On non-ferrous metals, measure the DFT with positive pressure eddy current gages (Elcometer 345N) or equal.

H. Evaluation of blast-cleaned surface preparation work will be based upon comparison with photographic samples contained in SSPC-VIZ 1.

I. Evaluation of surface profile will be based upon the use of TesTex pressure sensitive tapes.

3.11 PAINTING AND IDENTIFICATION OF PIPING

A. Painting and Color Coding:

1. Use colors and signs to identify all piping which is exposed to view in buildings or tunnels, above suspended ceilings or exposed above grade, and all outdoor piping. Identify each pipe by a color complying with the following schedule of colors and by applied markers.

2. Coat pipes with the number of coats and type of material specified. Base coats for pipeline painting may be a neutral color. Make each succeeding base coat a contrasting color. For the final coat, comply with the pipe identifying color schedule.

3. Apply pipe identification markers to exposed piping, except for the following pipe at wastewater lift stations:

a. Discharge piping for wastewater pumps.

b. Vent piping.

c. Any piping inside wet wells.

B. Pipe Identification Markers:

1. Identify all pipes with applied signs or markers at 15-foot centers, at both sides of penetrated walls or floors, adjacent to valves, at connected equipment, at branch fittings, and in congested pipe layouts.

a. Apply markers consisting of signs with legends as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
3/4 to 1- 1/4	8	1/2
1- 1/2 to 2- 3/8	8	3/4
2- 1/2 to 5- 7/8	12	1- 1/4
6 to 7- 7/8	12	1- 1/4
8 to 10	24	2- 1/2
Over 10	32	3- 1/2

b. As pipe markers, use semi-rigid outdoor grade acrylic plastic, Seton Name Plate Corp., SetMark, or equal. Use Type SNA for outside diameters 3/4 through 5- 7/8 inches and Type STR for 6-inch outside diameter or larger. For pipes less than 3/4-inch in diameter, use applied marker of brass identification tags 1-1/2 inches square with depressed letters 1/4-inch high, black-filled. Apply tightly to pipeline with metal or plastic straps.

C. Pipe Identification Color Schedule:

1. For wastewater facilities refer to current version of TCEQ chapter 217. For piping systems not found in TCEQ chapter 217, use the colors listed in the following pipe identification color schedule for facilities:

PIPE IDENTIFICATION COLOR SCHEDULE

PIPING SYSTEM	COLOR	FED. STD. NO.
Fire Mains	Red	11105
Oxygen	Orange	12246
Sodium Hypochlorite	Yellow	13655
Raw Polymer	Pink	11156
Diluted Polymer	Purple	17142
Natural Gas	Yellow	13655
Heating Water	Pink	11158
Domestic Hot	Light Pink	11668
Potable Water	Blue	15102
Non-Potable Water	White	17875
Instrument Air	Green	14187
Plant Air	Dark Green	14110
Raw Sewage	Gray	16473
Grit	Dark Gray	16187
Cyclone Return	Gray	16473
Classifier Return	Gray	16473
Heavy Solids	Dark Brown	10080
Return Sludge	Brown	10091
Waste Sludge	Yellow-Brown	10266
Scum	Light Brown	10334
Chilled Water Supply (CWS)	Blue-Green	14329
Chilled Water Return (CWR)	Blue-Green	14325
Condensing Water Supply (Cond-WS)	Light Green	14533
Condensing Water Return (Cond-WR)	Light Green	14533
Deionized Water (DW)	Light Blue	15526
Vacuum (Vac)	White	17875
Vent	Light Gray	16492

2. For pipe identification colors not listed above, follow American National Standard (ANSI A13.1-81) Color Schedule:

   a. Materials inherently hazardous, flammable or explosive; chemically active or toxic; extreme temperature or pressure; radioactive: Yellow Field with Black Letters.

   b. Material of inherently low hazard – liquid or liquid admixture: Green Field with White Letters; gas or gaseous admixture: Blue Field with White Letters.

   c. Fire quenching materials, water, foam, carbon dioxide, Halon, etc.: Red Field with White Letters.

3.12 COATING SYSTEM SCHEDULES – FERROUS METALS

A. Coating System Schedule, Ferrous Metal – Not Galvanized

SCHEDULE NO. AND APPLICATION	SURFACE PREPARATION	SYSTEM NO./ DESCRIPTION
FM-1: Surfaces indoors and outdoors, exposed or covered, except those listed below.	Near White Metal blast cleaning SSPC-SP10/NACE 2	(2) Inorganic zinc/epoxy/ polyurethane
FM-2: Surfaces in chlorination room, chlorine storage room, sodium hypochlorite storage room	Near White Metal blast cleaning SSPC-SP10/NACE 2	(100) Amine-cured epoxy
FM-3: Surfaces of pumps and equipment and other ferrous surfaces submerged or intermittently submerged in potable water, utility water, and wastewater; including surfaces lower than 2 feet above high-water level in hydraulic structures, and surfaces inside enclosed hydraulic structures, pump state wet wells, and vents (excluding shop-coated valves, couplings, and pumps).	White Metal Blast Cleaning SSPC-SP5/ NACE 1	(100) Amine-cured epoxy
FM-4: Surfaces exposed to high temperature between 1500 and 6000 F (650 and 3150 C).	Near White Metal blast cleaning SSPC-SP10/NACE 2	(3) Inorganic Zinc, water-based
FM-5: Surfaces exposed to high temperature between 6000 and 10000 F.	Near White Metal blast cleaning SSPC-SP10/NACE 2	(9) Aluminum silicon resin
FM-6: Where indicated, ferrous surfaces in water passages of valves 4-inch size and larger, exterior surfaces of submerged valves.	White Metal Blast Cleaning SSPC-SP5/ NACE 1	(101) Polyamide-cured epoxy
FM-7: Where indicated, ferrous surfaces in water passages of pumps which have discharge size of 4 inches or larger; exterior, submerged surfaces of pumps.	White Metal Blast Cleaning SSPC-SP5/ NACE 1	(101) Polyamide-cured epoxy
FM-8: Ferrous surfaces of sleeve couplings.	White Metal Blast Cleaning SSPC-SP5/ NACE 1	(103) Fusion-bonded epoxy
FM-9: Ferrous surfaces of sluice gates, flap gates, and shear gates, including wall thimbles.	White Metal Blast Cleaning SSPC-SP5/ NACE 1	(101) Polyamide-cured epoxy
FM-10: Structural steel, miscellaneous metal work, and supports for prefabricated metal buildings, not exposed to view in finished building.	Commercial Blast Cleaning (SSPC-SP6/NACE 3	(10) Zinc Rich Epoxy
FM-12: Ferrous metal exposed to view, inside and outside of buildings.	Near White Metal blast cleaning SSPC-SP10/NACE 2	(2) Inorganic zinc/ epoxy/polyurethane

SCHEDULE NO. AND APPLICATION	SURFACE PREPARATION	SYSTEM NO./ DESCRIPTION
FM-13: Surfaces of indoor equipment not submerged.	Commercial Blast Cleaning SSPC-SP6/ NACE 3	(5) Epoxy, equipment
FM14: Exterior (exposed) surfaces shop-coated with fusion-bonded epoxy.	Light abrasive blast to roughen surface	(6) Aliphatic polyurethane

B. Coating System Schedule, Ferrous Metal – Galvanized: Apply pretreatment coatings, barrier coatings, or washes as recommended by the coating manufacturer.

SCHEDULE NO. AND APPLICATION	SURFACE PREPARATION	SYSTEM NO./ DESCRIPTON
FMG-1: Exposed surfaces indoors and outdoors, except those listed below.	Alkaline cleaning SSPC-SP1	(1) or (4) Aliphatic Polyurethane, or Acrylic
FMG-2: Surfaces in chlorination room, chlorine storage room, and sodium hypochlorite storage room.	Alkaline Cleaning SSPC-SP1	(100) Amine-cured epoxy
FMG-3: Surfaces submerged in water or wastewater, including surfaces lower than 2 feet above high-water level and surfaces inside hydraulic structures and vents	Alkaline cleaning SSPC-SP1 followed by Brush-Off blast cleaning SSPC-SP7/ NACE 4	(100) Amine-cured epoxy
FMG-4: Surface exposed to view, inside and outside of building.	Alkaline Cleaning SSPC-SP1	(1) or (4) Aliphatic polyurethane, or Acrylic

C. Coating System Schedule, Interior Surface of Welded Steel Tanks: Coat interior surfaces, including tank nozzles, manholes, nozzle necks, and flange faces. For steel tank exterior coating systems, see paragraph 3.15.1, Coating System Schedule, Ferrous Metal – Not Galvanized.

PRODUCT STORED	SURFACE PREPARATION	SYSTEM NO. /DESCRIPTION
Zinc Orthophosphate	White metal blast cleaning SSPC-SP5/NACE1	(104) Natural rubber (soft) or neoprene
Liquid Alum	White metal blast cleaning SSPC-SP5/NACE1	(104) Natural rubber (soft) or neoprene
Polymer	White metal blast cleaning SSPC-SP5/NACE1	(104) Natural rubber (soft) or neoprene
Sodium Bisulfite	White metal blast cleaning SSPC-SP5/NACE1	(104) Natural rubber (soft) or neoprene
Ferric Chloride	White metal blast cleaning SSPC-SP5/NACE1	(104) Natural rubber (hard)
Aqueous Ammonia	White metal blast cleaning SSPC-SP5/NACE1	(104) Chlorobutyl rubber
Caustic Soda	Commercial Blast Cleaning SSPC-SP6/NACE 3	No Coating
Sodium Hypochlorite	White metal blast cleaning SSPC-SP5/NACE1	(104) Chlorobutyl Rubber
Sulfuric Acid (max. 45% concentration)	White metal blast cleaning SSPC-SP5/NACE1	(107) Hypalon
Sulfuric Acid (above 40% concentration)	White metal blast cleaning SSPC-SP5/NACE1	(107) Viton
Hydrofluosilicic Acid	White metal blast cleaning SSPC-SP5/NACE1	(107) Chlorobutyl Rubber
Water, Potable Water, Utility Water	White metal blast cleaning SSPC-SP5/NACE1	(100) Amine-Cured Epoxy

3.13 COATING SYSTEM SCHEDULES, NONFERROUS METAL, PLASTIC, FIBERGLASS

A. Where isolated non-ferrous parts are associated with equipment or piping, use the coating system for the adjacent connected surfaces. Do not coat handrails, gratings, frames, or hatches. Use primers recommended by coating manufacturer.

SCHEDULE NO. AND APPLICATIONS	SURFACE PREPARATION	SYSTEM NO./ DESCRIPTION
NFM-1: Exposed surfaces, indoors and outdoors, except those listed below.	Solvent cleaned SSPC-SP1	(1) Aliphatic Polyurethane
NFM-2: Chlorination room, chlorine storage room, sodium hypochlorite storage room.	Solvent cleaned SSPC-SP1	(100) Amine-Cured Epoxy
NFM-3: Aluminum surfaces in contact with concrete, or with any other metal except galvanized ferrous metal.	Solvent cleaned SSPC-SP1	(8) Aluminum Metal Isolation
NFM-4: Polyvinyl chloride plastic, indoors and outdoors, not submerged.	Solvent cleaned SSPC-SP1	(4) Acrylic
NFM-5: Fiberglass surfaces.	Per paragraph 3.09, Plastic, Fiberglass, and Non-Ferrous Metals Surface Preparation	(6) Aliphatic Polyurethane Fiberglass

END OF SECTION

09903

Plastic Liner for Utility/Facility Structures

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of plastic liners for concrete interceptor sewers and structures.

Only plastic liners manufactured with integral locking ribs spaced at approximately 2-1/2 inches on center over entire liner is acceptable. Liners relying on mechanically fastened batten strips as primary means of anchorage are unacceptable.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Work performed under this Section. Cost is incidental to work of large diameter sewers, precast concrete manholes, or cast- in-place, wastewater-containing structures.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCE STANDARDS

A. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers-Tension.

B. ASTM D 2440 - Standard Test Methods for Oxidation Stability of Mineral Insulating Oil.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Prior to submittal of shop drawings, manufacturer shall approve proposed panel layout and proposed details. Contractor shall then submit shop drawings showing proposed panel layout to cover area to be lined. Show on shop drawings proposed details for installation of liner at seams,

terminations, corners, openings, pipe penetrations, etc., and type of factory and field welds and attachments.

C. Provide sufficient details to permit placement of liner without use of design Drawings. Reproduction of design Drawings for use as shop drawings will not be allowed. Do not begin fabrication of liner until after shop drawings and submitted materials have been reviewed and accepted by Project Manager.

1.05 INSTALLER QUALIFICATIONS

A. Applicators. Application of plastic liner to forms and other surfaces, liner finishing, repair, and testing is considered highly specialized work and shall be performed only by firms and individuals recommended and approved by lining manufacturer. Personnel performing such work are to be trained in methods of installation and demonstrate their ability to Project Manager.

B. Welders.

1. Each welder is to pass qualification welding test before doing welding. Requalification may be required at time deemed necessary by Project Manager. Provide at least 24 hours notice to Project Manager to schedule qualification welding test.

2. Make test welds in presence of Project Manager. Test welds are to consist of following:

a. Begin with two pieces of liner, at least 15 inches long and 9 inches wide. Hold pieces in vertical position, lapped 1-1/2 inches.

b. Position weld strip over edge of lap and weld to both pieces of liner. Extend each end of weld strip at least 2 inches beyond liner to provide tabs.

3. The weld specimen will be tested as follows:

a. Subject each weld strip tab, tested separately, to 10-pound pull normal to face of liner with liner secured firmly in place. Weld is acceptable when there is no separation between weld strip and liner.

b. Cut three test specimens from welded sample and tested in tension across welds. Tensile strength measured across welded joints is to be at least 2000 psi when tested in

accordance with ASTM D 412. When none of these specimens fails when tested as indicated above, weld will be considered satisfactory.

c. If one specimen fails to pass tension test, retest will be permitted. Retest consists of testing three additional specimens cut from original welded sample. When three retest specimens pass test, weld will be considered satisfactory.

4. A disqualified welder may submit new weld sample when welder has had sufficient off-the-job training or experience to warrant re- examination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic liner shall be as manufactured by Ameron Protective Linings Division; Poly-Tee, Inc.; or approved equal.

2.02 MATERIALS

A. Manufacturing.

1. Manufacture plastic liner sheet, joint, corner and weld strips from high molecular weight thermoplastic polymer compounded to make permanently flexible material suitable for use as protective liner in concrete pipe or other concrete structures. Polyvinyl chloride resin is to constitute not less than 99 percent by weight of resin used in formulation. Copolymer resins will not be permitted.

2. During manufacture or prior to final acceptance of Work, Project Manager may sample specimens taken from sheets, strips, or welded joints for testing.

3. Changes in formulation will be permitted only after prior notice is given to Project Manager and manufacturer demonstrates that new plastic liner will meet or exceed requirements for chemical resistance and physical properties.

B. Properties.

1. Plastic liner sheets including locking extensions, joints,

corners, and welding strips are to be free of cracks, cleavages or other defects adversely affecting protective characteristics of material.

2. Except at shop welds, plastic liner sheets, joint, corner, and weld strips are to have the following properties when tested at 77 degrees F plus or minus 5 degrees F.

PROPERTY	ASTM TEST METHOD	CHEMICAL RESISTANCE TEST	
		INITIAL	AFTER CHEMICAL EXPOSURE (Note 1)
Tensile strength, min.	D 412, Die B	2200 psi	2100 psi
Elongation at break, min.	D 412, Die B	200 percent	200 percent
Shore durometer, Type D	D 2240, Within 1 sec.	50-60	±5 (Note 2)
	D 2240, 10 sec.	35-50	±5 (Note 2)
Weight change	(Note 3)	-----	±1.5% (Note 2)

Notes:
1. For 112 days in chemical solutions
2. With respect to initial test results
3. Specimen to be 1 inch x 3 inch sample sheet thickness, taken from sheet or strip prior to final acceptance of work.

2.03 MATERIAL TESTS

A. Material Properties. Test samples taken from sheets, joints or weld strips to determine material properties. Determine PVC tensile strength and elongation in accordance with ASTM D 412 using Die B. Determine indentation hardness in accordance with ASTM D 2240 using Type D durometer, except that single thickness of material will be used. Determination of change of weight and indentation hardness is to be made of 1-inch by 3-inch specimens. Thickness of specimens shall be thickness of sheet or strip.

B. Measurement of Initial Physical Properties. Determine initial values for tensile strength, weight, elongation and indentation hardness prior to chemical resistance tests.

C. Chemical Resistance Tests.

1. Determine physical properties of specimens after exposure to chemical solutions. Condition test specimens to constant weight at 110 degrees F before and after

submersion in the following solutions for period of 112 days at 77 degrees F plus or minus 5 degrees F.

Chemical Solution	Concentration
Sulfuric acid	20%*
Sodium hydroxide	5%
Ammonium hydroxide	5%*
Nitric acid	1%*
Ferric chloride	1 %
Soap	0.1 %
Detergent (linear alkyl benzyl sulfonate or LAS)	0.1%
Bacteriological	BOD not less than 700 ppm

* Volumetric percentages of concentrated C.P. grade reagents.

2. At 28 day intervals, remove specimens from each chemical solution and test. When specimen fails to meet 112-day property requirements specified in paragraph 2.02B before completion of 112-day exposure, material will be rejected.

D. Pull Test for Locking Extensions. Liner locking extensions embedded in concrete are to withstand test pull of at least 100 pounds per linear inch, applied perpendicularly to concrete surface for period of 1 minute, without rupture of locking extensions or withdrawal from embedment. Perform this test at temperature between 70 degrees F and 80 degrees F, inclusive.

E. Shop-Welded Joints. Shop-welded joints used to fuse individual sections of liner together, are to meet minimum requirements of liner for thickness, corrosion resistance and impermeability. Welds shall show no cracks or separations and be tested for tensile strength. Tensile strength, measured across welded joint in accordance with ASTM D 412 using Die B, shall be at least 2000 psi. Test temperature is to be 77 degrees F plus or minus 5 degrees F and use measured minimum width and thickness of reduced test specimen section.

F. Spark Test. Shop and field test liners for holidays or flaws using an approved spark tester set to provide minimum of 20,000 volts (Tinker and Rasor Model AP-W with power pack, or

approved equal). Satisfactorily repair sheets having holes in shop prior to shipment from manufacturer's plant. Repairs shall be made by welders qualified in accordance with these specifications.

2.04 MATERIAL DETAILS AND DIMENSIONS

A. Approval of Details. Liner sheet, strip, and other accessory pieces are to conform to requirements of these Specifications.

B. Thickness of Material. Minimum thickness of PVC sheet and strip shall be as follows:

Material	Thickness in Inches
Sheet, integral locking extensions	0.065
Sheet, plain	0.094
Joint strip	0.094
Weld strip	0.125

C. Material Sizes. Use pipe-size sheets for sheets of PVC liner to provide coverage required by Drawings. Structural sheets are to be standard 48- inches by 96-inches, with special size noted on shop drawings. Lengths specified shall include tolerance at ratio of plus or minus 1/4-inch for each 100 inches, or 0.25 percent. Joint strips shall be 4 inches plus or minus 0.25 inch in width and have each edge beveled prior to application. Weld strips shall be 1 inch plus or minus 0.125 inch in width. Weld strips are to have edges beveled at time of manufacture.

D. Locking Extensions.

1. No polygrip-type holding or locking extension will be permitted.

2. PVC liner to be embedded in concrete is to have integral locking extensions. Liner may not be bonded to concrete surfaces with adhesives except as specifically acceptable to Project Manager.

3. PVC locking extensions are to be same material as liner, be integrally molded or extruded with sheets, and have an approved cross section with minimum height of 0.375 inch and minimum web thickness of 0.085 inch. They are to be approximately 2.5 inches apart and be such that when extensions are embedded in concrete, liner will be held permanently in place.

4. PVC locking extensions are to be parallel and continuous except where interrupted for joint flaps, weep channels, strap channels and for other purposes shown on Drawings or permitted by Project Manager.

5. The liner sheet edge which will be lower terminal edge in structure is not to extend beyond base of final locking extension more than 0.375 inch.

E. Provisions for Strap Channels. Unless alternate methods are acceptable to Project Manager, liner required to be secured to inner form with straps are to have strap channels at not more than 20 inches on center perpendicular to locking extensions. Strap channels are to be maximum of 1-inch wide and formed by removing locking extensions so that maximum of 3/16-inch remains. Channels are not to be provided in final two locking extensions adjacent to terminal edge of liner coverage.

F. Flaps. When transverse flaps are specified or required, fabricate by removing locking extensions so that no more than 1/32 inch of base of locking extensions remains on sheet.

G. Adhesive Products. Adhesive products and application procedures used in installation of liner are to be according to manufacturer's recommendations. Adhesive products intended for use inside cast-in- place structures are to be non-flammable.

H. Cleaners. Cleaners used in installation of liner shall be reviewed by Project Manager prior to use. Cleaners are to be nonflammable and water soluble or water dispersible and not be detrimental to plastic liner.

I. Caulking Products. Caulking products and application procedures used in installation of liner and appurtenances are to be as recommended by manufacturer.

J. Mechanical Anchors. When approved for use with plain sheet liner, provide anchors and washers of Type 316 stainless steel, and as recommended by liner manufacturer.

PART 3 EXECUTION

3.01 NOTIFICATION

A. Notify Project Manager at least 24 hours before reinforcing steel placement so that lining maybe inspected and errors corrected without delaying Work.

3.02 PLACING LINER

A. Location. Place liner throughout entire length of interceptor sewer along
top 300 degrees of pipe circumference, and inside structures as indicated on Drawings. Liner is to be applied and secured to forms and inspected by Project Manager prior to placement of reinforcing steel.

B. Coverage.

1. In cast-in-place structures, no offset of lower terminal edge is permitted. Unless otherwise shown on Drawings, lower terminal edge is to be one foot below low water level ("all pumps off" level
for lift stations), or 6 inches below top of grout or concrete fillet, whichever is higher.

2. At station where there is difference in pipe's circumferential liner coverage, as shown on Drawings, and longitudinal terminal edges of liner downstream from that station are lower than those upstream, uniformly slope terminal edges of liner installed in section of pipe or structure immediately upstream from station for entire length of section of pipe or structure from limits of smaller coverage to those of greater coverage. Wherever longitudinal terminal edges of liner downstream from station are higher than those upstream, accomplish slope uniformly throughout length of section of pipe or structure immediately downstream from station. Provide an approved locking extension along sloping lower terminal edges of liner plate.

C. Positioning Liner.

1. Position PVC liner installed in pipe so that locking extensions are parallel to longitudinal axis of pipe.

2. Position PVC liner installed in cast-in-place structures so that locking extensions are parallel to direction of

concrete placement, which is normally vertically for vertical walls.

3. Closely fit liner to inner forms. Cut sheets to fit curved and warped surfaces using minimum number of separate pieces.

4. The Project Manager may require use of patterns or marking of sheet layouts directly on forms where complicated warped surfaces are involved.

5. At transverse joints between sheets of liner used in cast-in-place structures and pipe joints, space between ends of locking extensions, measured longitudinally, shall not exceed 4 inches. Where sheets are cut and joined for purpose of fitting irregular surfaces, this space shall not exceed 2 inches.

D. Securing Liner in Place.

1. Liner shall be held snugly in place against inner forms. For pipes and similar circular sections, use light steel banding straps or other approved means. Prefabricated pipe-size tubular sheets which do not require strap channels may also be used.

2. When used, place banding straps in strap channels, as specified under provision for strap channels, at spacing not to exceed 20 inches.

3. Any method of banding, other than in strap channels, shall be reviewed by Project Manager prior to use.

4. On vertical surfaces where form ties or form stabilizing rods pass through liner, make provisions to maintain liner in close contact with forms during concrete placement. These provisions shall be reviewed by Project Manager.

5. Prevent concrete from flowing around edges of sheets at joints by sealing joint or seam with waterproof tape recommended by manufacturer.

6. Forms in contact with plastic liner need not be oiled.

E. Weep Channels.

1. At each pipe joint and at transverse joints in cast-in-place structures, gap not less than 2-inches nor

greater than 4 inches shall be left in locking extensions to provide transverse weep channel. When locking extensions are removed to provide weep channel at joints, base of extension left on sheet shall not exceed 3/16 inch.

2. Provide intermediate weep channels as required to maintain maximum spacing of 8 feet. Intermediate weep channels shall not be less than 2.0 inches nor greater than 4.0 inches in width. When locking extensions are removed to provide intermediate weep channels, base of extension left on sheet shall not exceed 3/16 inch.

3. Any area behind liner, which is not properly served by regular weep channels, shall have additional weep channels 2 inches wide provided by cutting away locking extensions.

4. Provide transverse weep channel approximately 12 inches away from each liner return where surfaces lined with plastic liner join surfaces which are not so lined.

5. As part of work of installing liner, clear outlets of weep channels of obstructions which would interfere with their proper functions.

6. Design weep channels for external hydrostatic pressures of water column equal in height to greater of 50 feet (22 psi) or 1.1 times depth of burial.

F. Liner Returns.

1. Install liner return where shown on approved shop drawings and wherever surfaces lined with plastic liner joins surfaces which are not so lined.

2. Unless otherwise indicated by Drawings or approved shop drawings showing liner installation methods, make returns as follows:

a. Return liner at least 3 inches at surfaces of contact between concrete structure and items not concrete (including access frames, gate guides and pipe penetrations).

b. Follow the same procedure at joints where type of protective lining is changed, or new work is built

to join existing unlined concrete.

3. Provide locking extensions on returns to lock returns to concrete of plastic-lined, cast-in-place structures.

4. Seal each liner return to adjacent construction with which it is in contact by means of an adhesive system recommended by manufacturer and acceptable to Project Manager. When joint space is too wide or joint surfaces too rough to permit use of compound, fill joint space with 2 inches of densely caulked cement mortar, lead wool, or other caulking material and finished with minimum of 1 inch depth of an approved corrosion resistant sealant material.

3.03 CONCRETING OPERATIONS

A. Concrete Placement.

1. Carefully vibrate concrete placed against liner shall be so as to avoid damage to liner and to produce dense concrete securely anchoring locking extensions into concrete. Use external vibrators in addition to internal vibrators, particularly along lower terminal edge of liner.

2. Stiffeners, when used along locking extensions of liner installed in forms for pipe, shall be withdrawn completely during placement of concrete in forms. Re-vibrate concrete to consolidate concrete in void spaces caused by withdrawal of stiffeners.

B. Removing Forms.

1. In removing forms, take care to protect liner from damage. Do not use sharp instruments to pry forms from lined surfaces. When forms are removed, pull nails that remain in liner plate without tearing liner and clearly mark resulting holes. Mark form tie holes before ties are broken off. Mark areas of abrasion of liner.

2. Following completion of form removal, clean liner in pipe and structures for inspection.

3. Remove banding straps used in securing liner to forms for pipe and

cast-in-place structures within limits of unlined invert.

3.04 FIELD JOINTING OF LINER

A. Installation Requirements.

1. No field joint shall be made in liner until lined pipe or structure has been backfilled and 7 days have elapsed after flooding or jetting has been completed. Where ground water is encountered, joint shall not be made until pumping of ground water has been discontinued for at least 7 days and no visible leakage is evident at joint. Liner at joints shall be free of mortar and other foreign material and be clean and dry before joints are made.

2. Hot joint compound shall not be brought in contact with liner.

3. No coating shall be applied over joint, corner or welding strip, except where nonskid coating is applied to liner surfaces.

B. Field Joints in Pipe Installation.

1. Field joints in lining at pipe joints shall be one of the following types:

a. Type P-1. Make joint with separate 4-inch joint strip and two welding strips. Center 4-inch joint strip over joint, heat- sealed to lining, then welded along each edge to adjacent liner sheets with 1-inch weld strip. 4-inch joint strip shall lap over each sheet minimum of 1/2 inch.

b. Type P-2

(1) Make joint with joint flap with locking extensions removed as described in paragraph 2.04 above, and extending approximately 4 inches beyond pipe end. Joint flap shall overlap lining in adjacent pipe section minimum of 1/2 inch and be heat-sealed in place prior to welding. Complete field joint by welding flap to lining of adjacent pipe using 1-inch weld strip.

(2) Take care to protect flap from damage.

Avoid excessive tension and distortion in bending back flap to expose pipe joint during laying and joint mortaring. At temperatures below 50 degrees F heating of liner may be required to avoid damage.

2. Do not make field joints in liner at pipe joints until mortar in pipe joint, when used, has been allowed to cure for at least 48 hours.

3. Joints between lined pipe and lined structures are to be either Type C-1 joint or Type C-2 joint as described below.

C. Field Joints in Concrete Structures. Field joints in liner on concrete structures are to be one of following types:

1. Type C-1. Make joint with separate 4-inch joint strip and two welding strips. Center 4-inch joint strip over joint, heat-sealed to liner, then welded along each edge to adjacent sheets with 1-inch wide weld strip. Width of space between adjacent sheets is not to exceed 2 inches. 4-inch joint strip is to lap over each sheet minimum of 1/2 inch. It may be used at transverse or longitudinal joint.

2. Type C-2. Make joint by lapping sheets not less than 1/2 inch. One 1-inch weld strip is required. Upstream sheet is to overlap one downstream. Heat-seal lap into place prior to welding on 1-inch weld strip.

3. Type C-3. Make joint by applying 2-inch wide waterproof tape or 1-inch wide welding strip on back of maximum 1/4-inch gap butt joint or by some other method approved by Project Manager to prevent wet concrete from getting under sheet. After forms have been stripped, apply 1-inch weld strip over face to sheet.

D. Installation of Welding Strips.

1. All welding of joints is to be in strict conformance with specifications and instructions of lining manufacturer.

2. Welding is to fuse both sheets and weld strip together to provide continuous joint equal in corrosion resistance and impermeability to liner plate.

3. Hot-air welding tools shall provide effluent air to sheets to be joined at temperature between 500 degrees F and 600 degrees F. Hold welding tools approximately 1/2 inch from and moved back and forth over junction of two materials to be joined. Move welding tool slowly enough as weld progresses to cause small bead of molten material to be visible along both edges and in front of weld strip.

4. Maintain adequate ventilation in confined spaces during welding operations.

5. After repairs have been made, defective welds will be re-inspected and re-tested.

E. Joint Reinforcement. Apply 12-inch long welding strip as reinforcement across each transverse joint and weep channel which extends to lower terminal edge of liner. Center reinforcement strips over joint being reinforced and located as close to lower edge of liner as practicable. Weld in place after transverse welding strips have been installed.

F. Application of Liner to Concrete Surfaces with Adhesives. Application of liner plate to concrete surfaces by means of adhesive is allowed only where shown on Drawings for existing structures, or where specifically acceptable to Project Manager and called out on approved shop drawings, and is to be accomplished by following steps:

1. Etch concrete surface by abrasive blasting to develop slightly granular surface.

2. After abrasive blasting, thoroughly clean concrete surface of dust.

3. Apply primer, adhesive and liner in strict accordance with manufacturer's recommendations, as approved by Project Manager.

4. Place mechanical anchors at 12-inch centers each way after adherence of liner to concrete surface has been achieved. Place anchors after adhesive system has cured for minimum of 24 hours. Seal penetration of liner by anchor in accordance with manufacturer's recommendations.

G. Nonskid Surfaces. Surfaces of liner, shown on Drawings to be nonskid, treated as follows prior to installation:

1. Liner is to be cleaned, dried, and spread with an adhesive coating recommended by manufacturer of liner plate.

2. Liberally sprinkle surface with clean, dry, well graded sand, which will pass No. 30 sieve but be retained on No. 70 sieve.

3. After sanded surface has thoroughly dried, brush away excess sand and spray seal coat of adhesive coating over sand in sufficient quantity to coat and bond sand to liner plate.

4. Allow coated sand surface to dry thoroughly before handling.

H. Protection and Repair of Liner.

1. Take necessary measures and precautions to prevent damage to liner from equipment and materials used in or taken through Work. Repair damage to installed liner plate in accordance with requirements for repair of liner.

2. Patch nail and tie holes and cut, torn and seriously abraded areas in liner plate. Patches made entirely with welding strip are to be fused to liner over entire patch. Use of this method is limited to patches which can be made with single welding strip. Use of parallel, overlapping or adjoining welding strips will not be permitted. Larger patches may consist of smooth liner over damaged area, with edges covered with welding strips fused to patch and to liner adjoining damaged area. Limit size of single patch of latter type only as to its width, which shall not exceed 4 inches.

3. Whenever liner is not properly anchored to concrete, or whenever patches larger than those permitted above are necessary, accomplish repair of liner and restoration of anchorage by injecting epoxy grout behind liner plate by method approved by Project Manager. Use of adhesives will not be allowed to repair improperly anchored liner plate.

I. Field Tests.

1. Upon completion of installation, clean surface of liner to permit visual inspection and spark testing by Project Manager, using spark-type detector complying with requirements for Spark Test. Properly repair and retest areas of liner failing to meet field test.

2. Contractor is to assist in inspection and spark testing by providing adequate ventilation, ladders for access, barricades or other traffic control devices, and is responsible for opening and closing entrances and exits.

3. Spark testing of liner by Contractor is to be done with detector complying with these Specifications.

END OF SECTION

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SECTION 55923

STAINLESS STEEL FLOW CONTROL GATES

PART 1 GENERAL

1.01 GENERAL

A. Scope. This section governs all work necessary to furnish, install and place into initial operation all flow control gates. The Contractor, with the equipment manufacturer, will be responsible for an installed and operational system compatible in all respects with the overall treatment process.

B. Description.

1. The flow control gates shall be provided as described in this section.

2. The equipment to be provided includes, but is not limited to, the following:

a. Downward Opening Weir Gates – Rapid Mix Basin

b. Slide Gates – Bar Screen Channel

C. Design Criteria

1. The Bar Screen Channel Slide Gates

Number of Gates: 2	
Width:	2'-0"
Travel:	1'-6"

1.02 QUALITY ASSURANCE

A. All equipment described in this section shall be supplied by a single manufacturer with experience proven to the engineer.

B. All fabricated equipment shall be carefully inspected at the site of fabrication by factory inspectors who shall use whatever means are necessary, including shop assembly, to assure the proper fit of all field connections and compliance with all material requirements of this specification.

C. No field welding will be allowed for assembly of any equipment in this specification.

1.03 SUBMITTALS

A. Approval for equipment installation and incorporation into this project will be made only after the receipt and examination of equipment submittals, as described below. The following shall be provided, as a minimum.

1. One (1) complete, electronic (pdf) copy of the equipment submittal shall be provided. The equipment manufacturer shall supply as many additional copies as desired to be returned after review.
2. A letter of qualification shall be provided if the manufacturer is recommending any deviations from the contract drawings or this specification. Reasons for such requests shall be fully justified, with drawings when appropriate.
3. Instructions on receiving, storage, handling and installation of equipment.
4. Material specifications describing the size, type, and quality of individual items to be provided. Catalog cut sheets shall be provided when appropriate.
5. Equipment description for each component explaining scope of supply.
6. Shop drawings with all dimensions showing the location of embedded items and openings in structures required for installation of equipment and connecting piping. Shop drawings shall clearly and completely depict all equipment.

B. Installation, Operation and Maintenance Manuals shall be provided prior to delivery of equipment and updated, as necessary, during installation. The contractor shall not accept delivery of any equipment without the I.O.M. Manual onsite. The following shall be provided, as a minimum.

1. One (1) complete, electronic (pdf) copy of the installation, operation and maintenance manual shall be provided.
2. Name, address, and phone number of the nearest competent service organization who can supply parts and service. If this is not the manufacturer's own service department, then furnish a letter certifying that the named organization is authorized to represent the manufacturer and to perform warranty service.
3. Complete descriptive literature and drawings of all material furnished. This includes "as built" wiring diagrams of all electrical equipment, "as built" erection drawings providing up-to-date information on the actual fabrication and erection of the equipment and documentation of any field modifications made during installation, start-up, and testing.
4. Installation, operation, and maintenance brochures from the original manufacturers of all mechanical components such as valves, pipe couplings, gear reducers, bearings, etc. incorporated into the completed installation.
5. All required assembly, installation, alignment, leveling, adjustment, startup and testing instructions.
6. All required operating instructions.
7. All required maintenance instructions, including routine maintenance and lubrication schedules.

C. The equipment manufacturer shall provide a field certification report stating that equipment is properly installed and ready for operation. The field certification report shall be based on an actual jobsite assessment of the installed equipment.

1.04 WARRANTY

D. The manufacturer and contractor shall warrant the Airlift Equipment supplied to the owner against all defects in workmanship and materials for a period of twelve (12) months from date of startup, not to exceed eighteen (18) months from date of shipment from the manufacturer.

E. The manufacturer's warranty period shall run concurrently with the contractor's warranty period. No exception to this provision shall be allowed. The contractor shall be responsible for proper storage of the equipment so as to remain in "as shipped" condition. PRODUCT DELIVERY, STORAGE AND HANDLING

F. Preparation for Shipment:

1. All pieces shall be delivered in the largest pieces practical for field assembly by the Contractor. Individual pieces shall be permanently tagged with welded erection marks or stainless steel tags cross-referenced with information on the manufacturer's erection and assembly drawings.
2. Gear boxes, mechanical and electrical components shall be protected from the weather and suitably packaged to facilitate handling and storage.
3. Special lubricating and rust preventative oils shall be provided to prevent internal corrosion of gear assemblies.
4. All mechanical equipment shall be kept thoroughly dry at all times and shall be stored indoors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. PB Equipment, Inc.

B. G-H Systems, Inc.

C. Engineer's Pre-approved equivalent or Approved Equal.

1. Requests for equipment Pre-approval must be submitted in writing to the Engineer no later than fifteen days prior to the bid opening. The request for approval must be complete and shall contain at least the following information.
    a) A statement of compliance with the manufacturer's qualifications requirements described above and a list of qualified projects including the following information:
        1) Project Name, Locations and Equipment Description,

2) Owner's Name, Address and Telephone Number,

3) Engineer's Name, Address and Telephone Number,

4) Evidence of Ten (10) Years of Experience; and, 5) Evidence of Twenty (20) Similar Installations.

b) A description of all proposed equipment items. Materials and coatings shall be included.

c) Equipment layout drawings, hard and disk copies, with dimensions and component sizing. Drawings shall be in AutoCAD.

d) Calculations showing that the equipment complies with the requirements of this specification.

e) Operating data from the wastewater treatment plants listed in Item A. above and testimonials from the operating personnel. The data and testimonials shall include the maintenance history of the equipment including frequency of cleaning, labor and materials required for cleaning.

f) Complete catalog data for each item, including:

1) Detailed Shop Drawings,

2) Specification Data,

3) Catalog Cuts; and, 4) Brochures, etc.

g) Any deviations from specified requirements.

2. Pre-Approved equivalent manufacturers will be indicated by the Engineer in an addendum prior to the bid date. The Contractor will be responsible for meeting all the requirements of this specification when using alternate equipment.

2.02 DESIGN REQUIREMENTS AND PERFORMANCE

A. Slide Gates

1. Tolerances

a. The top edge of each slide gate shall be straight within ± 1/8".

b. Leakage shall not exceed 0.2 GPM per foot of seal.

2. Gate and Frame

a) The gate shall be minimum ¼" type 304 stainless steel plate reinforced with stainless steel stiffeners welded to the plate. The stem connections shall be the clevis type, with structural members welded to the gate and a minimum ½" diameter bolt to act as a pivot pin.

b) The guide frame shall be a rigid, welded unit with side bars, cross frame to support the operator, and bottom member flush with the invert of the channel.

c) Rubber J-bulb seals shall be provided for the submerged portion of the side bars and at the invert of the channel.

3. Operator

a. The operator stem shall be type 304 stainless steel designed to have annL/r of less than 200, to withstand at least twice the rated output of the operator at a 40 pound pull and to have a minimum diameter of 1-1/2".

b. Lifts shall operate the gate with a maximum pull of 40 lbs on the handwheel. Handwheel shall be located 36" above grating or walkway. All lifts shall have thrust bearings, bronze lift nuts, and an aluminum stop nut to limit the downward travel of the stem and slide. All lifts shall be rising stem type. Lifts shall be grease lubricated and regreasable through grease zerks. Oil bath lifts are not acceptable.

c. The operator assembly shall have a threaded bronze lift nut to engage a stainless steel threaded rod. B. Downward Opening Gates.

1. Tolerances

a. The top edge of each weir gate shall be straight within ± 1/8".

b. Leakage shall not exceed 0.2 GPM per foot of seal.

2. Gate and Frame

a) The gate slide shall be minimum ¼" thick Type 304 stainless steel plate reinforced with stainless steel stiffeners welded to the plate. The stem connection shall be clevis and pin type. The stem to gate connection pin shall be a minimum of ¾". The top edge of the gate shall act as a flat crested weir.

b) The gate frame shall be ¼" type 304 stainless steel.

c) The gate operator frame shall be minimum ¼" hot dip galvanized ASTM A-36 Steel.

d) Rubber J-bulb seals shall be provided for the submerged portion of the sidebars and at the invert of the channel. Seals shall be fluorocarbon clad on the working face.

e) The gate slide shall ride on wear strips made from UHMW polyethylene fastened to the frame with countersunk fasteners to prevent metal-tometal contact.

3. Operators

a) The operator shall be a handle type crank with 2:1 gear reduction. A maximum effort of 40 pounds pull shall be required to operate the gate after it is unseated.

b) Dual vertical gate lifting screws shall be located outside the normal water flow path and shall be operated from a single horizontal shaft with lift screws and bevel gear sets move both lifting tubes synchronously. Gates with lifting screws located in the flow path are unacceptable.

1) The lift screws shall be minimum 1-1/2" diameter single-lead 5 pitch ACME, Type 304 stainless steel. The lift nuts shall be corrosion resistant SAE 660 bronze. The lifting stems shall be non-rising.

2) Shaft support bearings shall be flanged ball bearing or roller bearing insert type with cast housings and shall be easily greased without removing any components or covers.

3) The gates shall be provided with position indicators comprised of a stationary staff gauge attached to the operator frame and reading in feet and tenths, and a Type 304 stainless steel pointer indicating the gate position on the gauge in relation to its total range of travel. Gauges shall be constructed from stainless steel and easily read.

c. The operating stem shall be type 304 stainless steel designed to have an L/r of less than 200, to withstand at least twice the rated output of the benchstand and to have a minimum diameter of 1-1/2 in. The stem shall be connected to the disc by means of a Type 304 stainless steel stem connector threaded and bolted to the stem and welded to the disc.

d. All lifts shall have thrust bearings, bronze lift nuts, and stainless steel stops to limit the downward travel of the stem and slide. All lifts shall be rising stem type. Lifts shall be grease lubricated and regreasable through grease zerks. Oil bath lifts are not acceptable.

4. Stainless steel nameplates giving the name of the manufacturer, model number, serial number, rated head, and any other pertinent data shall be attached to each weir gate.

2.03 PROTECTIVE COATINGS

A. All fabricated steel equipment described as hot dip galvanized shall conform with ASTM A-123.

1. Individual components shall be fabricated in maximum sizes suitable for shipping and galvanizing.

2. The equipment shall be designed and fabricated in accordance with ASTM A143, A384 and A-385 for bolt together assembly.

3. No field welding will be allowed on hot dip galvanized equipment.

B. Mechanical components, such as valves, gear reducers and bearings, shall be furnished with the original manufacturer's standard finish.

2.05 ANCHORAGE AND FASTENERS.

1 All anchors shall be minimum ½" Ø, Type 304 stainless steel with stainless steel nuts and washers.

2 All fasteners shall be Type 304 stainless steel.

PART – 3 EXECUTION

3.01 PREPARATION

A. Inspect all concrete and piping and determine that all dimensions and elevations relating to the equipment are correct. All modifications to cured concrete require approval of the Engineer.

B. The contractor shall have sufficient copies of the equipment manufacturer's installation, operation, and maintenance manuals onsite prior to installation.

3.02 INSTALLATION

1 The contractor shall install all equipment in accordance with the manufacturer's written instructions and as directed during onsite inspection by the manufacturer's representative.

2 Deviations from the manufacturer's written or verbal instructions shall be subject to approval of the Engineer.

3.03 FIELD TESTING

a. Prior to start-up, the contractor shall test all valves, switches and gauges for proper setting and operation.

b. Check assembly alignment.

c. Ensure all equipment is properly lubricated.

3.04 START-UP SERVICES

1 The manufacturer shall provide the services of a field service representative to inspect the equipment installation and place the equipment into initial operation.

2 The field service representative shall instruct operating personnel in the proper operation and maintenance of the equipment.

3 A minimum of one (1) eight hour day and one (1) trip to the jobsite shall be provided.

END OF SECTION

Section 432415

Discflo Laminar Pumping Equipment

Part 1 - General

1.1 Description

A. Scope: This section governs all work necessary to furnish, install and place into initial operation Discflo laminar pumps. The Contractor, with the equipment manufacturer, will be responsible for an installed and operational system compatible in all respects with the overall treatment process.

B. Description of System.
1. Discflo laminar pumps shall be provided as shown on the contract drawings and described in this specification.
2. The contractor shall coordinate control and piping to provide an appropriate pumping system.

C. Additional Requirements Specified Elsewhere.
1. Section 40 67 19 - Wall-Mounted Control Panels D.

Design Criteria.

1. The waste sludge pumps shall be based on the following.

Quantity: 2	2
Capacity: 200 gpm	200
Discharge Head: 40 ft	40
Motor Size: 7.5 hp	7.5

E. Site Conditions.

Elevation:	9.60	ft amsl
Maximum Temperature:	104°	F
Minimum Temperature:	20°	F

1.2 Quality Assurance

A. All equipment described in this section shall be supplied by a single manufacturer with experience proven to the engineer.

B. All fabricated equipment shall be carefully inspected at the site of fabrication by factory inspectors who shall use whatever means are necessary, including shop assembly, to assure the proper fit of all field connections and compliance with all material requirements of this specification.

C. No field welding will be allowed for assembly of any equipment in this specification.

1.3 Submittals

A. Approval for equipment installation and incorporation into this project will be made only after the receipt and examination of equipment submittals, as described below. The following shall be provided, as a minimum.

1. One (1) complete, electronic (pdf) copy of the equipment submittal shall be provided.
2. A letter of qualification shall be provided if the manufacturer is recommending any deviations from the contract drawings or this specification. Reasons for such requests shall be fully justified, with drawings when appropriate.
3. Instructions on receiving, storage, handling and installation of equipment.
4. Material specifications describing the size, type, and quality of individual items to be provided. Catalog cut sheets shall be provided when appropriate.
5. Equipment description for each component explaining scope of supply.
6. Shop drawings with all dimensions showing the location of embedded items and openings in structures required for installation of equipment and connecting piping. Shop drawings shall clearly and completely depict all equipment.

B. Installation, Operation and Maintenance Manuals shall be provided prior to delivery of equipment and updated, as necessary, during installation. The following shall be provided, as a minimum.

1. One (1) complete, electronic (pdf) copy of the installation, operation and maintenance manual shall be provided.
2. Name, address and phone number of the nearest competent service organization who can supply parts and service. If this is not the manufacturer's own service department, then furnish a letter certifying that the named organization is authorized to represent the manufacturer and to perform warranty service.
3. Complete descriptive literature and drawings of all material furnished. This includes "as built" wiring diagrams of all electrical equipment, "as built" erection drawings providing up-to-date information on the actual fabrication and erection of the equipment and documentation of any field modifications made during installation, start-up and testing.
4. Installation, operation and maintenance brochures from the original manufacturers of all mechanical components such as valves, pipe couplings, gear reducers, bearings, etc. incorporated into the completed installation.
5. All required assembly, installation, alignment, leveling, adjustment, start-up and testing instructions.
6. All required operating instructions.
7. All required maintenance instructions, including routine maintenance and lubrication schedules.

C. The equipment manufacturer shall provide a field certification report stating that equipment is properly installed and ready for operation. The field certification report shall be based on an actual jobsite assessment of the installed equipment.

1.4 Delivery, Storage And Handling

A. Delivery and Handling of Equipment:

1. Inspect all equipment and materials against reviewed shop drawings at the time of delivery.
2. Equipment and materials damaged or not meeting the requirements of the reviewed shop drawings shall be immediately returned for replacement or repair.

B. Storage:

1. Carefully prepare for storage and label all equipment and materials after they have been inspected.
2. Store materials to permit easy access for inspection and identification. Support all material off of the ground and protect steel members and packaged material from corrosion and deterioration as per manufacturers' instructions.

1.5 Warranty

A. The manufacturer and contractor shall warrant the equipment against all defects in workmanship, materials and installation for a period of twelve (12) months from date of startup, not to exceed eighteen (18) months from date of shipment from the manufacturer.

B. The manufacturer’s warranty period shall run concurrently with the contractor’s warranty period. No exception to this provision shall be allowed.

C. The contractor shall be responsible for proper storage of the equipment so as to remain in “as shipped” condition. If the equipment remains in storage at the job site for longer than six (6) months prior to installation, the contractor shall provide factory service personnel for a complete inspection of the equipment. Any work necessary to restore the equipment to “as shipped” condition shall be the responsibility of the contractor.

Part 2 - Products

2.1 Acceptable Manufacturers

A. Discflo Corporation

B. Engineer's approved equivalent.

1. Requests for equipment approval must be submitted in writing to the Engineer no later than fifteen days prior to the bid opening. The request for approval must be complete and shall contain at least the following information.

a. A statement of compliance with the manufacturer's qualifications requirements described above and a list of qualified projects including the following information:

1) Project Name, Locations and Equipment Description,

2) Owner's Name, Address and Telephone Number,

3) Engineer's Name, Address and Telephone Number,

4) Evidence of Ten (10) Years of Experience; and,

5) Evidence of Twenty (20) Similar Installations.

b. A description of all proposed equipment items. Materials and coatings shall be included.

c. Equipment layout drawings, hard and disk copies, with dimensions and component sizing. Drawings shall be in AutoCAD.

d. Calculations showing that the equipment complies with the requirements of this specification.

e. Operating data from the wastewater treatment plants listed in item a above and testimonials from the operating personnel. The data and testimonials shall include the maintenance history of the equipment including frequency of cleaning, labor and materials required for cleaning.

f. Complete catalog data for each item, including:

1) Detailed Shop Drawings, (if proprietary information – shall supply Texas PE Sealed X-sectional and General Arrangement drawing of the pump only and include seal and motor drawing and data as well.)

2) Specification Data,

3) Catalog Cuts; and,

4) Brochures, etc.

g. Any deviations from specified requirements.

2. Approved equivalent manufacturers will be indicated by the Engineer in an addendum prior to the bid date. The Contractor will be responsible for meeting all the requirements of this specification when using alternate equipment.

2.2 Performance and Design Requirements

A. General

1. All equipment shall be designed and built for 24-hour continuous duty at any and all points within the specified range of operation, without overheating, without cavitation, and without excessive vibration or strain.

2. The pumping units required under this section shall be complete. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the service to be performed as specified. Sufficient space for inspection, repairs and adjustment shall be provided.

3. Equipment shall include nameplate with pertinent equipment information. Pump nameplate shall be stainless steel and include the name of the MANUFACTURER, the rated capacity, head, speed and all other pertinent data. Additionally the pump job identifier, model, gear reduction and motor horsepower shall be cut into steel plate and welded to the skid for permanent identification.

4. All working parts of the pumps and motors, such as bearings, wearing rings, shaft, sleeves, etc., will be interchangeable between like units and such that the OWNER may, at any time in the future, obtain replacement and repair parts for those furnished in the original machines.

5. The nameplate ratings of the motors shall not be exceeded, nor shall the design service factor be reduced when the pump is operating at any point on its characteristic curve up to the maximum flow specified.

6. Mechanical equipment, including drives and electric motors shall be supplied and installed in accordance with applicable OSHA regulations. Unless otherwise specified, rigid painted steel or stainless steel guards shall be installed on all rotating assemblies. Guards shall be removable only by the use of a tool. The noise level of the pump system, unless otherwise noted, shall not exceed the limits established by ANSI/HI 3.1-3.5-2008 paragraph 3.3.17.3.

7. All lubrication and oil change fittings shall be brought to the outside of all equipment so that they are readily accessible from the outside without the necessity of removing covers, plates, housings, or guards.

8. For a period of five (5) years after installation, the MANUFACTURER agrees to ship standard spare parts within two (2) working days of receipt of order from OWNER or ship said spare parts to OWNER later without charge.

B. Pumps

1. The rotary lobe pumps specified herein shall be positive displacement, rotary lobe type designed for water and wastewater treatment pumping applications.

2. Pump and pump components, including but not limited to: castings, shafts, mechanical cartridge seals, gears, wear plates, lobes, flange rings, and strain bolts shall be manufactured, machined and assembled in the USA to avoid long lead times and to maintain availability of pump and replacement parts for (fast) turnaround of pump and parts orders.

3. Performance Requirements for Pump System:

a. The maximum pump lobe tip speed at the design flow in gallon per minute (GPM) and total dynamic head (TDH) shall be as specified.

b. Unless otherwise noted, MANUFACTURER shall supply standard ANSI-150# intake and discharge fittings. The dimension shall be provided in a drawing accompanying the bid.

c. Unless otherwise specified below, MANUFACTURER shall furnish an in-line motor/gear reducer standard combination designated for continuous duty at moderate [heavy] shock. Gear reducers and integral gear motors shall meet AGMA Class II, with service factor of 1.4 minimum for pump application with moderate shock, continuous duty and shall meet AGMA Class III, with service factor of 2.0 minimum for heavy shock, continuous duty operation.

2.3 Materials and Methods of Fabrication

A. Pump Castings

1. Each pump casting shall be made in accordance with ASTM A48, Class 30, (that are suitable for the application) featuring a heavy duty, positive displacement rotary lobe design with gray cast iron casing and smooth end cover.

2. The pump cover shall be constructed of (material suitable for the application) gray cast iron .

3. Removal of the rotors will be permitted without disturbing piping, bearings, and mechanical seals. The thickness of gear housing and seal cooling chamber mounting feet shall be a minimum of 24 mm. for heavy duty strength and rigidity, to prevent breakage. (Not applicable)

B. Wear Plates (Not applicable)

1. The wear plates shall be made of abrasion resistant AISI AR500 steel.

2. To approximately double the wear plates' useful service lives, both the front and rear wear (axial) plates shall be reversible. Radial wear plates are excluded.

C. Wear Plate Bolts (Not applicable)

1. All the bolts that secure the wear plates to the castings inside the pump assembly shall be of stainless steel material, hex head and conforms to AISI A2-A4.

D. Lobes (Not applicable)

1. The pump shall utilize lobes, which are driven through positive timing gears running in oil.

2. The lobe cores shall be made of fabricated steel with sufficient surface texturing to provide a minimum of 30% additional surface area for bonding compared to a smooth lobe core.

3. The steel lobe core shall be completely covered with a layer of NBR elastomer at an average durometer hardness of 70, per ASTM D2240.
4. The geometry of the lobe core shall be the same as that of the finished lobe.
5. Lobe geometry shall be helical with 4-wing tips for pumps having a theoretical displacement of more than 16 gallons per 100 revolutions and 6-wing for pumps having a theoretical displacement of 16 gallons or less per 100 revolutions.
6. Designs with lobe wing tips parallel to the shaft centerline and/or lobes with replaceable tips will not be accepted unless deemed necessary for the application.
7. The lobe shall be specifically designed for pumping thickened waste, primary and secondary sludge and anaerobically digested sludge containing organic solids, and small inorganic particles.
8. Lobes shall be positioned to the shaft by replaceable keys, and secured to the shaft by strain/expansion bolt and pressure disks.

E. Strain/Expansion Bolts

1. The expansion or strain bolt threads shall be made in compliance with ASTM standard and bolt manufacturer torque requirements.
2. The threads should be fully engaged to the shaft when fully positioned and tightened, certified tested and passed under ASTM F-606.

F. Shafts

1. The shafts shall be made of alloy steel AISI A4140.
2. The shaft keyway orientation shall be precisely timed in their rotation by timing gears running in a separate gear oil chamber also containing the shaft bearings.
3. To minimize torsional stress on the shafts, the shaft minimum diameters shall be:

Theoretical Displacement, gallons per 100 revolutions	Shaft Diameter, in
0 - 16	1.772
34 - 100	2.362
> 100	3.346

4. The maximum allowed shaft deflection shall not exceed 0.001 in. The use of step down shafts in the wet end of the pump is not acceptable.

G. Seals

1. For simplicity of servicing and reduction in cost, only rebuildable single mechanical cartridge type seals shall be used.
2. Heavy duty split Duronit V mechanical face seals shall be provided as a standard for each positive displacement pump, or as specified.

3. Each mechanical seal shall be pressure tested for static and dynamic pressures before final installation onto the pump.

4. Component type mechanical seals that use bushings to permanently place the seals will not be acceptable.

5. Seal holders for waste water sludge application shall be electroless-nickel coated for prolonged corrosion and chemical resistance.

6. Seal holders that are coated with black oxide shall not be acceptable.

7. Pumps and seals that utilize packing glands and external flushing for lubrication and cooling are not acceptable.

H. Seal Cooling Chamber

1. To provide protection from dry running for a minimum of 30 minutes, the mechanical seals shall be housed in a separate seal cooling chamber and bathed in oil.

2. This chamber shall be refillable from port on the top surface, and shall have an external sight glass for visual inspection of the chamber oil.

3. The seal cooling chamber of the pump shall not require pressurizing to prevent seal leaks and oil contamination at product pressures below 100 PSI.

4. Systems requiring the OWNER to manually pressurize the seal cooling chamber in order to prevent seal leaks and product contamination at pressures below 100 PSI are not acceptable.

5. Seals with an “air gap” adjacent to the gearbox shall not be accepted.

6. To prevent cross contamination, the gear housing and seal cooling chamber shall be separated by a double lip seal.

7. The surface facing the wet end of the seal cooling chamber shall be coated for corrosion resistance.

8. There shall be no recessed surfaces where dirt or sediments may accumulate on the wet end side of the seal cooling chamber.

I. Flanges

1. Port connections shall be ASME/ANSI B16.5-150 # flanges.

2. The flange sizes shall be the same as the suction and discharge pipe sizes as specified.

J. Pump Rear Cover

1. The removable rear cover shall be sealed with an O-ring compatible with the service required, and provide complete access to the pump chamber without disconnecting pipe work, glands, or bearings.

2. The removable rear cover is to be mounted to the pump with four individual bolts, to provide unhindered access to the rotors to facilitate ease of maintenance and operator safety.

3. For easy maintenance and wear plate replacement, the end cover casting shall permit 180 degree mounting without altering the performance of the pump.

K. Pump & Drive Assembly

1. The rotary lobe pump, gear reducer, and motor or gearmotor shall be mounted on a structural steel base plate, with structural supports as necessary, complete with couplings, guards, and mounting hardware, to meet the requirements specified.

L. Vibration

1. Rotary pumps and motors shall operate at any point within their operating range without undue noise and vibration.

2. Vibration at any point in the operating range shall not exceed the limits allowed by the Hydraulic Institute.

M. Pump Housing Segments

1. The top and bottom housing segments of the pump shall be constructed as per ASTM A48.

2. For pumps having a theoretical displacement greater than 16 gallons per 100 revolutions, the housing segments shall be adjustable based on wear.

3. The adjustment shall be accomplished by moving the locating roll pins from one hole to the next in the pump housing, allowing for the closing of tolerance around the rotors. This adjustment shall be available at a minimum of two times.

   a. For general purpose, non-sludge, and sludge applications, pump housing segments will be constructed of Class 30 Gray Iron.

   b. For corrosive and chemical applications, pump housing segments shall be stainless steel type 316 or as specified by the MANUFACTURER.

4. Pump housings that require wear inserts as radial wear plate shall not be acceptable.

5. Pump housings with integral flanges shall not be acceptable for pumps having a theoretical displacement greater than 16 gallons per 100 revolutions.

N. Bearings

1. Bearings shall be properly sized to withstand the maximum radial or axial load carried by the shafts for continuous duty.

2. The L10, bearing life in hours of rotary lobe pumps running at steady or constant speed, load, pressure and temperature shall have 100,000 hours minimum.

3. The minimum bearing life in hours for pumps with loads that are operated with variable frequency drive shall at least be 50,000 hours.

O. Gears

1. Gears shall be of spur gear type and shall conform to AISI 1045 material specifications.
2. Gear design shall meet AGMA Class 9 quality minimum.
3. Gears shall be accurately keyed and timed for smooth and quiet transmission of load.

a. Certification

1. Rotary lobe pump manufacturer shall be ISO 9001:2015 certified.
2. Manufacturers that are not ISO certified or do not have the latest ISO certification shall not be considered.

Q. Spare Parts

1. The MANUFACTURER will furnish the following:
   a. One (1) set of mechanical seals with necessary O-rings for each pump.
   b. One (1) lobe replacement kit for each size pump. The kit shall include sufficient lobes, O-rings, strain bolts and spring washers to completely replace the lobes in one pump.
   c. One (1) set of wear plates and bolts.

2.4 Pump Gauges and Pressure Relief System

A. Pump Discharge Gauges:

1. The MANUFACTURER shall furnish and install for each pump 1/2" tapped holes in the discharge piping to accommodate discharge gauges.

B. Pump Suction Gauge:

1. The MANUFACTURER shall furnish and install for each pump 1/2" tapped holes in the suction piping to accommodate suction gauges.
2. The suction gauge shall have a compound scale including vacuum and pressure scales.

C. Discharge Pressure Relief System:

1. The CONTRACTOR shall provide for pressure relief or pressure shutdown for the pump only not greater than 1.25 times the maximum TDH (Total Dynamic Head) or PSI specified.
2. If devices or other appurtenances in the pump system require pressure shutdown at lower TDH or PSI than specified, protective devices shall be installed.

2.5 Protective Coatings.

A. Before exposure to weather and prior to shop painting all surfaces shall be thoroughly cleaned, dry and free from all mill-scale, rust, grease, dirt and other foreign matter.

B. All exposed portions of the pumps and motors, other than pump or motor shafts, couplings, etc., shall be shop primed, with primer compatible with field painting as specified.

C. All nameplates shall be properly protected during painting.

D. The pump assembly shall be primed and painted with the MANUFACTURER'S standard color and procedure unless specified otherwise.

E. Average dry film thickness (DFT) of the top paint coat shall be 3.0 – 5.0 mils.

Part 3 - Execution

3.1 Preparation

A. Inspect all concrete and piping and determine that all dimensions and elevations relating to the equipment are correct. All modifications to cured concrete require approval of the Engineer. (By contractor)

B. The contractor shall have sufficient copies of the equipment manufacturer's installation, operation and maintenance manuals onsite prior to installation. (Supplier may cost extra for additional copies-no additional pay by Client/Owner)

3.2 Installation

A. The contractor shall install all equipment in accordance with the manufacturer's written instructions and as directed during onsite inspection by the manufacturer's representative. (Supplier may charge additional fee for field support under Field Service Supervision-no additional pay by Client/Owner.)

B. Deviations from the manufacturer's written or verbal instructions shall be subject to approval of the Engineer.

3.3 Field Testing

A. Prior to start-up, the contractor shall check for proper installation.

B. Check assembly alignment.

C. Ensure all equipment is properly lubricated.

3.4 Start-up Services

A. The manufacturer shall provide the services of a field service representative to inspect the equipment installation and place the equipment into initial operation (Confirm with manufacturer the Field Service Rates -no additional pay by Client/Owner)

B. The field service representative shall instruct operating personnel in the proper operation and maintenance of the equipment.

C. A minimum of one (1) eight hour day and one (1) trip to the jobsite shall be provided (Confirm with manufacturer the Field Service Rates -no additional pay by Client/Owner).

End of Section

SECTION 462111

MULTI-RAKE BAR SCREEN

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor materials, equipment and incidentals required and install, test, and place in satisfactory operation one (1) mechanically cleaned bar screen and associated appurtenances as specified herein and as indicated on the drawings.

B. The mechanically cleaned bar screen shall be a new Fairfield Model MACH-03 Multi-Rake 304 stainless steel unit and shall be installed in accordance with manufacturer's instructions in compliance with the inspection of the Manufacturer's Field Service Representative.

1.02 RELATED WORK

A. Division 01: General Requirements

B. Section 01 33 00: Submittal Procedures

C. Section 01 78 23: Operation and Maintenance Data

D. Division 25: Instrumentation and Control Requirements

E. Division 26: Electrical Requirements

F. Section 46 21 73 – Screenings Washing and Compacting Equipment

G. Section 46 05 00: Common Work Results for Water and Wastewater Equipment

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for all equipment including specifications, capacity ratings, finishes of materials, dimensions, weights, accessories furnished, and installation and start-up instructions.

B. Shop Drawings: Submit assembly type shop drawings showing equipment dimensions, required clearances, construction details, and field connection details.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to all equipment. Submit manufacturer's ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring factory installed and portions field installed.

D. One electronic version product data/shop drawings shall be furnished. Hard copies of final approved submittal shall be furnished as required by Engineer and/or General Contractor.

E. Operation and Maintenance (O & M) Data:

a Submit operation and maintenance instructions for all equipment including recommended spare parts list.

b Submit six (6) bound copies and one electronic copy of final approved Operation and Maintenance Manual.

1.04 REFERENCE STANDARDS

A. AISI, American Iron and Steel Institute

B. ASME, American Society of Mechanical Engineers

C. ASTM, American Society of Testing and Materials

D. ANSI, American National Standards Institute

E. AWS, American Welding Society

F. IEEE, Institute of Electrical and Electronics Engineers

G. NEC, National Electric Code

H. OSHA, Occupational Safety and Health Act

I. NEMA, National Electrical Manufacturers Association

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications

a. All products and services supplied herein shall be by a single Manufacturer. The manufacturer of the Bar Screen Equipment shall also furnish the Screenings Washing and Compactor Equipment, Section 462173

B. Acceptable Manufacturer:

1. Subject to compliance with the requirements, provide Multi-Rake bar screen manufactured by Fairfield Service Company of Indiana, LLC.
2. Engineer's approved equivalent

C. The naming of a manufacturer in this specification is not an indication that the manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the manufacturer may have the experience and capability of engineering and supplying a system as specified. Having a manufacturer specifically listed does not relieve the Manufacturer or Contractor from providing equipment that meets all aspects of these specifications. Service of Manufacturer's Representative

1. Provide the services of a factory certified service representative specifically trained in the installation, start-up, testing, operation, and maintenance of the bar screen system as herein specified.
2. The screen factory certified representative shall advise, consult, and instruct the Contractor on installation and adjustments and shall inspect the equipment installation as a condition of acceptance of the work. The service engineer shall verify the location of anchor bolts, placement, leveling, alignment, field erection of equipment, as well as control panel operation and electrical connections.
3. The factory certified service representative shall be present during all start-up and testing operations to make final adjustments as a condition of acceptance of the work.
4. The equipment shall not be energized or "bumped" to check the electrical connection for motor rotation without the service technician present.
5. The service technician shall make all necessary adjustments and settings to the controls. In particular, the service technician shall verify the measurement relay setting and the initial water level differential or upstream and downstream level settings for the bar screen.
6. The factory service technician shall train the operating personnel in proper operation and maintenance of the equipment.
7. The equipment manufacturer shall provide the services of a factory service technician for equipment installation inspection and operator training for a period of two (2) days on site in one (1) trip.

D. Design Criteria:

1. The mechanically cleaned bar screen shall be new Fairfield Service Company MACH – 03, CHFFM type bar screen. The equipment furnished shall be suitable for installation in the General Contractor constructed channels, with the screen frame recessed in the channel wall and floor and shall be grouted in place after installation. The screen shall be front cleaning with multiple rakes entering the bar rack from the

upstream side of the rack. Back cleaned screen and single rake designs will not be acceptable.

2. The mechanically cleaned bar screen shall conform to the following design requirements.
   a. Channel width: 2 feet
   b. Channel depth: 3 feet
   c. Design flow: 2 MGD
   d. Lift: Approximately 12 feet
   e. Clear opening between bars: 3/8”
   f. Bar Size: 3/8” x 1/16” x 1-3/4” Trapezoidal shaped, type 316 ss
   g. Screen incline from horizontal: 75 – 80 degrees
   h. Head shaft diameter: not less than 3-7/16 inches
   i. Foot shaft diameter: not less than 2-7/16” inches
   j. Drive motor not less than 2.0 HP
   k. VFD included
3. The screen shall be completely shop assembled, tested, and adjusted prior to shipment. Shop tests shall consist of running the screen mechanism through a minimum of one (1) complete cycle to ensure proper meshing of the rakes and bar rack, to check the alignment and clearances of the screen chains and side frame chain guides, and to check the clearance between the rake teeth and dead plate. If the screen is not shipped assembled this shall not eliminate the requirement for complete shop assembly and testing of the bar screen before shipment.
4. Areas of existing floor openings not covered by the new screening equipment shall be covered with bar grating. Provide all support members and type 304 stainless steel anchors necessary. The screening equipment manufacturer shall be responsible for the design and fabrication.

1.06 DELIVERY, STORAGE, AND HANDLING

A. The Manufacturer shall be responsible for the cost of shipping and insuring during shipment, and for properly packing and protecting all components prior to shipment. Any special handling and storage requirements shall be included in the shipping documents.

B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the equipment is in operation.

C. Equipment shall be handled and stored in accordance with the Manufacturer’s instructions. All the components shall be examined before installation. No items shall be installed which are found to be defective and any such items must be repaired to the satisfaction of the Engineer or replaced at no cost to the Owner.

D. The bar screen shall be constructed and shipped in the minimum practical number of pieces to the jobsite.

E. The Contractor shall be responsible for off-loading all components, storage in a protected location, and protection of all equipment before and after installation and prior to acceptance by the Owner.

F. Contractor shall perform all maintenance required by the Manufacturer during the storage period and prior to installation.

1.07 MAINTENANCE/SPARE PARTS

A. Provide Spare Equipment as follows:

1. One (1) Wiper Blade
2. Two (2) Proximity Switches
3. Two (2) Sets rake assemblies
4. 5 year supply of lubricaiton

1.10 WARRANTY

a. The equipment Manufacturer shall provide a one (1) year warranty, commencing on the date of substantial completion, for all parts associated with the equipment and the labor associated with repair and/or replacement of the parts. Warranty period and warranty requirements shall be in accordance with Section 01 78 33. The warranty must be submitted during the shop drawing phase. Approval of the shop drawings will be contingent on the receipt of the warranty. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the Owner.

PART 2 PRODUCTS

2.01 DESCRIPTION OF EQUIPMENT

A. Manufacturer: Subject to compliance with requirements, provide one (1) mechanically cleaned bar screen and appurtenances as manufactured by: 1. Fairfield Service Company of Indiana, LLC

1. P.B. Equipment, Inc.

B. General Description: The screening equipment is comprised of one (1) mechanically cleaned bar screen and appurtenances, consisting of but not limited to cleaning rakes, rake wiper, sprockets, shafts, bearings, chains, drive unit complete with reducer and motor, overload device, side frames, bar rack, dead plate, discharge chute, head section, intermediate housings, electrical controls, and anchor bolts, all as required for a complete and functional system.

B. Cleaning Rakes:

1. Cleaning rakes shall be mounted on two (2) strands of chain running over two (2) sets of sprocket wheels at a speed of approximately 7 FPM.Raking mechanism shall consist of not less than two (2) cleaning rakes.The debris shall be removed from the bar rack by the cleaning rakes, conveyed up the dead plate to the discharge point where the rakes shall be cleaned by the rake wiper. A clearance of approximately 1/4" shall be maintained between the cleaning rake teeth and the dead plate so that the debris picked up by the cleaning rakes cannot bypass back into the channel.
2. Cleaning rakes shall be of type 304 stainless steel plate, not less than 3/4" thick, with teeth of suitable shape to effectively clean the front and sides of the bars. The rakes shall be not less than 8" wide with not less than a 6-3/4" solid shelf provided for debris carrying capacity in front of the bar rack. Each rake shall be reinforced with two (2) 3/8" thick type 304 stainless steel angles arranged to form a box section extending the full length of the rake.

D. Rake Wiper:

1. Pivoting rake wiper of not less than 3/16" thick type 304 stainless steel shall be furnished with replaceable 3/8" thick UHMW-PE wiper blades and wear strips bolted to two (2) structural type 304 stainless steel pivot arms. Arms shall be mounted on a heavy duty shock absorber supported by the upper discharge housing. The wiper arms shall be designed to return the wiper quietly and without shock to the screen. The wiper shall also be designed to prevent debris from wrapping around the wiper during debris removal. The entire wiper mechanism shall be located within the head section.

E. Sprockets:

1. Sprockets for the screen chains shall have chilled tooth bearing surfaces. The tooth bearing surfaces shall have a hardness of 360 BHN minimum and a chill depth of at least 3/16".

2. Driving sprockets shall be keyed firmly to shafts and the foot shaft sprockets shall be free to turn on the shafts and held in place by use of a steel retainer plates bolted to the shaft. Foot shaft sprockets shall be solid with a smooth surface to prevent debris from hanging on the sprocket. Foot shaft sprockets shall be provided with centrifugally cast cobalt based chromium tungsten alloy bushing with a hardness range of 40-49 Rc (or Graphite Impregnated Bronze). The sprocket bushings shall rotate on stub shafts with a sleeve of equivalent design and quality as the bushing, except the sleeve shall have a hardness range of 50-56 Rc. Sleeve shall be press fitted to the stub shaft. The screen chain sprockets shall be not less than 9-tooth, 17.54 P.D. Head shaft sprockets shall be split to facilitate replacement.

F. Shafting:

1. All shafting shall be type 304 stainless steel. Keyways with fitted keys shall be provided where necessary. The head shafts shall be equipped with an adjustable screw take-up providing for a minimum 6" adjustment of the screen chains. The foot shafts shall be fixed replaceable steel stub shafts with pressed on sleeves as specified under sprocket description.

2. Bearings:The head shaft bearings shall be self-aligning roller bearings and provided with lubrication fittings.

G. Chains:

1. Screen chains shall be manufactured of a corrosion resistant processed metal having an average tensile strength of 80,000 psi, and a hardness range of 179-229 Brinell. The chains shall be #720S heavy pintle type having 6" pitch links and weighing 5.1 lbs. per foot, with the plain and attachment links assembled with 3/4" diameter thru hardened steel pins with pin locks. The chain shall have an allowable working load of 4,250 pounds, and each assembled strand shall be proof tested at a minimum of 18,800 pounds to detect and remove defective castings. The rake attachment links shall be a special casting of the same corrosion resistant processed metal.
2. The drive chain shall be #R588 Chabelco steel roller type (or JS882), 2.609" pitch links, and shall have a working load of 2,450 pounds. The drive chain shall be suitably covered with a #14 gauge type 304 stainless steel guard.

H. Drive Unit:

1. The drive unit shall be of the motorized type mounted on directly to the head shaft on the screen head section. The drive unit speed reducer shall be of the helical gear type, fully housed, running in oil, with anti-friction bearings throughout.
2. The motor shall be totally enclosed, TEFC - explosion-proof, ball bearing, constant speed, of ample power for starting and continuously operating the mechanism under normal operating conditions without overloading. The motor shall conform to NEMA standards, and shall be suitable for operation on 230/460 volt, 3 phase, 60 Hertz current.
3. VFD (variable frequency drive) with solid state overload will be furnished for the screen.
4. The drive unit shall be assembled by the manufacturer and shipped as a complete assembly to ensure proper assembly of all components.

I. Side Frames:

1. The screen shall be of a design utilizing not less than 1'-8" wide x 5" deep structural side frames to which are bolted the bar rack and dead plate resulting in structurally self-supporting unit. Designs in which side frames or chain guides are supported from the channel walls shall not be acceptable.
2. The screen side frames shall be fabricated of not less than 5/16" thick type 304 stainless steel and shall include U-shaped guides for both the carrying and return run of the screen chain. The U-shaped guides shall assure proper meshing between the rake teeth and the bar rack, and proper clearance between the rake teeth and the dead plate. The U-shaped guides shall provide minimal clearance to prevent debris from coming in contact

   with the screen chains.
3. The side frames shall include type 304 stainless steel shrouds around the foot shaft sprockets to prevent debris from interfering with the proper meshing of the chains and sprockets. The

shrouds shall also be designed to prevent grit accumulation at the chain and sprocket location.

J. Bar Rack

1. The bar rack shall be type 304 stainless steel consisting of replaceable vertical tapered bars, minimum of 1/4" x 3/16" x 1-3/4", with 3/8" clear openings between bars, held firmly and accurately in place by means of welded spacers on each end. The bar rack shall occupy the full width of the channel and shall extend from the bottom of the channel up to a point not less than 2 ft., 6" below the bottom of the channel, and be connected at that point to the dead plate. The bars in the rack shall be so constructed as to be readily removable.

K. Dead Plate:

1. The bar rack shall be type 304 stainless steel consisting of replaceable vertical tapered bars, minimum of 1/4" x 3/16" x 1-3/4", with 3/8" clear openings between bars, held firmly and accurately in place by means of welded spacers on each end. The bar rack shall occupy the full width of the channel and shall extend from the bottom of the channel up to a point not less than 2 ft., 6" below the bottom of the channel, and be connected at that point to the dead plate. The bars in the rack shall be so constructed as to be readily removable.

L. Discharge Chute

1. Discharge chute of not less than 1/4" type 304 stainless steel shall be provided to guide the debris from the steel lip at the top of the dead plate to the discharge point. Clearance between the bottom of the discharge chute and the receiving equipment must be dimensionally correct to transfer material properly.
2. The configuration shall allow discharge of screenings directly onto the receiving equipment. The CONTRACTOR shall be responsible to make any field modifications required to achieve this requirement.

M. Head Section:

1. The side frames of the bar screen shall act as the side panels of the head section above the operating floor. The portion of the head section supporting the drive unit shall be fabricated of not less than 3/16" thick type 304 stainless steel plate. The balance of the head section shall be covered by #14 gauge type 304 stainless steel with 3/16" thick supports. The hood over the head shaft assemblies shall be 14 gauge type 304 stainless steel, hinged and provided with lifting handles for access to the head shaft. The head section shall be provided with necessary inspection doors located for easy access, and when open shall lay flat against the head section panels below the door.

N. Maintenance Covers:

1. Provide removable covers fabricated from 1/4" thick clear impact-resistant material that will allow visual observation during operation of the screen.

2.02 CONTROLS

A. The screen shall be equipped with a limit switch to stop the cleaning rakes in a position that will reduce potential jamming when the screen is started again (whisker limit switch) and a limit switch for shear pin. The limit switch shall be in explosion proof enclosure, mounted on the screen

head section, and be furnished by the manufacturer. The whisker limit switch shall be located as necessary to ensure that the rakes will be positioned at the bottom of the boot section when the screen is stopped.

B. One (1) Main Control Panel will be provided for the screen, completely pre-wired and tested. Construction of the enclosure will be NEMA 7. It will house the VFD and PLC with all the indicating lights and devices required. One (1) Local Control Panel will be furnished in a NEMA 7 enclosure. It will house the Hand-Off Automatic and Forward/Off/Reverse 3-position switches as well as the emergency Stop pushbutton.

C. An ultrasonic differential controller (Hydro-Ranger) shall be provided to automatically initiate the operation of the bar screen when an adjustable headloss in inches is sensed across the bar rack. The controller shall allow the headloss set point to be adjusted.

PART 3 EXECUTION

3.01 INSTALLATION

1 Contractor shall coordinate the installation of bar screen components based on the sequencing of construction and the Owner. Refer to Section 01 11 00, Summary of Work and Section 01 12 16, Construction Sequence for general sequence of construction and construction constraints.

2 General: Install equipment as indicated and in accordance with manufacturer's published installation instructions and recognized industry practices, ensuring equipment complies with requirements and serves intended purpose.

3 CONTRACTOR shall make all required mechanical, electrical, and control connections and modifications between existing and proposed equipment in order to provide a complete and functional system.

3.02 INSPECTION

a. The services of a factory trained Field Service Representative of the
b. Manufacturer shall be provided to inspect the installation equipment.

3.03 START-UP

A. Upon completion of installation of the mechanically cleaned bar screen and after motor is energized with normal power source, test equipment to demonstrate compliance with requirements. Field correct malfunctioning equipment then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

B. Start-up, test, and adjust equipment in presence of manufacturer's authorized representative.

3.04 ACCEPTANCE TESTING

a. Manufacturer shall provide written documentation to the Engineer of successful

completion of the factory test at least 2 days prior to shipment of the bar screens.

END OF SECTION

SECTION 462173

SCREENINGS WASHER/COMPACTOR

PART 1 GENERAL

1.01 SCOPE OF WORK

This specification governs for the fabrication, installation and making operational of one (1) new mechanical screw type screenings washer compactor to handle the screenings debris from the discharge of the mechanically cleaned bar screen in the proposed head works structure.

1.02 SYSTEM DESCRIPTION

The screw washer compactor shall be used to transport and de-watered debris from the mechanical bar screen. It shall apply the conveying abilities of a screw to move screened refuse forward from the receiving hopper towards a suitable discharge location. Screenings shall be washed and compacted within the inlet hopper and dewatering zone before reaching the transport tube end.

1.03 DESIGN CONDITIONS

A.	Capacity:	1-2 yards per hour.
B.	Diameter of tube:	11 inches
C.	Diameter of spiral/screw:	10 inches
D.	Speed of spiral/screw:	12 rpm
E.	Incline angle:	60°
F.	Receiving Hopper:	36 inches length x 20 inches width
G.	Transporting distance:	65 inches
H.	Discharge Height:	36”
I.	De-watering ratio:	Approximately 50-80%

1.04 QUALITY ASSURANCE

A. Standardization: All parts of the complete mechanical installation including the inlet receiving hopper, the screw, and the transport tube shall be the product of one manufacturer experienced in the design and fabrication of screw type screening washer compactor equipment.

B. Acceptable Manufacturers

1. EMSIL Group, Ekoton
2. Fairfield Service Company of Indiana,LLC
3. Engineer's approved equivalent

C. Requests for equipment approval must be submitted in writing to the Engineer no later than fifteen days prior to the bid opening. The request for approval must be complete and shall contain at least the following information.

1. A statement of compliance with the manufacturer's qualifications requirements described above and a list of qualified projects including the following information:
2. Project Name, Locations and Equipment Description,
3. Owner's Name, Address and Telephone Number,
4. Engineer's Name, Address and Telephone Number,
5. Evidence of Ten (10) Years of Experience; and,
6. Evidence of Twenty (20) Similar Installations.
7. A description of all proposed equipment items. Materials and coatings shall be included.
8. Equipment layout drawings, hard and disk copies, with dimensions and component sizing. Drawings shall be in AutoCAD.
9. Calculations showing that the equipment complies with the requirements of this specification.
10. Operating data from the wastewater treatment plants listed in Item A above and testimonials from the operating personnel. The data and testimonials shall include the maintenance history of the equipment including frequency of cleaning, labor and materials required for cleaning.

a. Complete catalog data for each item, including:

i Detailed Shop Drawings,

ii Specification Data,

iii Catalog Cuts; and,

iv Brochures, etc.

v. Any deviations from specified requirements.

a. Approved equivalent manufacturers will be indicated by the Engineer in an addendum prior to the bid date. The Contractor will be responsible for meeting all the requirements of this specification when using alternate equipment.

B. Coordination: The contract documents provide details of a complete equipment installation for the purpose specified. It shall be the responsibility of the Contractor to coordinate all the details required for a complete operating system, such as protective coatings, non-potable wash water piping and isolation valves, electrical, wiring and controls. The Contractor shall provide for all work required properly installing, adjusting, and placing into operation a complete working system.

C. Manufacturer's Quality Control: The screw type screenings washer compactor shall be factory assembled and tested and shipped to the jobsite as a completely assembled unit. The manufacturer shall be responsible to assure compliance with all material and fabrication requirements of these specifications.

1.05 SUBMITTALS

A. The Equipment Manufacturer shall furnish to the General Contractor one electronic copy of the Approval submittal for the Mechanical Screenings Washer/Compactor as required for approval by the Engineer prior to incorporation into the project shall include the following:

1. Certified dimension prints detailing all required anchor bolt locations and conduit stub-outs.

2. Specifications for all electrical and mechanical components and complete wiring diagrams for the electrical drive for the screw.

3. Manufacturer's recommended procedures for jobsite storage and handling of equipment.

B. Operation and Maintenance Manuals: Prior to delivery of equipment and updated as required during installation of the equipment, the manufacturer shall furnish complete and detailed installation, operation and maintenance manuals which shall include the following information as a minimum requirement:

1. Assembly, installation and adjustment instructions.
2. Lubrication and maintenance instructions.
3. Complete descriptive literature of all materials and components furnished.
4. Erection drawings with equipment mark numbers.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION

The screw compactor shall be of heavy-duty construction with inlet hopper and discharge chute. The conveying mechanism shall be a screw driven by an assembly of a motor driven gear reducer.

Utilizing the rotational movement and gravity, the screw pushes the screenings forward, while washing, and gradually de-waters the screenings as they reach the discharge end of the transport tube where they shall be compressed up to 80% in volume reduction.

2.02 INLET HOPPER

The hopper shall be of 48 inches x 20 inches open at top. The material of the inlet hopper shall be 304 SS stainless steel. The hopper shall be properly reinforced. The wall thickness shall be no less than ¼ inch. The inlet hopper shall span past the width of the mechanical bar screen by at least 6 inches on both sides.

A screw shall be housed in a truncated cone shaped open trough at the bottom of the inlet hopper, which receives the screenings from the screen discharge chute. The trough shall be fabricated of cylindrically shaped perforated 304 SS sheet screen section to permit draining of released water from screenings. Water collection shall be provided under the perforated sheet screen with a collection tray and drain. The collection tray shall be provided with a spray water connection to permit periodic washing of the collection tray and drain.

2.03 SCREW

The screw shall be formed from 304 Stainless Steel. The thickness of screw blade shall be a minimum 6 mm (1/4”).

2.04 DEWATERING ZONE

A de-watering zone shall be at the lower end of the transport tube where the screw ends. The dewatering zone shall consist of a cylindrical perforated screen drum to permit discharge of pressate. The screen drum shall be fabricated of 304 SS. A minimum of two water spray nozzles shall be provided and mounted in this section to permit period washing of the drum and drain. Clean spray wash water shall be provided to the washing nozzles at 40-psi minimum at 3-5 GPM total.

2.05 TRANSPORT TUBE

A screenings transport tube shall attach through bolted, flanged connection, to the discharge end of inlet hopper. The tube shall be fabricated of 304 SS and sized to match the diameter of the screw at the beginning. The transport tube shall be fabricated with expanding diameter where transport distance and angles are sufficient to warrant the expansion. The screw shall force the compressed, dewatered screenings to discharge at the end of the transport tube.

The transport tube shall be 1650 mm (65”) long discharging at 915 mm (36”) off the reinforced concrete walkway. In order to assure sufficient backpressure for dewatering the screenings, a "hinged or swing-out" pressure plate shall be provided and springloaded at the end of discharge.

2.06 SCREENINGS WASHING:

A minimum of two water spray nozzles shall be provided and mounted at the end of the screw, where it enters the transport tube. Clean spray wash water shall be provided to the washing nozzles at 40-psi minimum at 3-5 GPM total.

2.07 SCREEN DISCHARGE CHUTE/ INLET HOPPER ENCLOSURE

The completed installation shall include flanged connections with gasket between screen discharge chute and compactor receiving hopper. Enclosure shall include an access window / hatch to permit inspection of the compacting.

2.08 DRIVE UNIT

A motor driven gear reducer shall drive the rotating screw from the opposite end of the discharge. The motor shall be TEFC, insulation F, induction motor. The output of motor shall be 2 hp. The electrical power supply shall be 460volt, 3 phase, 60cycle electrical service. The reducer shall be a worm gear reducer with overload protection. The drive unit shall be rated NEMA4x (IP 55) or better.

2.09 PROTECTIVE COATINGS

i. All gearboxes and motors and controls will have manufacturer's standard machinery paint finish, to be top coated with final coatings as per other sections of these technical specifications. Verify compatibility of coatings.

ii. Prior to shop assembly, the stainless steel frame shall be shop brush blasted with a fine sand to a matte finish to clean the raw metal and provide a uniform finish. Within thirty-six (36) hours of this sand blasting, all of the stainless steel surfaces shall be coated with a polyurethane or hard wax coating to seal surface from the atmosphere. All other stainless steel components shall be shop assembled without alternation.

iii. The manufacturer shall provide a heavy duty fabricated stainless steel support stand, with stainless steel anchorage for mounting the unit to the reinforced concrete housekeeping pads.

PART 3 EXECUTION

3.01 INSTALLATION

A. Manufacturer's Service Technician: The screw type screenings washer compactor shall be furnished complete by the manufacturer and installed by the Contractor as directed by the manufacturer in his working drawings and written instructions. The installation, alignment, and testing shall be checked and approved by a factory representative before acceptance.

1. The Contractor shall include in his bid the services of a factory trained service technician for a minimum period of two (2) days and two (2) round trips. The manufacturer's service technician shall inspect the completed installation, and assist the Contractor in aligning, start-up and testing. The service technician shall also instruct plant personnel in the operation and maintenance of equipment.

2. A written report shall be furnished by the equipment manufacturer and shall describe the service technician's observations. The report shall describe in detail any deficiencies noted. All such deficiencies, whether by the manufacturer or Contractor, shall be corrected at no expense to the Owner.

3. Prior to final approval, the manufacture shall submit a letter certifying that the installation meets all requirements of the manufacturer.

   i. Lubrication: Lubricants of the type recommended by the equipment manufacturer shall be furnished and applied by the Contractor. The Contractor shall certify that the drive and bearings have received the proper amount of recommended lubricant.

   ii. Anchorage: The equipment manufacturer shall furnish all required anchor bolts with leveling nuts, washers, and tie-down nuts. The Contractor shall place the anchorage in exact accordance with the manufacturers certified dimension prints and as directed by the manufacture. The Contractor shall furnish all templates needed to accurately set the anchor bolts to the dimensions and projections specified.

3.02 TESTING

The manufacturer shall demonstrate to the Owner and Engineer that the screw type screenings washer compactor mechanism effectively washes, compacts and transports the screenings debris to the point of discharge from the transport tube.

END OF SECTION

SECTION 462333

AERATED GRIT REMOVAL SYSTEM

PART 1 GENERAL

1.01 SCOPE

This section of the specifications specifies the design, fabrication, installation and making operational of the complete aerated grit removal system. The items of equipment included in this section are the G-O Diffuser Air Drop Assemblies, draft tube, support bridge; grit classifier with grit dewatering cyclone and grit pump.

1.02 SYSTEM DESCRIPTION

The proposed aerated grit removal system shall provide sufficient diffused aeration into the grit tank contents so that the heavier solids sink to the bottom and the lighter, organic material remains in suspension and is transported through the activated sludge process. Settled grit solids are then pumped into the separation cyclone mounted on the inlet of the grit classifier. The excess transport liquid is separated and discharged into the plant drain system for recycle back to the influent lift station. The grit solids are deposited into the grit classifier, where they are washed with a gentle spray and conveyed up an inclined screw for dewatering and discharge into the owner supplied container. Ultimately the washed grit solids and screenings are collected and disposed of in an approved land fill disposal facility.

1.03 SYSTEM DESIGN REQUIREMENTS

A. The Aerated Grit Collection Basin shall be designed and provided as follows:

i.	Maximum Flow Rate	0.99 MGD
ii.	Grit Collection Basin Length	10.0 ft square
iii.	Grit Collection Basin Volume	1,470 cf
iv.	Grit Collection Basin Hopper Depth	6.06 Feet
v.	Design Air Requirements	40 scfm/1000 cf
vi.	Number of Draft Tubes	1
vii.	Number of Airdrops in Tube	1 – 2” GO Diffuser
viii.	Diameter of Draft Tube	24 Inches

B. The grit lift pump shall have the following characteristics:

1. Capacity 189 GPM x 2 pumps, 1 pump standby

2.	Total Dynamic Head	50 Feet
3.	Run time	1.7 min/hr

C. The Grit Dewatering Cyclone (2 units to maintain 0.5 MGD Capacity) shall be capable of separating and removing ninety five percent (95%) of the solids within the range of 100 to 250 microns at 15 to 17 PSIG differential pressure. This shall be applicable for solids of the 2.3 to 2.5 specific gravity. The Grit Dewatering Cyclone shall have the following characteristics:

1.	Inflow at:	350 GPM
2.	Differential Pressure	15 PSI
3.	Feed Chamber Size	11 Inches
4.	Inlet Size	4 Inches
5.	Overflow Size	6 Inches

D. Additional Requirements Specified Elsewhere.

1 Section 46 51 33 Aeration System

2 Section 43 11 24 Positive Displacement Blowers

1.04 QUALITY ASSURANCE

A. Coordination

To assure compatibility, all items of equipment furnished under this section shall be furnished by a single manufacturer who shall assume unit responsibility for the complete system and shall be responsible for the adequacy of design and fitness for the application of the process system described in this section including all appurtences.

B. Submittal Drawings

All equipment and materials shall be new and shall be designed for the function and service specified. No equipment or materials shall be used except as specified or as approved by the Engineer. Approval for installation and incorporation into the project will be made only after the submittal and examination of shop drawings, specifications and other information as required below. The following information shall be provided:

i. Submittal drawings shall be complete with all dimensions showing the location of anchor bolts, fasteners or other mounting devices; openings in structures required for installation of equipment and connecting piping; and, if required the size and location of electrical conduits and conduit openings.

ii. Specifications for all electrical and mechanical components with complete schematics for the control system.

iii. Detailed drawings of the major fabricated components labeled with member sizes and materials of construction.

iv. Manufacturer's recommended procedures for job site storage of equipment, handling and erection.

C. Manufacturer's Quality Control

All fabricated equipment shall be carefully inspected at the site of fabrication by factory inspectors who shall use whatever means are necessary, including shop assembly, to assure the proper fit of all field connections and compliance with all material requirements of the specifications.

D. Operation and Maintenance Manuals

Prior to delivery of equipment and up-dated as needed during installation, the manufacturer shall furnish complete and detailed installation, operation and maintenance manuals, which shall include the following information as a minimum requirement:

i. Name, address and phone number of the nearest competent service organization who can supply parts and service. If this is not the manufacturers own service department, then furnish a letter certifying that the named organization is authorized to represent the manufacturer and to perform warranty service.

ii. Complete descriptive literature and drawings of all material furnished. This is to include "as built" wiring diagrams of all electrical equipment, "as built" erection drawings providing up-to-date information on the actual construction of the equipment furnished and documentation of any field modifications made during installation, start-up and testing.

iii. Installation, operation and maintenance brochures from the original manufacturers of all mechanical components such as gear reducers, drive couplings, bearings, etc., incorporated into the completed installation.

iv. Recommended spare parts list.

v. Guide to "trouble shooting".

vi. All required assembly, installation, alignment, adjustment and checkout instructions.

vii. All required operating instructions.

viii. All required maintenance instructions including schedules of routine maintenance and lubrication checks.

E. COATINGS AND PAINTING

a. All fabricated steel assemblies with the exception of items furnished as stainless steel shall be hot dipped galvanized in accordance with ASTM A123.

b. Pieces shall be fabricated in maximum sizes suitable for shipping and galvanizing. The equipment shall be designed and fabricated per ASTM A-143, A-384 and A-385 for bolt-together field assembly. No field welding on hot dipped galvanized equipment will be permitted.

c. Minor defects in the hot dipped galvanizing coating caused by shipping, handling, or installation shall be repaired after equipment installation. The defects shall be thoroughly cleaned and wire brushed to remove all foreign substances and coated with at least 3 mils of a zinc rich compound conforming to U.S.N. Specification MIL-P-21035.

d. Mechanical components such as valves, pumps, gear reducers and motors shall be furnished with the manufacturer's standard finish.

F. ANCHORAGE AND FASTENERS

i. All submerged and non-submerged anchorage shall be the drop-in type as manufactured by the Molly Division of USM Corporation or equal. The minimum size anchor bolt used shall be 1/2" in diameter and all anchors shall be furnished in stainless steel with stainless steel nuts and washers.

ii. All submerged erection bolts shall be of Type 304 stainless steel.

iii. All exposed erection bolts attaching to stainless steel items shall be Type 304 stainless steel. All other exposed erection bolts shall be hot dipped galvanized.

iv. No field welding will be allowed for assembly of any of the equipment in this specification section.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. PB Equipment, Inc.

B. G-H Systems, Inc.

C. Engineer's approved equivalent.

1. Requests for equipment approval must be submitted in writing to the Engineer no later than fifteen days prior to the bid opening. The request for approval must be complete and shall contain at least the following information.

   a. A statement of compliance with the manufacturer's qualifications requirements described above and a list of qualified projects including the following information:

      1) Project Name, Locations and Equipment Description,

      2) Owner's Name, Address and Telephone Number,

      3) Engineer's Name, Address and Telephone Number,

      4) Evidence of Ten (10) Years of Experience; and,

      5) Evidence of Twenty (20) Similar Installations.

   b. A description of all proposed equipment items. Materials and coatings shall be included.

   c. Equipment layout drawings, hard and disk copies, with dimensions and component sizing. Drawings shall be in AutoCAD.

   d. Calculations showing that the equipment complies with the requirements of this specification.

   e. Operating data from the wastewater treatment plants listed in item a above and testimonials from the operating personnel. The data and testimonials shall include the maintenance history of the equipment including frequency of cleaning, labor and materials required for cleaning.

   f. Complete catalog data for each item, including:

      1) Detailed Shop Drawings,

      2) Specification Data,

      3) Catalog Cuts; and, 4) Brochures, etc.

   g. Any deviations from specified requirements.

2. Approved equivalent manufacturers will be indicated by the Engineer in an addendum prior to the bid date. The Contractor will be responsible for meeting all the requirements of this specification when using alternate equipment.

2.02 AIR DISTRIBUTION PIPING AND EQUIPMENT

A. Air Piping

The air distribution piping shall be complete with all fittings, valves, couplings, diffuser connections, supports, anchorage, fasteners and gaskets within the limits indicated. The air piping shall be furnished in the size shown on the plans or larger as required. The air piping shall be sized such that the velocity of the air flowing inside it at the maximum airflow rates and at standard conditions is less than 3000 FPM.

i. The air piping shall be fabricated from minimum 1/4" wall thickness steel pipe, and shall be hot dipped galvanized after fabrication.

ii. Air piping flanges shall be 150 lb. slip-on welded flanges. Compression couplings shall be provided as needed to facilitate assembly and shall have gaskets suitable for 250oF and 10 PSIG service.

iii. Fittings for piping 3" diameter and smaller may have threaded connections provided that the threaded connections shall be field coated, by the Contractor, to prevent rusting of the exposed threads; and, that the piping is minimum Schedule 40.

iv. Air control valves shall be furnished in the sizes indicated and at the locations shown on the plans. The air control valves shall be lever operated wafer style butterfly valves with resilient seats, suitable for operation in temperatures up to 250oF.

B. Draft Tube

The draft tube aerator shall be furnished and installed as shown on the plans and as described below. The tube shall consist of a submerged static aerator designed to suspend the lighter organic solids within the grit basin. The draft tube assembly shall be complete with a steel draft tube, energy recovery baffle and supports. The draft tube shall be supported from the floor. The draft tube shall have a full diameter opening and shall have no obstructions inside the tube. The draft tube shall extend from a point 3'-0" below the operating water level in the tank to 2'-0" above the floor at the center of the tube.

i. The draft tube, energy dissipation baffle, and supports shall be fabricated from structural steel pipe, plate and shapes with a minimum wall thickness of 1/4". The entire assembly shall be detailed for bolted field connections and shall be hot dipped galvanized after fabrication.

ii. The energy recovery baffle shall be installed at the operating water level in each tank. It shall consist of a flat level plate with openings for the diffuser drop pipes to pass through. The baffle shall be reinforced as needed to withstand the forces exerted by the draft tube flows and shall be at least 12" larger in diameter than the draft tube. The baffle shall be complete with adjustable clamping plates for supporting the diffuser drop pipes and for attachment to the draft tube support legs. The baffle shall increase the efficiency of the draft tube and prevent excessive splashing when operating at the maximum recirculation rate.

C. G-O Air Diffusers

i. The G-O air diffusers shall be of one piece construction with no moving parts and shall consist of a double tapered defector and an air release tube. Air diffusers shall be pressure injection molded of ABS plastic. The material must be exceptionally high heat resistant compound combining high impact characteristics and retention of mechanical properties at elevated temperatures. The diffusers must be of proven structural design without inherent structural deficiencies or weaknesses. The air release tube shall transport airflow from the pipe connection at the top of the diffuser, down through the deflector to the air release slots. The tube shall have an inside diameter equal to or greater than that of the drop pipe throughout its length and shall terminate with a full diameter opening. The full diameter opening allows positive cleaning of the airway through each diffuser by allowing a brush or rod inserted at the top end of the drop pipe to pass completely through the diffuser.

ii. The bottom of the tube shall contain vertical slots 1/4" wide to insure proper distribution of airflow to all four (4) quadrants of the deflector. The slots shall begin to release air at a point no closer than 2" below the deflector shear plane to create an initial upward direction of air bubble travel before the bubbles hit the deflector shear plane. The slots shall extend to full width openings at the open bottom of the air release tube to facilitate cleaning. The outside of the air release tube shall have four separating vanes extending up to the bottom of the deflector which contain the air flows in each quadrant and assure even distribution of the air to the circular shear plane.

iii. The shear plane shall breakup the coarse bubbles generated at the release tube slots into the medium bubbles required for efficient oxygen transfer. The underside of the deflector shall provide an expanding slope approach to the shearing edge where the bottom taper and top taper meet. The shear edge shall provide sharp discontinuity in the air/water flow, generating high shear forces on the coarse bubbles causing bubble breakup. The top surface of the diffuser shall slope upwards and back towards the drop pipe connection to prevent coalescence of the fine bubbles. Air diffusers using only flat plate deflectors will not be acceptable.

D. Air Diffuser Assemblies:

An individual air diffuser drop (air feed pipe) shall be furnished for each G-O air diffuser. Airdrops and diffusers shall be furnished in the number and size at the location as shown on the Drawings.

1. 2-inch Diffuser Assemblies:

a.) Each 2-inch diffuser assembly shall consist of a diffuser, an individual drop pipe, of schedule 40, 304 SS and an orifice/tee assembly. The assembly shall be fastened to the air supply header through a horizontal screwed coupling, fabricated with the header. The orifice/tee assembly shall consist of a 2” threaded nipple screwed into the air header, a 2” tee, a removable

orifice and a standard screwed 2" plug. The orifice insert shall be removable to allow for positive cleaning of the drop pipe and diffuser in place.

b.) Each vertical drop pipe shall extend from the above-water orifice/tee assembly to the air diffuser located at the required air release elevation. Each air drop pipe shall be rigidly secured in place by the top orifice/tee assembly and by an intermediate HDG structural steel support located at the energy dissipation baffle.

2.02 GRIT DEWATERING EQUIPMENT

A. Hydrocyclone: There shall be furnished one (1) hydrocyclone to be installed on top of and supported by the classifier tank. The underflow of the hydrocyclone separator shall discharge into the classifier influent box. The hydrocyclone shall be sized as required above.

1. The cyclone shall consist of a heavy-duty cast iron volute feed chamber with cylindrical and conical sections of steel and aluminum to minimize overhung weight. All interior surfaces in contact with the grit slurry to be fully lined with replaceable molded neoprene liners. Each section liner shall be independently replaceable. The inlet and overflow connections shall be Victaulic grooved cast steel flange adapters to facilitate alignment. The cyclone underflow shall discharge directly into the grit washer.

2. The cyclone vortex finder shall be made from abrasion resistant nickeliron alloy having an approximate hardness of 500 Brinnell. Quick disconnect clamps shall be provided between the apex assembly and lower cone section to allow removal of material which might clog the apex.

3. The apex assembly shall have a manually adjustable neoprene apex valve.

4. The cyclone shall be mounted 11.25o from the horizontal to minimize the amount of flow discharged with the grit and to minimize plugging. An 11.25o flanged elbow and victaulic coupling shall be provided at the cyclone overflow to adjust for the cyclone-mounting angle.

5. The cyclone inlet shall be fitted with a 1/4" NPT connection and diaphragm protected pressure gauge.

B. Grit Classifier

The grit classifier shall be capable of washing, classifying and dewatering the hydrocyclone underflow. The grit washer shall consist of a classifier tank and grit washing/dewatering screw.

1. The classifier tank shall be fabricated from minimum 3/16" thick Type 304 stainless steel and shall be inclined at 3-1/2" on 12". The classifier tank shall be equipped with an adjustable stainless steel weir at least 2'-0" long for regulating the depth of the liquid in the tank. The weir overflow shall discharge into a launder box equipped with a 3" diameter plain end discharge for use with a sleeve type coupling to the overflow piping. The tank shall provide a settling compartment for grit concentration with a minimum full water depth equal to 150% of the screw diameter and a pool area at the maximum water level of 10 square feet.

   i. The classifier tank shall also include a drain valve, stilling baffle and provisions for mounting the hydrocyclone units.

   ii. The classifier tank shall be supported on fabricated steel legs of minimum 1/4" thick material that are hot dipped galvanized after fabrication.

   iii. The classifier tank shall be covered with aluminum expanded metal panels.

   iv. The grit discharge end of the classifier tank shall be fitted with a 14 gauge Type 304 stainless steel discharge chute.

2. The grit shall be removed from the bottom of the classifier tank compartment by means of a 50% pitch, 12" diameter screw conveyer operating at a maximum of 12 RPM.

   a. The flighting on the screw shall be sectional ribbon type and shall be a minimum 1/4" thick steel. The flighting shall be 1-1/2" wide and shall have 1-1/2" wide hard surfacing on the leading face and edge. All components of the flighting shall be continuously seal welded and shall be attached to 2" (2-3/8" O.D.) Schedule 40
   steel pipe shaft. Sections of screw shall be close-coupled with 11/2" diameter solid shafting of Type 304 stainless steel. Coupling bolts shall be a minimum of 1/2" diameter and shall be Type 304 stainless steel with locking fasteners. The close coupled flighting shall butt tightly such that the ribbon is continuous for the length of the conveyer. The grit screw may be furnished bare metal.

   b. The submerged end of the screw shall be fitted with a solid Type 304 stainless steel shaft of minimum 2-7/16" diameter. The tail shaft shall be supported by a split pillow block bearing of materials specially selected for submerged application in gritty, inaccessible locations. The bearing housing shall be split cast iron and shall be nickel-plated. Cap bolts shall be Type 304 stainless steel. The side of the bearing pointing upward shall be fitted with a resilient lip seal. The bearing liner shall be split and replaceable and shall be of NEMA Grade C Phenolic Resin Laminate material. The bearing shall be designed for supplemental grease lubrication during dry

operation. The bearing shall be mounted to a heavy stainless steel bracket fabricated into the classifier tank weldment.

c. The drive unit shall be attached to and supported by a heavy trough end plate, flanged mounted to the upper U-shaped end of the classifier tank. The drive shaft shall be a minimum of 1-1/2" diameter and shall be supported by a flange mounted grease lubricated thrust bearing using heavy duty roller bearings mounted onto precision machined shaft shoulders. The bearings shall be contained in a gray iron housing with lip-type mechanical shaft seals at both ends of the housing.

d. The speed reducer shall be the helical gear type for flange mounting to the trough end. The reducer shall be selected for Class II service and shall operate the screw at a maximum of 12 RPM.

e. The input shaft of the speed reducer shall be belt driven by an electric motor mounted on an adjustable steel base bolted directly to the speed reducer. The motor shall be a minimum of 1/2 HP, 1750 RPM, TEFC, for 3-phase, 60 cycle, 460-volt operation and shall be of the "Severe Duty" type.

f. The belt drive shall be enclosed in a belt guard with quick-release latches and expanded metal front for viewing the belts. The belt guard shall be fabricated of minimum 14-gauge steel. Extra belts and sheaves shall be provided so that the screw can be operated at 3, 6, 9 and 12 RPM.

g. The end plate, bearing, speed reducer, motor and chain guard assembly shall be prime painted with one coat of a suitable primer and finished with one coat of Polyurethane Enamel.

C. Grit Lift Pump

1. Description
Two (2) Discflo laminar flow grit lift pumps-1 spare.

D. Control Panel

1. Description
The grit system manufacturer shall furnish a factory pre-wired control panel in a NEMA 4 enclosure.

2. Controls
The control panel shall provide for one disconnect switch and two HOA switches with one repeat cycle timer to control the grit pump operation and one time delay relay to control the grit screw drive.

3. Electrical Service
   The control panel shall be for 120 VAC / 1 Phase / 60 Hz service.

PART 3 EXECUTION

3.01 PREPARATION AND INSTALLATION

A. Inspect all concrete work to determine if all dimensions and elevations relating to these units are correct. Consult the Engineer before modifying any concrete work.

B. The Contractor shall install all equipment in exact accordance with the manufacturer's written instructions and as directed on the site during inspection visits by the manufacturer's service representative.

C. Deviations from the manufacturer's written or verbal instructions shall be subject to approval by the Engineer.

3.02 SERVICE AND START-UP

i. The manufacturer shall furnish the services of a competent service representative to inspect the installation of the equipment and to place the equipment into initial operation.

ii. The manufacturer's representative shall instruct operating personnel in the proper care and maintenance of the equipment at the time that is placed in operation.

iii. A minimum of one (1) eight-hour day and one (1) trip to the jobsite shall be included.

END OF SECTION

SECTION 466623

ULTRAVIOLET DISINFECTION SYSTEM

PART 1 GENERAL

1.01 SCOPE

A. Furnish and install a complete closed vessel, medium pressure, high intensity, ultraviolet (UV) disinfection system as described in this specification and as shown on the drawings. The Contractor shall be responsible for equipment installation per the project specifications and drawings and any additional instructions provided by the Manufacturer during the submittal phase. The Manufacturer shall be responsible for verification of system installation, start-up, testing, and operation and maintenance training of the Owner's personnel.

B. The Manufacturer shall guarantee that the system shall be capable of disinfecting a flow of 2.0 mgd with one (1) unit out of service and the water characteristics as defined in section 2.02 Operating Parameters.

C. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment application. It is, however, intended to cover the furnishing, delivery, complete installation and field testing of all materials, equipment, and all appurtenances required to complete the work of this section, whether or not specifically mentioned in the project specifications or drawings.

1.02 ACCEPTABLE MANUFACTURERS

A. Only companies with a history of successful closed vessel medium pressure, high intensity UV systems will be considered. In addition to a successful installation base, the Manufacturer shall have been fabricating UV systems in the United States for a minimum of five years with more than 600 UV systems manufactured. Preapproved companies are as follows:

1. ETS-UV an Evoqua brand

2. Engineer approved equivalent

a. Requests for equipment approval must be submitted in writing to the Engineer no later than fifteen days prior to the bid opening. The request for approval must be complete and shall contain at least the following information.

b. A statement of compliance with the manufacturer's qualifications requirements described above and a list of qualified projects including the following information:

1) Project Name, Locations and Equipment Description,

2) Owner's Name, Address and Telephone Number,

3) Engineer's Name, Address and Telephone Number,

4) Evidence of Ten (10) Years of Experience; and, 5) Evidence of Twenty (20) Similar Installations.

c. A description of all proposed equipment items. Materials and coatings shall be included.

d. Equipment layout drawings, hard and disk copies, with dimensions and component sizing. Drawings shall be in AutoCAD.

e. Calculations showing that the equipment complies with the requirements of this specification.

f. Operating data from the wastewater treatment plants listed in item a above and testimonials from the operating personnel. The data and testimonials shall include the maintenance history of the equipment including frequency of cleaning, labor and materials required for cleaning.

g. Complete catalog data for each item, including:

1)Detailed Shop Drawings,

2)Specification Data,

3)Catalog Cuts; and,

4)Brochures, etc.

5)Any deviations from specified requirements.

h. Pre-Approved equivalent manufacturers will be indicated by the Engineer in an addendum prior to the bid date. The Contractor will be responsible for meeting all the requirements of this specification when using alternate equipment.

PART 2 - MATERIALS

2.01 GENERAL

A. The Contractor shall furnish and install a complete medium pressure, high intensity UV disinfection system as described herein. The system shall include, but is not limited to, a stainless steel disinfection chamber and associated power and control equipment. The Contractor shall provide the power source, electrical conduit, field wiring, and equipment base supports. The Contractor shall physically install the disinfection chamber and power and control cabinets according to the project specifications and drawings and any additional information provided by the Manufacturer during the submittal phase. The Manufacturer shall be responsible for verification of installation, start-up, testing, and operation and maintenance instruction of the Owner's personnel.

2.02 OPERATING PARAMETERS

Maximum Flowrate:	3.9 MGD
Transmittance:	> 65% in a 1 cm quartz cell @ 253.7 nm
Total Suspended Solids:	< 30 mg/l
Iron Concentration:	< 0.1 mg/l
Manganese Concentration:	< 0.1 mg/l

Influent Enterococci:	< 40,000 /100
Effluent Enterococci:	ml < 126 /100 ml

WWTP

End of lamp life factor:	0.90
Fouling Factor:	0.90
Dose:	>30 mJ/cm2

2.04 ULTRAVIOLET DISINFECTION CHAMBER

A. Chamber

1. The UV system shall consist of four (4) UVLW-6800-10 UV chambers. The chambers shall be capable of disinfecting up to 3.9 MGD (687.5 gpm each) of wastewater of characteristics described in section 2.02 Operating Parameters with one unit out of service. Open channel systems or closed vessel systems using low pressure, low pressure high output, or low pressure amalgam lamps will not be acceptable.

2. The chambers shall have the dimensions as depicted on the drawings. Any chambers that require piping modification will not be acceptable.

3. Each chamber shall have isolation valves (furnished and installed by contractor) installed upstream and downstream of the UV system so that the flow can be isolated during times of maintenance. If there is going to be only one automatic valve, it is recommended that the automated valve be installed on the effluent side of the UV chambers.

4. The chambers shall be constructed of 316L SS. All wetted parts shall be stainless steel, high purity quartz, Viton, or other UV resistant material.

5. UV lamp orientation shall be horizontal and perpendicular to the flow. Lamps shall be protected from contact with the water by high purity quartz thimbles. The lamps shall be removed from the motor side of the chamber. Lamps that require connections from either side of the chamber will not be acceptable.

6. The chambers shall be designed in such a way that when properly installed and operated there is no possibility of direct operator exposure to UV light from the UV lamps.

B. UV Lamps

1. Only medium pressure high intensity ultraviolet lamps shall be provided for disinfection. Maximum power consumption for each UV chamber shall be: 18 kW

2. Maximum power consumption includes lamp power, power supply losses, cooling fans, and all other appurtances.

3. The power/control operation shall allow for multiple lamp power levels to extend their operating life. Output of lamps shall vary from 50 to 100%.

4. Lamps shall be single ended frame style. Lamps that require connections on both sides of the chamber will not be acceptable.

5. Germicidal UV output from the lamps shall not be affected by temperature (any type of low pressure lamp will be affected by temperature variances in the wastewater and shall not be acceptable).

6. The lamp connections shall be quick disconnect type and have a fail safe mechanical interlock to prevent lamp removal without disconnecting power. If the lamp is disconnected when live the design should be such that operators are protected from the live terminals.

7. Lamp design shall be a water tight design NEMA4 (IP68).

C. UV Intensity Monitor

1. One lamp in each chamber shall be equipped with a UV monitor, which measures the UV intensity of that lamp, providing continuous performance verification over the above specified water transmission range.

2. The monitor shall be fitted with a filter, which allows measurement of UV energy between 220 and 290 nm wavelengths.

3. The monitor shall be unaffected by static, electromagnetic fields, or short wave radio emissions that comply with current FCC regulations.

4. The monitor shall produce a 4-20 ma signal, which shall be sent to the power/control module.

5. The monitor shall have an IP67 rating and shall be removable without draining the chamber (dry connection).

D. Cleaning Mechanism

i. For periodic cleaning of the quartz thimbles and UV monitor probe, the chamber shall be fitted with an automatic/mechanical cleaning mechanism, which shall consist of a SS yoke and molded wiper rings, which fit over the quartz thimbles. Wiper rings shall be replaceable.

ii. The cleaning mechanism shall be electrical/mechanical and shall be operated by means of a fractional horsepower motor and a lead screw. Pneumatic or hydraulic cleaning mechanisms will not be acceptable.

iii. Wiper power supply shall be 24 V DC for improved safety. Wipers that require voltage greater than 24 V will not be acceptable.

iv. The cleaning mechanism shall operate by pulse technology which will stop

1. the wiping mechanism before it reaches the end of the chamber. No limit switches (external or internal) shall be used to monitor the position of the wiper mechanism.

v. The cleaning cycle shall be field adjustable. The cleaning cycle shall be activated from the control system or manually at the operator interface.

E. Temperature Sensor

A temperature sensor shall be fitted to the chamber for protection against heat buildup under low or no flow conditions. The UV system shall shut down and alarm in event of heat buildup in the chamber.

F. Access Hatch

A circular access hatch shall be provided on top of the chamber to allow easy, simple access for visual lamp/thimble inspection and/or removal of foreign debris from the chamber without removing the lamps or quartz thimbles. The profile of the hatch shall be designed to eliminate flow disruptions and air pockets.

2.05 ELECTRICAL/INSTRUMENTATION AND CONTROLS

A. General

1. The quantity and size of power/control cabinets are designated on the drawings.

2. Cabinets shall conform to NEMA12, suitable for indoor installation in an environmentally controlled room.

3. Cabinets shall be fan cooled and shall include louver covers with replaceable inlet filters.

4. Cabinets shall be constructed of epoxy coated steel.

5. The door of each cabinet shall be electrically interlocked so that the module is de-energized when the door is opened.

6. All wiring within the cabinets shall be harnessed or enclosed in wire channel.

7. Incoming circuits shall be protected by circuit breakers.

B. Power Requirements - 480V 3-phase, 3 wire, 60 Hz

C. Power/Control Cabinets

1. Each of the cabinets shall power and control the required number of lamps to treat the water as specified in Section 2.03 Operating Parameters.

2. The power/control cabinets shall contain a front panel mounted at eye level. This front panel shall consist of LEDs, an alphanumeric display, and membrane buttons for operator interface. All information, warnings, and alarms shall be presented on the alphanumeric display for ease of operation and fault finding. The following information shall be available:

a) UV dose
b) Lamp current
c) UV intensity
d) Flow (accepts a 4-20 mA flowmeter signal)
e) Chamber temperature
f) Lamp hours run (resettable)
g) System hours run
h) System spares listing
i) Lamp fault
j) Low UV
k) Chamber temperature alarm
l) Power supply temperature alarm
m) Ground fault
n) Wipe fault

2.06 MONITORING/INTERFACING AND CONTROL REQUIREMENTS

The control module shall contain the following output signals for remote monitoring and input signals for control of that group:

A. Local/Remote operation
B. Process interrupt (from valves, flowmeter, and/or pressure switches)
C. Valve control with limit switch feedback
D. Low UV shutdown or alarm
E. Flowmeter input
F. Automatic restart
G. Variable power control
H. User selectable system trip levels

I. MODBUS or PROFIBUS option for control and monitoring

2.07 QUALITY RECORDS

The controls shall have a built in data logging capability (retrievable through a PC or laptop) that shall log the following parameters:

A. UV intensity set point
B. UV intensity
C. Lamp current
D. Temperature

E. Flow (if flowmeter is connected)
F. Time and date
G. All alarms (restrike timer, low intensity, low dose, high temperature, power supply temperature, lamp fault and ground fault)

2.08 SPARE PARTS

The following spare parts shall be supplied with the equipment:

A. 16 - UV lamps
B. 8 - Electronic ballasts
C. 16 - Quartz thimbles
D. 16 - Sets of quartz thimbles seals
E. 16 - Wiper rings
F. 1 - Wiper flap UB intensity monitor
G. 1 – UV intensity monitor

2.09 MANUFACTURER ON-SITE SERVICES

A. Manufacturer's representative shall as a minimum perform the following tasks:

B. Inspect, test and adjust the equipment after installation to verify mechanical, structural and electrical integrity and conformance to the equipment specifications. This task shall be scheduled for two trips requiring a maximum of four days on site.

C. Instruct Owner's personnel in the proper operation and maintenance of the equipment.

D. Provide additional services at no cost to the owner to correct any operational problems due to the design and/or fabrication of the UV equipment. Any problems with the UV associated with upstream process failures or incorrect use of the equipment will not be covered under this section.

PART 3 – EXECUTION

3.01 FABRICATION

The UV disinfection system specified herein should be factory assembled, to the largest extent

possible, complete with all components specified. All UV systems shall come from an UV company that has been actively manufacturing UV equipment in the United States for a minimum of five years and with over 600 UV systems manufactured.

3.02 INSTALLATION

1 The Contractor shall install the UV equipment based upon the project plans and specifications.

2 The Manufacturer shall answer any related questions that the Contractor may have.

3.03 TESTING

A Prior to startup, the Manufacturer shall inspect the installed UV disinfection system for proper alignment, correct operation, proper connections, and satisfactory function of all components.

B. After startup and as part of the equipment certification process, the Owner shall submit to the Manufacturer one month of collected data as indicated below. This information will be used by the manufacturer to provide feedback to the systems operation.

1. Monthly operator's reports for 30 days following start-up.
2. Daily values for:

i. Plant flow (at time sample was collected)
ii. Number of units in operation
iii. Power level
iv. Time sample was collected
v. Fecal/E. coli count/100 ml (influent and effluent)
vi. Transmittance
vii. TSS
viii. Sample collected by

C. Laboratory Tests

All laboratory tests necessary to confirm the Guaranteed Performance Requirements testing for the UV Disinfection System shall be performed in accordance with the applicable portions of the most recent edition of Standard Methods.

3.04 WARANTIES

The Manufacturer shall furnish a written warranty that provides for:

1 Full replacement of all defective lamps within the first 2,000 hours of operation provided that the system is operated continuously and the system is being operated and maintained per the directions of the Manufacturer.

2 Full replacement of components against defects in materials and workmanship for a period of one year from date of start up not to exceed 18 months from date of shipment.

3 Performance warranty as outlined in Section 2.02 Operating Parameters.

END OF SECTION

SECTION UL 2215

Oil Water Separator

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor materials, equipment and incidentals required and install, test, and place in satisfactory operation one (1) Oil/Water Separator and associated appurtenances as specified herein and as indicated on the drawings.

B. The Oil/Water Separator shall be Highland Tank Model HTC 15000 Gallon Highguard Oil/Water Separator and shall be installed in accordance with manufacturer's instructions in compliance with the inspection of the Manufacturer's Field Service Representative.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for all equipment including specifications, capacity ratings, finishes of materials, dimensions, weights, accessories furnished, and installation and start-up instructions.

B. Shop Drawings: Submit assembly type shop drawings showing equipment dimensions, required clearances, construction details, and field connection details.

C. One electronic version product data/shop drawings shall be furnished. Hard copies of final approved submittal shall be furnished as required by Engineer and/or General Contractor.

D. Operation and Maintenance (O & M) Data:

1. Submit operation and maintenance instructions for all equipment including recommended spare parts list.
2. Submit six (6) bound copies and one electronic copy of final approved Operation and Maintenance Manual.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. All products and services supplied herein shall be by a single Manufacturer.

B. Acceptable Manufacturer:

1. Subject to compliance with the requirements, provide Oil/Water Separator manufactured by Highland Tank or engineer approved equivalent.
2. The naming of a manufacturer in this specification is not an indication that the manufacturer's standard equipment is acceptable in lieu of the specified component features. Naming is only an indication that the manufacturer may have the experience and capability of engineering and supplying a system as specified. Having a manufacturer specifically listed does not relieve the Manufacturer or Contractor from providing equipment that meets all aspects of these specifications.

C. Design Criteria:

1. The Oil/Water Separator shall be new Highland Tank Model HTC 15000 Gallon Highguard Oil/Water Separator. The equipment furnished shall be suitable for installation underground by Contractor.
2. The Oil/Water Separator shall conform to the following design requirements.
   a. Application: Underground
   b. Type: Double Wall Type I 360
   c. Design flow: 1,500 GPM
   d. Material: Mild Carbon Steel
   e. Diameter: 10' 0"
   f. Width: 25' 6"
   g. Inlet/Outlet: 14" 150# Flange RFSO
   h. Vent Size: 2" FNPT
   i. Exterior Coating: Highguard

1.04 DELIVERY, STORAGE, AND HANDLING

A. The Manufacturer shall be responsible for the cost of shipping and insuring during shipment, and for properly packing and protecting all components prior to shipment. Any special handling and storage requirements shall be included in the shipping documents.

B. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the equipment is in operation.

C. Equipment shall be handled and stored in accordance with the Manufacturer's instructions. All the components shall be examined before installation. No items shall be installed which are found to be defective and any such items must be repaired to the satisfaction of the Engineer or replaced at no cost to the Owner.

D. The oil/water separator shall be constructed and shipped in the minimum practical number of pieces to the jobsite.

E. The Contractor shall be responsible for off-loading all components, storage in a protected location, and protection of all equipment before and after installation and prior to acceptance by the Owner.

F. Contractor shall perform all maintenance required by the Manufacturer during the storage period and prior to installation.

1.10 WARRANTY

A. The equipment Manufacturer shall provide a one (1) year warranty, commencing on the date of substantial completion, for all parts associated with the equipment and the labor associated with repair and/or replacement of the parts. Warranty period and warranty requirements shall be in accordance with Section 01 78 33. The warranty must be submitted during the shop drawing phase.

Approval of the shop drawings will be contingent on the receipt of the warranty. If any part of the equipment should fail during the warranty period, it shall be replaced at no expense to the Owner.

PART 2 PRODUCTS

2.01 DESCRIPTION OF EQUIPMENT

A. Manufacturer: Subject to compliance with requirements, provide one (1) Oil/Water Separator and appurtenances as manufactured by:

1. Highland Tank or engineer approved equivalent

B. General Description: The Oil/Water Separator equipment is comprised of one underground oil/water separator and appurtenances, consisting of but not limited to manways, parallel corrugated Plate Coalescer Corella PVC Plate, Removable Petroscreen Cartridge with Coalescer, Pull Rod for Petro Screen Removal, 4" Pump Out Pipe, Level Sensor Pipe, Leak Detection Pipe and Sensor, 120 V/60Hz/1 Phase Alarm Panel, all as required for a complete and functional system.

PART 3 EXECUTION

3.01 INSTALLATION

i. Contractor shall coordinate the installation of Oil Water Separator components based on the sequencing of construction and the Owner. Refer to Section 01 11 00, Summary of Work and Section 01 12 16, Construction Sequence for general sequence of construction and construction constraints.

ii. General: Install equipment as indicated and in accordance with
iii. manufacturer's published installation instructions and recognized industry practices, ensuring equipment complies with requirements and serves intended purpose.

iv. CONTRACTOR shall make all required mechanical, electrical, and control connections and modifications between existing and proposed equipment in order to provide a complete and functional system.

3.02 INSPECTION

A. The services of a factory trained Field Service Representative of the Manufacturer shall be provided to inspect the installation of the equipment.

3.03 START-UP

1 Upon completion of installation of the oil/water separator, test equipment to demonstrate compliance with requirements. Field correct malfunctioning equipment then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

2 Start-up, test, and adjust equipment in presence of manufacturer's authorized representative. A minimum of one (1) eight hour day and one (1) trip to the jobsite shall be provided.

3.04 ACCEPTANCE TESTING

A. Manufacturer shall provide written documentation to the Engineer of successful completion of the factory test at least 2 days prior to shipment of the oil/water separator.

END OF SECTION

ATTACHMENT A

GEOTECHNICAL REPORT