



CONTRACT DOCUMENTS  
AND TECHNICAL SPECIFICATIONS  
FOR CONSTRUCTION OF  
60-INCH AND 54-INCH WATERLINE ALONG  
GRANT ROAD AND COPELAND ROAD  
PROJECT NO. 28-B

HARRIS COUNTY, TEXAS



*Carl D. McConnell*  
*5/18/2020*

May 2020



## TABLE OF CONTENTS

### CONTRACT DOCUMENTS

<b><u>Section No.</u></b>	<b><u>Title</u></b>
00001	Inside Title Page
00003	Table of Contents
00004	List of Drawings
00020	Invitation to Bid
00100	Instructions to Bidders
00300	Bid
00500	Agreement
00610	Construction Performance Bond
00620	Payment Bond
00630	One-Year Maintenance Bond
00700	General Conditions of the Construction Contract
00800	Supplementary Conditions

### TECHNICAL SPECIFICATIONS

#### Division 1 – General Requirements

<b><u>Section No.</u></b>	<b><u>Title</u></b>	<b><u>Pages</u></b>
01110	Summary of Work	3
01145	Use of Premises	5
01160	Potentially Contaminated Areas (Guide Specification)	15
01255	Change Order Procedures	5
01270	Measurement and Payment	4
01292	Schedule of Values	3
01312	Coordination and Meetings	3
01321	Construction Photographs	6
01325	Construction Schedule	5
01326	Construction Schedule (Bar Chart)	4
01330	Submittal Procedures	8
01340	Shop Drawings, Product Data, and Samples	3
01410	TPDES Requirements	36
01422	Reference Standards	4
01450	Contractor's Quality Control	2
01452	Inspection Services	1
01454	Testing Laboratory Services	4
01502	Mobilization	2
01504	Temporary Facilities and Controls	12
01520	Temporary Field Office	4
01555	Traffic Control and Regulation	8

Division 1 – General Requirements

<b><u>Section No.</u></b>	<b><u>Title</u></b>	<b><u>Pages</u></b>
01562	Tree and Plant Protection	9
01572	Source Controls for Erosion and Sedimentation	8
01574	Reinforced Filter Fabric Barrier	4
01575	Stabilized Construction Exit	5
01576	Waste Material Disposal	2
01577	Inlet Protection Barriers	3
01578	Control of Ground Water and Surface Water	9
01580	Project Identification Signs	5
01610	Basic Product Requirements	4
01725	Field Surveying	3
01731	Cutting and Patching	4
01740	Restoration of Site	4
01770	Closeout Procedures	4
01782	Operations and Maintenance Data	3
01785	Project Record Documents	3

Division 2 – Site Work

<b><u>Section No.</u></b>	<b><u>Title</u></b>	<b><u>Pages</u></b>
02081	Cast-In-Place Concrete Manholes	9
02082	Precast Concrete Manholes	13
02084	Frames, Grates, Rings, and Covers	4
02085	Valve Boxes, Meter Boxes, and Meter Vaults	8
02086	Adjusting Manholes, Inlets, and Valve Boxes to Grade	4
02221	Removing Existing Pavements, Structures and Buried Utilities	5
02233	Clearing and Grubbing	3
02260	Trench Safety System	4
02316	Excavation and Backfill for Structures	10
02317	Excavation and Backfill for Utilities	20
02318	Extra Unit Price Work for Excavation and Backfill	3
02319	Borrow	3
02320	Utility Backfill Materials	12
02321	Cement Stabilized Sand	9
02330	Embankment	4
02336	Lime-Stabilized Subgrade	7
02337	Lime/Fly-Ash Stabilized Subgrade	3
02338	Portland Cement Stabilized Subgrade	6
02400	Tunnel Shafts	7

Division 2 – Site Work

<b><u>Section No.</u></b>	<b><u>Title</u></b>	<b><u>Pages</u></b>
02425	Tunnel Excavation and Primary Liner	27
02431	Tunnel Grout	11
02441	Microtunneling and Pipe-Jacked Tunnels	12
02447	Dry and Slurry Augering of Pipe and Conduit	10
02465	Drilled Shaft Foundations	5
02501	Ductile Iron Pipe and Fittings	10
02502	Steel Pipe and Fittings	12
02506	Polyvinyl Chloride Pipe	12
02507	Prestressed Concrete Cylinder Pipe	18
02511	Water Lines	21
02514	Disinfection of Water Lines	5
02515	Hydrostatic Testing of Water Lines	4
02517	Water Line in Tunnels	7
02518	Steel Pipe and Fittings for Large Diameter Water Lines	38
02520	Flushing Hydrants	6
02521	Gate Valves	10
02522	Butterfly Valves	16
02524	Air Release and Vacuum Relief Valves	4
02527	Polyurethane Coatings on Steel Pipe	10
02528	Polyethylene Wrap	7
02613	Bar Wrapped Steel Cylinder Pipe	18
02621	Geotextile	3
02632	Cast-in-Place Inlets, Headwalls and Wingwalls	4
02633	Precast Concrete Inlets, Headwalls, and Wingwalls	4
02753	Concrete Pavement Curing	4
02754	Concrete Driveways	3
02771	Curb, Curb and Gutter, and Headers	4
02775	Concrete Sidewalks	6
02821	Chain Link Fences and Gates	4
02911	Topsoil	3
02915	Tree Planting	8
02921	Hydro-Mulch Seeding	4
02922	Sodding	5



Division 3 – Concrete

<b><u>Section No.</u></b>	<b><u>Title</u></b>	<b><u>Pages</u></b>
03002	Concrete Pavement	13
03210	Reinforcing Steel	6
03315	Concrete for Utility Construction	19

Division 16 – Electrical

<b><u>Section No.</u></b>	<b><u>Title</u></b>	<b><u>Pages</u></b>
16640	Cathodic Protection for Pipelines	21
16645	AC Interference Mitigation Systems for Pipelines Gradient Control Systems	9

**LIST OF DRAWINGS**

<b><u>Sheet No.</u></b>	<b><u>Title</u></b>
1	COVER SHEET
2	HARRIS COUNTY EXPRESS REVIEW SHEET
3	SHEET INDEX
4	CONSTRUCTION NOTES
5	PROJECT OVERALL LAYOUT SHEET
6	SHEET LAYOUT, PARCEL INDEX AND BORING PLAN (SHEET 1 OF 2)
7	SHEET LAYOUT, PARCEL INDEX AND BORING PLAN (SHEET 2 OF 2)
8	SURVEY CONTROL MAP (SHEET 1 OF 4)
9	SURVEY CONTROL MAP (SHEET 2 OF 4)
10	SURVEY CONTROL MAP (SHEET 3 OF 4)
11	SURVEY CONTROL MAP (SHEET 4 OF 4)
12	SWING TIES SHEET 1 OF 3
13	SWING TIES SHEET 2 OF 3
14	SWING TIES SHEET 3 OF 3
15	NOT USED
16	NOT USED
17	GRANT ROAD BASELINE PLAN STA. 2+00 TO 7+00
18	GRANT ROAD BASELINE PROFILE STA. 2+00 TO 7+00
19	GRANT ROAD BASELINE PLAN STA. 7+00 TO 11+00
20	GRANT ROAD BASELINE PROFILE STA. 7+00 TO 11+00
21	GRANT ROAD BASELINE PLAN STA. 11+00 TO 16+00
22	GRANT ROAD BASELINE PROFILE STA. 11+00 TO 16+00
23	GRANT ROAD BASELINE PLAN STA. 16+00 TO 21+00
24	GRANT ROAD BASELINE PROFILE STA. 16+00 TO 21+00
25	GRANT ROAD BASELINE PLAN STA. 21+00 TO 26+00
26	GRANT ROAD BASELINE PROFILE STA. 21+00 TO 26+00
27	GRANT ROAD BASELINE PLAN AND PROFILE STA. 26+00 TO 31+00
28	GRANT ROAD BASELINE PLAN AND PROFILE STA. 31+00 TO 36+00
29	GRANT ROAD BASELINE PLAN AND PROFILE STA. 36+00 TO 40+00
30	GRANT ROAD BASELINE PLAN AND PROFILE STA. 40+00 TO 44+00
31	GRANT ROAD BASELINE PLAN AND PROFILE STA. 44+00 TO 48+00
32	GRANT ROAD BASELINE PLAN AND PROFILE STA. 48+00 TO 53+00
33	GRANT ROAD BASELINE PLAN STA. 53+00 TO 58+00
34	GRANT ROAD BASELINE PROFILE STA. 53+00 TO 58+00
35	MATZKE PARK BASELINE PLAN STA. 1+00 TO 6+00
36	MATZKE PARK BASELINE PROFILE STA. 1+00 TO 6+00
37	MATZKE PARK BASELINE PLAN AND PROFILE STA. 6+00 TO 10+50
38	MATZKE PARK BASELINE PLAN STA. 10+50 TO 15+50
39	MATZKE PARK BASELINE PROFILE STA. 10+50 TO 15+50
40	MATZKE PARK BASELINE PLAN AND PROFILE STA. 15+50 TO 20+50
41	MATZKE PARK BASELINE PLAN AND PROFILE STA. 20+50 TO 25+50
42	MATZKE PARK BASELINE PLAN AND PROFILE STA. 25+50 TO 30+50
43	COPELAND ROAD BASELINE PLAN AND PROFILE STA. 1+00 TO 5+00
44	COPELAND ROAD BASELINE PLAN AND PROFILE STA. 5+00 TO 10+00
45	COPELAND ROAD BASELINE PLAN AND PROFILE STA. 10+00 TO 15+00
46	COPELAND ROAD BASELINE PLAN AND PROFILE STA. 15+00 TO 18+00
47	LAKEWOOD FOREST BASELINE PLAN AND PROFILE STA. 1+00 TO STA. 3+00
48	NOT USED

49	WATER LINE CONNECTION DETAILS
50	NOT USED
51	STANDARD WATER LINE DETAILS
52	PRESTRESSED CONCRETE CYLINDER PIPE DETAILS
53	STEEL PIPE DETAILS
54	TUNNEL AND CASING DETAILS
55	MISCELLANEOUS WATER LINE DETAILS
56	VALVE AND SERVICE MANHOLE DETAILS
57	COMBINATION AIR VALVE AND DETAILS
58	HEAVY DUTY MANHOLE RING AND COVER DETAILS
59	PROJECT SIGN DETAIL
60	NOT USED
61	DETAILS FOR CATHODIC PROTECTION CABINET AND ANODE GROUND BED
62	CATHODIC PROTECTION DETAILS FOR TEST STATIONS
63	CATHODIC PROTECTION TEST STATION SCHEDULE
64	CATHODIC PROTECTION DETAILS FOR JOINT BONDING
65	MISCELLANEOUS CATHODIC PROTECTION DETAILS
66	CATHODIC PROTECTION GROUND BED LAYOUT AND NEGATIVE CABLE TRENCH DETAIL
67	CATHODIC PROTECTION DETAILS FOR TUNNEL OR CASED CROSSING
68	STANDARD PAVING DETAILS
69	PAVEMENT MARKING DETAILS
70	DRIVEWAY AND SIDEWALK PAVING DETAILS
71	EXCAVATION, BEDDING, BACKFILL & PAVEMENT REPAIR DETAILS
72	NOT USED
73	NOT USED
74	STORM WATER POLLUTION PREVENTION PLAN (SHEET 1 OF 5)
75	STORM WATER POLLUTION PREVENTION PLAN (SHEET 2 OF 5)
76	STORM WATER POLLUTION PREVENTION PLAN (SHEET 3 OF 5)
77	STORM WATER POLLUTION PREVENTION PLAN (SHEET 4 OF 5)
78	STORM WATER POLLUTION PREVENTION PLAN (SHEET 5 OF 5)
79	STORM WATER POLLUTION PREVENTION PLAN DETAILS
80	GRANT ROAD STA. 0+00 TO STA. 20+00
81	GRANT ROAD STA. 20+00 TO STA. 44+00
82	GRANT ROAD STA. 44+00 TO STA. 58+00
83	JONES ROAD TO COPELAND ROAD
84	COPELAND ROAD STA. 0+00 TO STA. 18+00
85	BC (1): BARRICADE AND CONSTRUCTION GEN. NOTES AND REQUIREMENTS
86	BC (2): BARRICADE AND CONSTRUCTION PROJECT LIMIT
87	BC (3): BARRICADE AND CONSTRUCTION WORK ZONE AND SPEED LIMIT
88	BC (4): BARRICADE AND CONSTRUCTION TEMPORARY SIGN NOTES
89	BC (5): BARRICADE AND CONSTRUCTION TYPICAL SIGN SUPPORT
90	BC (8): BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES
91	BC (9): BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES
92	BC (10): BARRICADE AND CONSTRUCTION CHANNELING DEVICES
93	WZ (BRK): WORK ZONE "GIVE US A BRAKE" SIGNS
94	TCP (1-1): CONVENTIONAL ROAD SHOULDER WORK
95	TCP (1-2): ONE-LANE TWO-WAY TRAFFIC CONTROL
96	TCP (1-4): LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS
97	TCP (2-1): CONVENTIONAL ROAD SHOULDER WORK
98	TCP (2-2): ONE-LANE TWO-WAY TRAFFIC CONTROL
99	TCP (2-4): LANE CLOSURES ON MULTILANE CONVENTIONAL ROADS

**INVITATION TO BID**

Date: May 29, 2020

**North Harris County Regional Water Authority  
3648 Cypress Creek Pkwy, Suite 110  
Houston, Texas 77068**

PROJECT TITLE: Proposed 60" and 54" Water Line Along Grant Road and Copeland Road

PROJECT NO.: 28B CONTRACT NO.: 1

LOCATION: Grant and Copeland Road, Houston, Texas, Harris County

Sealed BIDs in duplicate will be received at the office of the North Harris County Regional Water Authority, 3648 Cypress Creek Pkwy, Suite 110, Houston, Texas 77068 until 10:00 a.m. local time, Tuesday, June 23, 2020, then publicly opened and read. BIDs received after the closing time will be returned unopened. Due to the COVID-19 pandemic and the State and Federal guidelines of not gathering in groups of more than ten (10) people, members of the public who wish to attend the Bid Opening for this project must do so by telephone. To attend the Bid Opening by telephone, dial (877) 286-5733 and enter conference ID: 275 356 489#.

General Contractors are invited to attend a virtual pre-bid conference for this project. The pre-bid conference will be held on Tuesday, June 9, 2020, at 10:00 a.m. local time. To participate by video conference, go to <https://tinyurl.com/NHCRWA-Project-28B>. To participate by telephone conference only dial (877) 286-5733 and enter conference ID: 733 293 630#.

Bid Security in the amount not less than five percent (5%) of the total amount of the BID must accompany each BID as a guarantee that the Successful Bidder will enter into a proper Contract and execute Bonds and Guaranties on the forms provided within eight (8) days after the date Contract Documents are received by the CONTRACTOR. Bid Security shall be in accordance with Section 00100 - Instructions to Bidders and Section 00700, Paragraph 5.1.1 of the General Conditions.

Copies of the Bidding Documents may be obtained from [www.civcastusa.com](http://www.civcastusa.com); search NHCRWA Project 28B. Bidders must register on this website in order to view and/or download specifications and plans for this project. There is NO charge to view or download documents. Bidders may submit questions online through CIVCAST at [www.civcastusa.com](http://www.civcastusa.com).

This contract is contingent upon release of funds from the Texas Water Development Board. Any contract or contracts awarded under this Invitation for Bids is/are expected to be funded in part by a loan or grant from the Texas Water Development Board. Neither the state of Texas, nor any of its departments, agencies, or employees are or will be a party to this Invitation for Bids or any resulting contract.

The OWNER reserves the right to reject any or all BIDs and to waive technical defects in bidding.

Jimmie Schindewolf, P.E.  
General Manager,  
North Harris County  
Regional Water Authority

## **INSTRUCTIONS TO BIDDERS**

### **1. Defined Terms**

Terms used in these Instructions to Bidders are defined in Section 00700 - General Conditions of the Construction Contract.

### **2. Copies of Bidding Documents**

2.1. Complete sets of the Bidding Documents, in the number and for the payment sum stated in the Invitation to Bid, may be obtained from [www.civcastusa.com](http://www.civcastusa.com).

2.2. Complete sets of Bidding Documents must be used in preparing BIDs; neither OWNER, PROJECT MANAGER, nor ENGINEER assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents or otherwise associated with the Bidding Documents.

2.3. OWNER, PROJECT MANAGER, and ENGINEER, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining BIDs for the Work and do not confer a license or grant for any other use. BIDDER may not make copies of the Bidding Documents. Ownership of the Bidding Documents shall remain with the OWNER.

### **3. Qualifications of BIDDERS**

To demonstrate qualifications to perform the Work, each BIDDER must submit, with their BID in a separate sealed envelope, detailed written evidence such as financial data, previous experience, present commitments, and proof that the BIDDER has the personnel, equipment, and material to execute the work required by the Contract Documents or any other such data as may be called for below. Although OWNER will not ordinarily release financial data submitted to it under this paragraph, BIDDERS should expect that this information may be available for public scrutiny if it is submitted.

### **4. Examination of Contract Documents and Site**

4.1. It is the responsibility of each BIDDER, before submitting a BID:

4.1.1. to examine thoroughly the Contract Documents and other related data identified in the Bidding Documents (including "technical data" referred to below);

4.1.2. to visit the site to become familiar with and satisfy BIDDER as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work;

4.1.3. to consider federal, state, and local Laws and Regulations that may affect cost, progress, performance, or furnishing of the Work;

4.1.4. to study and carefully correlate BIDDER's knowledge and observations with the Contract Documents and such other related data; and

4.1.5. to promptly notify PROJECT MANAGER of all conflicts, errors, ambiguities or

discrepancies which BIDDER has discovered in or between the Contract Documents and such other related documents.

4.2. Reference is made to the General and Supplementary Conditions for identification of those reports of explorations and tests of subsurface conditions at or contiguous to the site which have been utilized by ENGINEER in preparation of the Contract Documents. BIDDER may rely upon the general accuracy of the “technical data” contained in such reports but not upon other data, interpretations, opinions, or information contained in such reports or otherwise relating to the subsurface conditions at the site, nor upon the completeness thereof for the purposes of bidding or construction. **OWNER, PROJECT MANAGER, AND ENGINEER EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES THAT THE INFORMATION, DATA, INTERPRETATIONS, AND OPINIONS SHOWN, INDICATED, OR CONTAINED IN THE REPORTS ARE ACCURATE, CORRECT, COMPLETE, OR FIT FOR THEIR INTENDED PURPOSES.**

Copies of such reports will be made available by OWNER to any BIDDER on request. Those reports and drawings are not part of the Contract Documents, but the “technical data” contained therein upon which BIDDER is entitled to rely as provided in Paragraph 4.2 of the General Conditions has been identified and established in Paragraph SC-4.2 of the Supplementary Conditions. BIDDER is responsible for any interpretation or conclusion drawn from any “technical data” or any such data, interpretations, opinions, or information.

4.3. Information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER, PROJECT MANAGER, and ENGINEER by owners of such Underground Facilities or others, and OWNER, PROJECT MANAGER, and ENGINEER do not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary Conditions. **OWNER, PROJECT MANAGER, AND ENGINEER EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES THAT THE INFORMATION, DATA, INTERPRETATIONS, AND OPINIONS SHOWN, INDICATED, OR CONTAINED IN THE PLANS ARE ACCURATE, CORRECT, COMPLETE, OR FIT FOR THEIR INTENDED PURPOSES.** It is to be anticipated by the CONTRACTOR that some of the Underground Facilities located at or contiguous to the site will be found at locations that may differ from the sites shown on the Contract Documents. It is part of the scope of CONTRACTOR’s work to perform the exploratory work necessary to precisely identify the exact locations of Underground Facilities. It is also to be anticipated that these may be underground Facilities at or contiguous to the site that have not been identified in the Contract Documents and it is part of the scope of the work to be able to accommodate the likelihood of encountering some additional underground Facilities.

4.4. Provisions concerning responsibilities for the adequacy of data furnished to prospective BIDDERS with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Contract Documents due to differing or unanticipated conditions appear in Paragraphs 4.2 and 4.3 of the General Conditions.

4.5. Before submitting a BID, each BIDDER will be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning

conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance, or furnishing of the Work, or which relate to any aspect of the means, methods, techniques, sequences, or procedures of construction to be employed by BIDDER and safety precautions and programs incident thereto or which BIDDER deems necessary to determine its BID for performing and furnishing the Work in accordance with the time, price, and other terms and conditions of the Contract Documents.

4.6. On request, OWNER will provide each BIDDER access to the site to conduct such examinations, investigations, explorations, tests, and studies as each BIDDER deems necessary for submission of a BID. BIDDER must fill all holes and clean up and restore the site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.7. The submission of a BID will constitute an incontrovertible representation by BIDDER that BIDDER has complied with every requirement of this Article 4, that, without exception, the BID is premised upon performing and furnishing the Work required by the Contract Documents, and applying the specific means, methods, techniques, sequences, or procedures of construction (if any) that may be shown or indicated or expressly required by the Contract Documents, the BIDDER has given PROJECT MANAGER written notice of all conflicts, errors, ambiguities, and discrepancies that BIDDER has discovered in the Contract Documents, and written resolutions thereof by PROJECT MANAGER are acceptable to BIDDER, that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work, that the BIDDER has no questions regarding the Work, that the BIDDER has all information necessary to make a fully informed BID, and that the BIDDER has conducted all tests at the site it deems necessary.

4.8. The provisions of 4.1 through 4.7, inclusive of this Article, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste, or Radioactive Material covered by Paragraph 4.5 of the General Conditions.

## **5. Availability of Lands for Work, etc.**

The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by CONTRACTOR in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment, or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by OWNER unless otherwise provided in the Contract Documents.

## **6. Interpretations and Addenda**

6.1. All questions about the meaning or intent of the Bidding Documents are to be directed to PROJECT MANAGER. Interpretations or clarifications considered necessary by PROJECT MANAGER in response to such questions will be issued by Addenda mailed, transmitted by facsimile machine, or delivered to all parties recorded by PROJECT MANAGER as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by formal written Addenda will

be binding. Oral and other interpretations or clarifications may not be relied upon and will not be binding upon OWNER or PROJECT MANAGER or legally effective.

6.2. Addenda may also be issued to modify the Bidding Documents as deemed advisable by OWNER or ENGINEER.

## **7. Bid Security**

7.1. Each BID must be accompanied by Bid Security made payable to OWNER in an amount of five percent (5%) of BIDDER's maximum Bid price and in the form of a certified or cashier's check or a Bid Bond issued by a surety meeting the requirements of Paragraph 5.1.1 of the General Conditions.

7.2. The Bid Security of Successful Bidder will be retained until such BIDDER has executed the Agreement, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid Security will be returned. If the Successful Bidder fails to execute and deliver the Agreement and furnish the required contract security within eight (8) days after the Notice of Award, OWNER may annul the Notice of Award, and the Bid Security of that BIDDER will be forfeited. The Bid Security of other BIDDERS whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of the seventh day after the Effective Date of the Agreement or the thirty-sixth day after the BID opening, whereupon Bid Security furnished by such BIDDERS will be returned. Bid Security with Bids which are not competitive will be returned within seven (7) days after the BID opening.

## **8. Contract Times**

The Contract Times, as defined in Paragraph 1.13 of the General Conditions, are set forth in the Agreement.

## **9. Liquidated Damages**

Provisions for liquidated damages are set forth in the Agreement.

## **10. "Or-Equal" Items**

The Contract, if awarded, will be on the basis of materials and equipment described in the PLANS or specified in the Specifications without consideration of possible "or-equal" items. Whenever it is indicated in the PLANS or specified in the Specifications that an "or-equal" item of material or equipment may be furnished or used by CONTRACTOR if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application by CONTRACTOR to the PROJECT MANAGER for consideration by ENGINEER is set forth in Paragraphs 6.4.1, 6.4.2 and 6.4.3 of the General Conditions and may be supplemented in the Supplementary Conditions.



**11. Subcontractors, Suppliers, and Others**

11.1. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) to be submitted to OWNER in advance of a specified date prior to the Effective Date of the Agreement, apparent Successful Bidder, and any other BIDDER so requested, shall, within five (5) days after BID opening, submit to OWNER a list of all such Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, person, or organization if requested by OWNER. OWNER who, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person, or organization may, before the Notice of Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in Bid Price.

If the apparent Successful Bidder declines to make any such substitution, OWNER may award the contract to the next lowest BIDDER that proposes to use acceptable Subcontractors, Suppliers, and other persons and organizations. Declining to make requested substitutions will not constitute grounds for sacrificing the Bid Security of any bidder. Any Subcontractor, Supplier, other person, or organization listed and to whom OWNER does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to OWNER subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.5.2 of the General Conditions.

11.2. The apparent Successful Bidder, prior to the Notice of Award, shall identify in writing to OWNER those portions of the Work that such BIDDER proposes to subcontract and after the Notice of Award may only subcontract other portions of the Work with OWNER's written consent.

**12. Bid Form**

12.1. The Bid Form is included with the Bidding Documents; additional copies may be obtained from the Issuing Office described in the Invitation to Bid.

12.2. All blanks on the Bid Form must be completed by ink.

12.3. BIDs by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary of the corporation. The corporate address and state of incorporation must be shown below the signature.

12.4. BIDs by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature, and the official address of the partnership must be shown below the signature.

12.5. All names must be typed or printed in ink below the signature.

12.6. The BID shall contain an acknowledgment of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

12.7. The street and/or post office box address and telephone and/or fax number for communications regarding the BID must be shown.

12.8. When applicable, evidence of authority to conduct business as an out-of-state corporation in the state where the Work is to be performed shall be provided in accordance with Paragraph 3 above. State contractor license number, if any, must also be shown.

### **13. Submission of Bids**

Each BID shall be submitted at the time and place indicated in the Invitation to Bid and shall be enclosed in a sealed envelope, marked with the Project title and name and address of BIDDER and accompanied by the Bid Security and other required documents. If the BID is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it.

### **14. Modification and Withdrawal of Bids**

14.1. BIDs may be modified or withdrawn by an appropriate document duly executed (in the manner that a BID must be executed) and delivered to the place where BIDs are to be submitted at any time prior to the opening of BIDs.

14.2. If, within twenty-four (24) hours after Bids are opened, any BIDDER files a duly signed, written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there were material and substantial mistakes in the preparation of its BID of such a nature as to warrant the withdrawal of a Bid under the common law of the State of Texas, that BIDDER may withdraw its BID and the Bid Security will be returned. Thereafter, that BIDDER will be disqualified from further bidding on the Work to be provided under the Contract Documents.

### **15. Opening of Bids**

BIDs will be opened and read aloud publicly (unless obviously nonresponsive) at the place where BIDs are to be submitted. An abstract of the amounts of the base BIDs and major alternates (if any) will be made available to BIDDERS after the opening of BIDs.

### **16. Bids to Remain Subject to Acceptance**

All BIDs will remain subject to acceptance for sixty (60) days after the day of the BID opening, but OWNER may, in its sole discretion, release any BID and return the Bid Security prior to that date.

### **17. Award of Contract**

17.1. It is the intention of the OWNER to select the lowest responsible responsive BIDDER and make an effort to enter a Contract with that BIDDER. However, OWNER reserves the right

to reject any or all BIDs, including without limitation the right to reject any or all nonconforming, nonresponsive, unbalanced, or conditional BIDs and to reject the BID of any BIDDER if OWNER believes that it would not be in the best interest of the Project to make an award to that BIDDER, whether because the BID is not responsive or the BIDDER is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by OWNER. OWNER also reserves the right to waive all informalities in BIDs and to negotiate contract terms with the Successful Bidder. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. OWNER also reserves the right to enter a Contract with a BIDDER other than the lowest BIDDER if it does not reach an agreement with the lowest BIDDER.

17.2. In evaluating BIDs, OWNER will consider the qualifications of BIDDERS, whether or not the BIDs comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

17.3. OWNER may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. OWNER also may consider the operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

17.4. OWNER may conduct such investigations as OWNER deems necessary to assist in the evaluation of any BID and to establish the responsibility, qualifications and financial ability of BIDDERS, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to OWNER's satisfaction within the prescribed time.

17.5. If the contract is to be awarded, it will be awarded to the lowest BIDDER whose evaluation by OWNER indicates to OWNER that the award will be in the best interests of the Project.

17.6. If the contract is to be awarded, OWNER will give Successful Bidder a Notice of Award within sixty (60) days after the day of the BID opening.

17.7. This contract is contingent upon release of funds from the Texas Water Development Board. Any contract or contracts awarded under this Invitation for Bids is/are expected to be funded in part by a loan or grant from the Texas Water Development Board. Neither the state of Texas, nor any of its departments, agencies, or employees are or will be a party to this Invitation for Bids or any resulting contract.

17.8. A governmental entity may not award a governmental contract to a nonresident BIDDER unless the nonresident underbids the lowest BID submitted by a responsible resident BIDDER by an amount that is not less than the amount by which a resident BIDDER would be required to underbid the nonresident BIDDER to obtain a comparable contract in the state in which the

nonresident's principal place of business is located. A non-resident BIDDER is a Contractor whose corporate offices or principal place of business is outside of the state of Texas (Source: Texas Government Code, Chapter 2252, Subchapter A, Nonresident Bidders, §2252.002).

The BIDDER will complete form TWDB-0459, Vendor Compliance with Reciprocity on Non-Resident Bidders, **which must be submitted with the BID.**

## **18. Contract Security**

Paragraph 5.1.1 of the General Conditions and the Supplementary Conditions set forth OWNER's requirements as to performance, payment, and maintenance Bonds. When the Successful Bidder delivers the executed Agreement to OWNER it must be accompanied by the required Bonds.

## **19. Signing of Agreement**

When OWNER gives a Notice of Award to the Successful Bidder, it will be accompanied by the required number (as stated in Section 00500 "Agreement") of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within eight (8) days thereafter, CONTRACTOR shall sign and deliver the required number of counterparts of the Agreement and attached documents to OWNER with the required Bonds. Thereafter, OWNER shall deliver one fully signed counterpart to CONTRACTOR. Each counterpart is to be accompanied by a complete set of the PLANS with appropriate identification.

## **20. Prebid Conference**

A prebid conference will be held as stated in Section 00020 ("Invitation to Bid").

## **21. Taxes**

21.1. CONTRACTOR shall pay all applicable sales, consumer, use, and other similar taxes except as exempted.

21.2. Sales tax. CONTRACTOR shall obtain the necessary documentation so that any sales tax exemptions due to the nature of the Work performed by CONTRACTOR or Subcontractors pursuant to this Agreement shall be applied to this Agreement, and these cost savings due to the Project's exempted status shall be passed on to OWNER. CONTRACTOR and each of its Subcontractors or sub-Subcontractors must obtain a Texas Limited Sales, Excise and Use Tax Permit for all materials required to be purchased in connection with the Project.

## **22. Retainage**

Provisions concerning retainage are set forth in the Agreement.

**23. Supplemental Pay Items**

Approximate quantity and a minimum unit price have been established for some of SUPPLEMENTAL ITEMS shown in Section 00300-BID. The CONTRACTOR may not bid a unit price less than the minimum value; however, he may increase the minimum unit price. If no entry is made in the spaces provided, the minimum unit prices shown shall apply. These Items are included to facilitate payment for changes and alterations that may be required to complete work. The actual work, as provided by the GENERAL AND SUPPLEMENTARY CONDITIONS OF CONSTRUCTION CONTRACT and TECHNICAL SPECIFICATIONS and shown on PLANS, is described in bid items excluding supplemental pay item. When work covered by SUPPLEMENTAL ITEMS is requested by the CONTRACTOR and approved by OWNER, payment will be based on the quantity actually constructed and unit prices bid in BID.

**24. Ownership of Proposals**

Submitted Proposals, documentation and supporting materials shall become the property of Owner. Financial data submitted under Paragraph 3 of this Instruction to Bidders will be returned to any unsuccessful BIDDER upon request following Contract award.

**25. Division of Project in Unit Prices**

The Contract Documents describe a complete Scope of Work to be performed. If the Work is divided for purpose of calculation of compensation into UNIT PRICES for Units of Work, it is to be understood that all aspects of the Work described in the Contract Documents are included in the total Units provided for under the Contract. The fact that the description of Units may not include an itemization of tasks incidental to the Work that are identified in the Contract Documents as parts of the Scope of Work will not relieve CONTRACTOR of the obligation to perform this incidental work for the Unit Prices.

**26. HB 914 Conflict Disclosures**

Effective January 1, 2006, Texas Local Government Code Section 176.001, et seq. requires that all persons who seek to contract with a local governmental entity such as North Harris County Regional Water Authority (the "Authority") complete and submit a Conflicts of Interest Questionnaire (the "Questionnaire") to the Authority. The purpose of the Questionnaire is to disclose certain relationships a potential bidder or contractor may have with Board members or consultants of the Authority. Please complete the enclosed Questionnaire and submit it with the bid. To assist with completing the Questionnaire, we have included a list of the Authority's Board members and Officers in Section 00800, Attachment "C-1". **FAILURE TO COMPLETE AND SUBMIT THE QUESTIONNAIRE WILL RESULT IN THE BID BEING DECLARED INCOMPLETE AND COULD LEAD TO CRIMINAL LIABILITY.** In the discretion of the Authority, an incomplete bid resulting from the failure to complete and submit the Questionnaire by the bid submission deadline may be waived provided that the Questionnaire is completed and submitted prior to award of the contract by the Authority.

**27. Texas Ethics Commission Form 1295**

Effective January 1, 2016, pursuant to Texas Government Code § 2252.908 (the “Interested Party Disclosure Act” or the “Act”), the Authority may not award the contract to a BIDDER unless the BIDDER has provided to the Authority a completed, signed and notarized TEC Form 1295 which has been assigned a certificate number by the Texas Ethics Commission (the “TEC”). Pursuant to the rules prescribed by the TEC, the TEC Form 1295 must be completed online through the TEC’s website, assigned a certificate number, printed, signed and notarized, and provided to the Authority. **THE TEC FORM 1295 SHOULD ACCOMPANY THE BID.** For purposes of completing the TEC Form 1295, the entity’s name is North Harris County Regional Water Authority; the contract ID number is Project No. [\_\_\_\_]; and the description of goods and services is [name of project]. Neither the Authority nor its consultants have the ability to verify the information included in a TEC Form 1295, and neither have an obligation nor undertake responsibility for advising any BIDDER with respect to the proper completion of the TEC Form 1295.

**THE BIDDER UNDERSTANDS THAT FAILURE TO PROVIDE SAID FORM COMPLETE WITH A CERTIFICATE NUMBER ASSIGNED BY THE TEC WILL RESULT IN A NON-CONFORMING BID.** In the discretion of the Authority, an incomplete bid resulting from the failure to complete and submit the completed TEC Form 1295 by the bid submission deadline may be waived provided that the form is completed and submitted prior to award of the contract by the Authority.

**28. Texas Government Code Sec. 2270.002 and 2252 Compliance with Laws Prohibiting Contracts with Companies Boycotting Israel and Certain Companies Engaged in Business with Iran, Sudan or Foreign Terrorist Organizations:**

By submitting a BID, BIDDER hereby verifies that BIDDER does not boycott Israel and will not boycott Israel during the term of the Contract. For purposes of this verification, “boycott Israel” means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes, as required by Section 2270.002, Texas Government Code.

Pursuant to Chapter 2252, Texas Government Code, the BIDDER represents and certifies that, at the time of execution of this Agreement, neither the BIDDER nor any wholly owned subsidiary, majority-owned subsidiary, parent company or affiliate of the same (i) engages in business with Iran, Sudan, or any foreign terrorist organization as described in Chapters 806 or 807 of the Texas Government Code, or Subchapter F of Chapter 2252 of the Texas Government Code, or (ii) is a company listed by the Texas Comptroller of Public Accounts under Sections 806.051, 807.051, or 2252.153 of the Texas Government Code. The term “foreign terrorist organization” in this paragraph has the meaning assigned to such term in Section 2252.151 of the Texas Government Code.

BIDDER acknowledges and agrees that the verification stated above is a material term of, and material consideration for, the Contract and that Owner is expressly relying on this verification in agreeing to enter the Contract with BIDDER.

**END OF SECTION**

**BID**

Date: \_\_\_\_\_

BID of \_\_\_\_\_, an individual proprietorship, a corporation authorized to transact business in Texas, or a partnership consisting of \_\_\_\_\_, registered to transact business in Texas \_\_\_\_\_

**60-INCH AND 54-INCH WATERLINE ALONG GRANT ROAD AND COPELAND ROAD**

**PROJECT NO. 28-B**

Work of the contract is for the construction of 60-Inch and 54-Inch Waterlines along Grant Road and Copeland Road using open cut and trenchless construction.

**THIS BID IS SUBMITTED TO:**

North Harris County Regional Water Authority  
3648 Cypress Creek Pkwy., Suite 110  
Houston, Texas 77068

1. The undersigned BIDDER proposes and agrees, if this BID is accepted, to enter into an agreement with OWNER in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Bid Price and within the Bid Times indicated in this BID and in accordance with the other terms and conditions of the Contract Documents. BIDDER accepts the terms of the form of Agreement and the Contract Documents.

2. BIDDER accepts all of the terms and conditions of the Invitation to BID and Instructions to Bidders including without limitation those dealing with the disposition of Bid Security. This BID will remain subject to acceptance for sixty (60) days after the day of BID opening. If BIDDER is the Successful Bidder, BIDDER will sign and deliver the required number of counterparts of the Agreement with the Bonds and other documents required by the Bidding Requirements within eight (8) days after the date of OWNER's Notice of Award.

3. In submitting this BID, BIDDER represents and warrants, as more fully set forth in the Agreement, that:

- (a) BIDDER has examined and carefully studied the Bidding Documents and Addenda. BIDDER hereby acknowledges receipt of the following Addenda: (List Addenda by Addendum Number and Date).

Addendum No.: \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No.: \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No.: \_\_\_\_\_ Dated: \_\_\_\_\_



- (b) BIDDER has visited the site, has conducted all testing at the site BIDDER deems necessary, has become familiar with, has taken into consideration in formulating its BID, and accepts the general, local and site conditions that may affect cost, progress, performance, and furnishing of the Work;
- (c) BIDDER is familiar with, has taken into consideration in formulating its BID and accepts all federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.
- (d) BIDDER has carefully studied all reports of explorations and tests of subsurface conditions at, or contiguous to, the site which have been identified in the Supplementary Conditions as provided in Paragraph 4.2.1 of the General Conditions. BIDDER accepts the determination set forth in Paragraph SC-4.2 of the Supplementary Conditions of the extent of the “technical data” contained in such reports upon which BIDDER is entitled to rely as provided in Paragraph 4.2 of the General Conditions. BIDDER understands, acknowledges, and agrees that such reports are not Contract Documents and may not be complete for BIDDER’s purposes. BIDDER understands, acknowledges, and agrees that OWNER, PROJECT MANAGER, and ENGINEER are not responsible for and make no warranties regarding the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to surface and subsurface conditions and Underground Facilities at or contiguous to the site. BIDDER acknowledges that it has had the opportunity to obtain and study any and all such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work, or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by BIDDER, and safety precautions and programs incident thereto as may be necessary. BIDDER does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this BID for performance and furnishing of the Work in accordance with the times, price, and other terms and conditions of the Contract Documents.
- (e) BIDDER is aware of the general nature of work to be performed by OWNER and others at the site that relates to Work for which this BID is submitted as indicated in the Contract Documents.
- (f) BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.
- (g) BIDDER has given PROJECT MANAGER written notice of all conflicts, errors, ambiguities, or discrepancies that BIDDER has discovered in the Contract Documents, and the written resolution thereof by ENGINEER is acceptable to BIDDER; BIDDER has no questions regarding the Work; BIDDER has all information necessary to make a fully informed BID; and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions

for performing and furnishing the Work for which this BID is submitted.

- (h) This BID is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; BIDDER has not directly or indirectly induced or solicited any other BIDDER to submit a false or sham BID; BIDDER has not solicited or induced any person, firm, or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself any advantage over any other BIDDER or over OWNER.
- (i) The Unit Prices in the Bid are not intentionally unbalanced so as to enable CONTRACTOR to receive periodic payments that will, by percentage, significantly exceed its percentage of overall completion on the Project.

4. BIDDER is duly qualified to carry on business in the State of Texas; possesses or has the ability to possess all licenses, permits, and certificates of authority necessary to commence and to complete the Work in accordance with the Bidding Documents; is fully qualified and has experience in performing work of the same type as the Work covered by the Bidding Documents; and will provide all necessary labor, superintendence, machinery, equipment, tools, materials, services, and other means of construction to complete all work upon which BIDDER bids and complete said work within the time stated and for maintaining same as required for the following prices:

**North Harris County Regional Water Authority**

Item No.	Approx. Qty.	Unit	Description of Item Unit Price Written in Words	Unit Price*	Total Amount Bid
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**CLEARING AND GRUBBING ITEMS**

1	6	Acre	Clearing and Grubbing, Including Removal and Off-Site Disposal, Complete in Place		
			@ _____		
			_____	\$ _____	\$ _____
			Per Acre		
<b>SUBTOTAL CLEARING AND GRUBBING ITEMS</b>				<b>\$ _____</b>	

**EROSION CONTROL ITEMS**

2	12	Months	Pollution Prevention Implementation Including Maintenance, Inspections, and Reporting for All Pollution Prevention Measures as Shown on the Plans, Complete in Place		
			@ _____		
			_____	\$ _____	\$ _____
			Month		
3	11,660	Linear Foot	Furnish and Install Reinforced Filter Fabric Barrier per Plans and Specifications as Shown on Plans, Complete in Place		
			@ _____		
			_____	\$ _____	\$ _____
			Linear Foot		

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
4	400	Linear Foot	Furnish and Install Reinforced Filter Fabric Barrier per Plans and Specifications, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
5	2,800	Square Yard	Furnish and Install Stabilized Construction Access per Plans and Specifications, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
6	20	Each	Furnish and Install Curb Inlet Protection Barrier as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
7	6	Acre	Furnish and Install Hydromulch Seeding of all Disturbed Areas, including fine grading as Shown on Plans, Complete in Place  @ _____  _____ Acre	\$ _____	\$ _____
<b>SUBTOTAL EROSION CONTROL ITEMS</b>				<b>\$ _____</b>	

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
<b>WATER LINE ITEMS</b>					
8	1,350	Linear Foot	Furnish and Install 60-Inch Pipe, Including Fittings, Restrained Joints and Appurtenances in Open Cut, With Standard Bedding and Backfill as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
9	250	Linear Foot	Furnish and Install 60-Inch Carrier Pipe in a Tunnel With Welded Steel Casing, Including Tunnel Shafts, Restrained Joints and Appurtenances as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
10	6,675	Linear Foot	Furnish and Install 54-Inch Pipe, Including Fittings, Restrained Joints and Appurtenances in Open Cut, With Standard Bedding and Backfill as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
11	1,675	Linear Foot	Furnish and Install 54-Inch Carrier Pipe in a Tunnel With Welded Steel Casing, Including Tunnel Shafts, Restrained Joints and Appurtenances as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
12	30	Linear Foot	Furnish and Install 16-Inch Pipe, Including Fittings, Restrained Joints and Appurtenances in Open Cut, With Standard Bedding and Backfill as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
13	20	Linear Foot	Furnish and Install 12-Inch Pipe, Including Fittings, Restrained Joints and Appurtenances in Open Cut, With Standard Bedding and Backfill as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
14	100	Linear Foot	Furnish and Install 12-Inch Pipe by Auger and Casing, Including All Fittings and Appurtenances as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
15	1	Each	Furnish and Install 60-Inch Butterfly Valve with Operator Manhole as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
16	5	Each	Furnish and Install 54-Inch Butterfly Valve with Operator Manhole as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
17	1	Each	Furnish and Install 12-Inch Gate Valve with Box as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
18	16	Each	Furnish and Install 4-Inch Combination Air Release and Vacuum Relief Valve Assembly with Vent Piping, 3 Bollards and Service Manhole, as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
19	6	Each	Furnish and Install Access Manway With Service Manhole as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
20	82	Vertical Foot	Furnish and Install Extra Depth on Service Manhole as Shown on Plans, Complete in Place  @ _____  _____ Vertical Foot	\$ _____	\$ _____
21	1	Each	Furnish and Install Connection 28-A Including Removal of 54-Inch Dish Head Plug as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.



**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
22	1	Each	Furnish and Install Connection 28-C Including 60-Inch Dish Head Plug, Two 16-Inch Gate Valve and Box with Blind Flange Assemblies as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
23	1	Each	Furnish and Install Connection 28-E Including One 16-Inch Gate Valve and Box and One 16-Inch Plug with 2-Inch Blow Off Valve as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
24	1	Each	Furnish and Install Connection 28-F Including Two 16-Inch Gate Valve and Box with Blind Flange Assemblies as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
25	1	Each	Furnish and Install 12-Inch Plug and Clamp as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
26	1	Each	Furnish and Install Flushing Hydrant Assembly, Including 6-Inch Gate Valve, Box and Tee as Shown on Plans, Complete in Place  @ _____  _____ Each	\$ _____	\$ _____
27	8,075	Linear Foot	Furnish and Install Trench Safety System for Water Line Construction, as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
<b>SUBTOTAL WATER LINE ITEMS</b>				<b>\$ _____</b>	

**PAVING ITEMS**

28	340	Square Yard	Remove and Dispose of Asphaltic Surfacing including Base (all thicknesses) as Shown on Plans, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
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\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
29	340	Square Yard	Furnish and Install Recycled Crushed Concrete Base Course as Shown on Plans, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
30	340	Square Yard	Furnish and Install Up to 2-Inch Thick Asphaltic Concrete Pavement as Shown on Plans, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
31	405	Square Yard	Remove and Dispose of Reinforced Concrete Pavement (all thicknesses), with or without Asphalt Overlay, with or without Curb, including Base and Subgrade as Shown on Plans, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
32	9	Ton	Furnish and Install Lime Stabilized Subgrade (dry weight) as Shown on Plans, Complete in Place  @ _____  _____ Ton	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
33	405	Square Yard	Mix 8-Inch Lime Stabilized Subgrade as Shown on Plans, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
34	405	Square Yard	Furnish and Install up to 6-Inch Thick Reinforced Concrete Pavement as Shown on Plans, Complete in Place  @ _____  _____ Square Yard	\$ _____	\$ _____
35	270	Linear Foot	Furnish and Install Curbs as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
36	311	Square Yard	Remove and Dispose of Concrete Sidewalks (all thicknesses) and Driveways (all materials, all thicknesses) @ _____  _____ Square Yard	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
37	311	Square Foot	Furnish and Install Concrete Sidewalks, as Shown on Plans, Complete in Place  @ _____  _____ Square Foot	\$ _____	\$ _____
<b>PAVING SUBTOTAL ITEMS</b>				\$ _____	
<b>MISCELLANEOUS ITEMS</b>					
38	1	Lump Sum	Mobilization and Furnish Performance, Payment, and Maintenance Bonds in accordance with the Contract Documents  _____ Lump Sum	\$ <u>275,000***</u>	\$ <u>275,000***</u>
39	1	Lump Sum	Furnish, Install, and Maintain Traffic Control Devices and Appurtenances, in Accordance With Texas Manual on Uniform Traffic Control Devices (Latest Edition), Including Flagmen, Complete in Place as Required  @ _____  _____ Lump Sum	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
40	1	Lump Sum	Furnish and Install Cathodic Protection per Specifications and as Shown on Plans, Complete in Place  @ _____  _____ Lump Sum	\$ _____	\$ _____
41	2,395	Linear Foot	Remove and Dispose of Existing Fence (all types), as shown on Plans  @ _____  _____ Linear Foot	\$ _____	\$ _____
42	1,563	Linear Foot	Furnish and Install 6-Foot Chain Link Fence to match existing as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
43	225	Linear Foot	Furnish and Install 10-Foot Wood Fence to replace existing 6-Foot Wood Fence along Grant Road as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
44	50	Linear Foot	Furnish and Install 6-Foot Wood Fence to match existing as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
45	165	Linear Foot	Furnish and Install 3-Strand Barb Wire Fence, to match existing, with Metal Posts and Gate, as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
46	338	Linear Foot	Furnish and Install 6-foot Wrought Iron Fence, with brick columns, to match existing, as Shown on Plans, Complete in Place  @ _____  _____ Linear Foot	\$ _____	\$ _____
47	1000	Linear Foot	Regrade Existing Ditches, Complete in Place @ _____  _____ Linear Foot	\$ _____	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
48	50	Linear Foot	Furnish, Install, and Remove 24-Inch Reinforced Concrete Pipe, Complete in Place @ _____ _____ Linear Foot	\$ _____	\$ _____

**SUPPLEMENTAL PAY ITEMS**

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

49	100	Square Yard	Furnish, Install, and Establish Extra Solid Sod, Complete in Place @ _____ _____ Square Yard	\$ _____ (\$5.00)**	\$ _____
50	8	Each	Furnish and Install Crushed Stone Manhole Foundation for Wet Conditions, Complete in Place @ _____ _____ Each	\$ _____ (\$150.00)**	\$ _____
51	100	Linear Foot	Furnish and Install Bedding and Backfill for Wet Conditions, Complete in Place @ _____ _____ Linear Foot	\$ _____ (\$15.00)**	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.



**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
52	50	Cubic Yard	Furnish and Install Extra Class "A" Concrete With Reinforcing Steel, Complete in Place  @ _____ _____ Cubic Yard	\$ _____ (\$265.00)**	\$ _____
53	50	Pound	Furnish and Install Extra Reinforcing Steel, Complete in Place  @ _____ _____ Pound	\$ _____ (\$50.00)**	\$ _____
54	100	Cubic Yard	Furnish and Install Extra Bank Sand Backfill, Complete in Place  @ _____ _____ Cubic Yard	\$ _____ (\$18.00)**	\$ _____
55	100	Cubic Yard	Furnish and Install Extra Cement Stabilized Sand, Complete in Place  @ _____ _____ Cubic Yard	\$ _____ (\$24.00)**	\$ _____

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
56		Each	Furnish and Install Extra 54-Inch Water Line Fitting, All Angles, Complete in Place  @ _____  _____ Ton	\$ _____ (\$1,000)**	\$ _____
57		Each	Furnish and Install Extra 60-Inch Water Line Fitting, All Angles, Complete in Place  @ _____  _____ Ton	\$ _____ (\$1,000)**	\$ _____
58		Ton	Furnish and Install Extra 16-Inch Water Line Fitting, All Angles, Complete in Place  @ _____  _____ Ton	\$ _____ (\$500.00)**	\$ _____
59		Ton	Furnish and Install Extra 12-Inch Water Line Fitting, All Angles, Complete in Place  @ _____  _____ Ton	\$ _____ (\$500.00)**	\$ _____
<b>SUBTOTAL SUPPLEMENTAL PAY ITEMS</b>				<b>\$ _____</b>	

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.

\*\*Minimum allowable prices. Bidder may choose to quote a higher price.

\*\*\*Maximum allowable bid price. Bidder may not change.

North Harris County Regional Water Authority

Item No.	Approx. Qty.	Unit	Description of Item Unit Price Written in Words	Unit Price*	Total Amount Bid
<b>CASH ALLOWANCE ITEMS</b>					
***Maximum Allowable Bid Price, Bidder may not change.					
60	NA	NA	Allowance for Harris County Permits, Reimbursed on an Actual Cost Basis  @ _____  _____		<u>\$20,000.00</u>
61		NA	Cash Allowance for Approved Construction Modifications, Reimbursed in Accordance with Article 10 of Section 00700 of the General Conditions.  @ _____  _____		<u>(Amount 5% of Construction Cost)***</u>
<b>SUBTOTAL CASH ALLOWANCE ITEMS</b>				<b>\$</b> _____	

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.  
\*\*Minimum allowable prices. Bidder may choose to quote a higher price.  
\*\*\*Maximum allowable bid price. Bidder may not change.

**North Harris County Regional Water Authority**

<b>Item No.</b>	<b>Approx. Qty.</b>	<b>Unit</b>	<b>Description of Item Unit Price Written in Words</b>	<b>Unit Price*</b>	<b>Total Amount Bid</b>
<b>TOTAL AMOUNT BID</b>			\$ _____		
<b>TOTAL AMOUNT FOR MATERIALS</b>			\$ _____		
<b>TOTAL AMOUNT FOR SKILLS, LABOR, EQUIPMENT, ETC.:</b>			\$ _____		

The OWNER in its continuing partnership with the Texas Water Development Board (TWDB) is enlisting the assistance of the BIDDER in obtaining contractor cost data on the cost of compliance with TWDB-1105, Rev 11/07/2018 "United States Iron and Steel (US I&S) Guidance for Projects Funded through State Programs" (See Attachment of TWDB-1105 in Section 00800 "Supplementary Conditions"). In this regard the OWNER requires the BIDDER provide the LUMP SUM compliance cost on this Project to be used for information purposes only.

Lump Sum	Cost of Compliance with TWDB-1105, Rev 11/07/2018 - United States Iron and Steel (US I&S) Guidance for Projects Funded through State Programs		
	@ _____		
	_____	\$ _____	\$ _____
	Lump Sum		

\*In the event of a discrepancy, figures in the 'UNIT PRICE' column govern.  
 \*\*Minimum allowable prices. Bidder may choose to quote a higher price.  
 \*\*\*Maximum allowable bid price. Bidder may not change.

The undersigned (Contractor) represents and warrants that (1) all tangible personal property identified as 'materials' in the Proposal will be incorporated into Project, subject only to field adjustments as to quantities, (2) the prices of such material are exclusive of sales and use taxes, and (3) all sales and use taxes regarding tangible personal property not incorporated into the work are the sole responsibility of the Contractor and the Contractor has paid or will pay such taxes regarding such property.

Acknowledge receipt of Addendum Nos. \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
(initial)

**ALL BID PRICES SHALL INCLUDE ALL APPLICABLE SALES  
TAX**

5. BIDDER agrees to begin work promptly after written Notice to Proceed is given by OWNER and will substantially complete the Work within 335 days in accordance with Paragraph 15.5 of the General Conditions and will complete the Work and be ready for final payment within 365 days after the date of the written Notice to Proceed in accordance with Paragraph 15.9 of the General Conditions.

BIDDER accepts all the provisions of the Agreement and the Contract Documents, including the provision for liquidated damages in the event of failure to complete the Work within the time specified in the Agreement.

6. BIDDER has enclosed with this BID the required Bid Security in the form of a \_\_\_\_\_ in the amount of \$ \_\_\_\_\_. BIDDER agrees that this amount is a measure of liquidated damages which OWNER will sustain by failure of the BIDDER to execute and deliver above named Agreement and Bonds, and not a penalty, and further agrees that this Bid Security shall be collected and retained by OWNER as liquidated damages in the event this BID is accepted by OWNER within sixty (60) days after opening of Bids, and BIDDER fails to execute the Agreement and the required Bonds with OWNER within eight (8) days after Contract Documents are received by BIDDER; otherwise said Bid Security shall be returned to the BIDDER in accordance with Paragraph 7 of Section 00100 - Instruction to Bidders.

7. BIDDER has enclosed with this BID the required HB 194 Conflict Disclosures form, which is located in Section 00800 – Supplementary Conditions, Attachment C-1.

**(THIS SPACE INTENTIONALLY LEFT BLANK)**

***North Harris County Regional Water Authority***

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ATTEST:

Very truly yours

\_\_\_\_\_  
(SEAL, if Bidder is Corporation)

By: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Typed or Printed Name)

Title: \_\_\_\_\_

Bidder: \_\_\_\_\_  
(Name of Company)

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone No.: \_\_\_\_\_

Facsimile No.: \_\_\_\_\_

Surety Company: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone No.: \_\_\_\_\_

Facsimile No.: \_\_\_\_\_

**AGREEMENT**

**THIS AGREEMENT** is dated as of the \_\_\_\_\_ day of \_\_\_\_\_ in the year \_\_\_\_\_ by and between North Harris County Regional Water Authority (hereinafter called OWNER) and \_\_\_\_\_ (hereinafter called CONTRACTOR).

OWNER and CONTRACTOR, in consideration of the mutual covenants hereinafter set forth, agree as follows:

**Article 1. WORK.**

1.1. CONTRACTOR shall perform the Work in a good and workmanlike manner and in the best way and most expeditious and economical manner consistent with the interests of the OWNER, shall exercise the degree of care, skill, and diligence in the performance of the Work in accordance with and consistent with industry standards for similar circumstances, shall utilize its best skill, efforts, and judgment in furthering the interests of the OWNER, and shall furnish efficient business administration and supervision (collectively, CONTRACTOR's "Standard of Care").

1.2. CONTRACTOR shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Clearing and Grubbing, construction of erosion control measures, construction of 60-Inch and 54-Inch Water Transmission Line by trenchless and open-cut methods, construction of 16-Inch District waterlines and site restoration.

**Article 2. PROJECT MANAGER AND ENGINEER.**

**2.1 PROJECT MANAGERS.**

AECOM Technical Services, Inc. has been designated as the PROJECT MANAGER and is to assume all duties and responsibilities assigned to PROJECT MANAGER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

**2.2 ENGINEER.**

The Project has been designed by Dannenbaum Engineering Corp., who is to assume all duties and responsibilities assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

**Article 3. CONTRACT TIMES.**

3.1. The Work will be substantially completed within 335 days after the date when the Contract Times commence to run as provided in Paragraph 2.3 of the General Conditions and will be completed and ready for final payment in accordance with Paragraph 15.9 of the General Conditions within 365 days after the date when the Contract Times commence to run.

3.2. *Liquidated Damages.* OWNER and CONTRACTOR recognize that time is of the essence to this Agreement and that OWNER will suffer financial loss if the Work is not completed within the times specified in Paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense, and difficulties involved in proving the actual loss suffered by OWNER if the Work is not completed on time. Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty), CONTRACTOR shall pay OWNER Two Thousand\_dollars (\$2,000) for each day that expires after the time specified in Paragraph 3.1 above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if CONTRACTOR shall neglect, refuse, or fail to complete the remaining Work within the time specified in Paragraph 3.1 above for completion and readiness for final payment or any proper extension thereof granted by OWNER, CONTRACTOR shall pay OWNER Two Thousand\_dollars (\$2,000) for each day that expires after the time specified in Paragraph 3.1 for completion and readiness for final payment.

**Article 4. CONTRACT PRICE.**

OWNER shall pay CONTRACTOR for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the sum of the amounts as indicated in the Bid, Section 00300.

As provided in Paragraph 11.4.1 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classification are to be made by PROJECT MANAGER as provided in Paragraph 9.7 of the General Conditions. Unit prices have been computed as provided in Paragraph 11.4 of the General Conditions.

**Article 5. PAYMENT PROCEDURES.**

CONTRACTOR shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by the PROJECT MANAGER as provided in the General Conditions.

5.1. *Progress Payments; Retainage.* Subject to OWNER's right to withhold payment in Paragraph 15.4.4 of the General Conditions, OWNER shall make progress payments on account of the Contract Price on the basis of CONTRACTOR's completed Applications for Payment as recommended by PROJECT MANAGER, on or about the 25<sup>th</sup> day of each month during construction as provided in Paragraphs 5.1.1. and 5.1.2. below. All such payments will



be measured by the schedule of values established in Paragraph 2.4.2.3 of the General Conditions (and in the case of Unit Price Work based on the number of units completed).

5.1.1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as PROJECT MANAGER shall determine, or OWNER may withhold, in accordance with Paragraph 15.4.4 of the General Conditions.

95 percent of Work completed and included in the Application for Payment (with the balance being retainage).

85 percent (with the balance being retainage) of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to OWNER as provided in Paragraph 15.2 of the General Conditions) and included in the Application for Payment.

5.1.2. Upon Substantial Completion and submission of a completed Application for Payment, in an amount sufficient to increase total payments to CONTRACTOR to 98 percent of the Contract Price (with the balance being retainage), less such amounts as PROJECT MANAGER shall determine, or OWNER may withhold, in accordance with Paragraph 15.4.4 of the General Conditions.

5.2. *Final Payment.* Upon final completion and acceptance of the Work in accordance with Paragraph 15.9 of the General Conditions and submission of a completed Application for Payment, OWNER shall pay the remainder of the Contract Price as recommended by PROJECT MANAGER as provided in said Paragraph 15.9.

## **Article 6. NOT USED**

## **Article 7. CONTRACTOR'S REPRESENTATIONS.**

In order to induce OWNER to enter into this Agreement, CONTRACTOR makes the following representations and warranties:

7.1. CONTRACTOR has examined and carefully studied the Contract Documents (including the Addenda listed in Article 8) and the other related data identified in the Bidding Documents including "technical data."

7.2. CONTRACTOR has visited the site, has conducted all testing at the site CONTRACTOR deems necessary, has become familiar with, has taken into consideration in formulating its BID, and accepts the general, local, and site conditions that may affect cost, progress, performance and furnishing of the Work;

7.3. CONTRACTOR is familiar with and has taken into consideration in formulating its BID and accepts all federal, state, and local Laws and Regulations that may affect cost, progress, performance, and furnishing of the Work.

7.4. CONTRACTOR has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site which have been identified in the Supplementary Conditions as provided in paragraph 4.2.1 of the General Conditions. CONTRACTOR accepts the determination set forth in paragraph SC-4.2 of the Supplementary Conditions of the extent of the “technical data” contained in such reports and drawings upon which CONTRACTOR is entitled to rely as provided in paragraph 4.2 of the General Conditions. CONTRACTOR understands, acknowledges, and agrees that such reports are not Contract Documents and may not be complete for CONTRACTOR’s purposes. CONTRACTOR understands, acknowledges, and agrees that OWNER, PROJECT MANAGER, and ENGINEER are not responsible for and make no warranties regarding the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to surface and subsurface conditions. CONTRACTOR has obtained and carefully studied and is responsible for obtaining and studying any and all such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto as may be necessary. CONTRACTOR does not consider that any additional examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price and other terms and conditions of the Contract Documents.

7.5. CONTRACTOR is aware of the general nature of work to be performed by OWNER and others at the site that relates to Work for which this BID is submitted as indicated in the Contract Documents.

7.6. CONTRACTOR has correlated the information known to CONTRACTOR, information and observations obtained from visits to the site, reports and PLANS identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies, and data with the Contract Documents.

7.7. CONTRACTOR has given PROJECT MANAGER written notice of all conflicts, errors, ambiguities or discrepancies that CONTRACTOR has discovered in the Contract Documents, and the written resolution thereof by PROJECT MANAGER is acceptable to CONTRACTOR, CONTRACTOR has no questions regarding the Work, CONTRACTOR has all information necessary to make a fully informed BID, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this BID is submitted.

7.8. CONTRACTOR represents and warrants that CONTRACTOR (i) is qualified and experienced, (ii) is capable of performing the Work and has available resources to perform the Work, and (iii) understands and agrees to the terms of all of the Contract Documents.

## **Article 8. CONTRACT DOCUMENTS.**

The Contract Documents that comprise the entire agreement between OWNER and CONTRACTOR concerning the Work consist of the following:

- 8.1. This Agreement (pages 1 to 8, inclusive).
- 8.2. Bid Form (pages 1 to 23, inclusive) marked Section 00300.
- 8.3. Construction Performance Bond, Payment Bond, and One-Year Maintenance Bond, identified as Sections 00610, 00620, and 00630 consisting of 4, 2, and 4 pages, respectively.
- 8.4. Other Exhibits to this Agreement (pages N\A to N\A, inclusive) (if any).
- 8.5. Notice to Proceed.
- 8.6. General Conditions (pages i to 60, inclusive), marked Section 00700.
- 8.7. Supplementary Conditions (pages 1 to 6, inclusive), marked Section 00800.
- 8.8. Specifications, bearing the title 60-INCH AND 54-INCH WATERLINE ALONG GRANT ROAD AND COPELAND ROAD PROJECT NO. 28-B and consisting of 1 volumes, as listed in table of contents thereof.
- 8.9. PLANS consisting of a cover sheet and sheets numbered 1 through 99 inclusive with each sheet bearing the following general title: North Harris County Regional Water Authority, Project 28-B Proposed 60" and 54" Water Line Along Grant Road and Copeland Road.

The documents listed in Article 8.2 et seq. above are attached to this Agreement (except as expressly noted otherwise above).

There are no Contract Documents other than those listed above in this Article. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraphs 3.3.1 and 3.3.2 of the General Conditions.

**Article 9. MISCELLANEOUS.**

- 9.1. Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 9.2. No assignment by CONTRACTOR of any rights under or interests in the Contract Documents will be binding on OWNER or effective without the prior written consent of the OWNER; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

9.3. OWNER and CONTRACTOR each binds itself, its partners, successors, assigns, and legal representatives to the other party hereto, its partners, successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

9.4. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon OWNER and CONTRACTOR, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision. If, however, the void or unenforceable provision is of the essence of this Agreement, nothing in this Paragraph 9.4 shall prevent this entire Agreement from being void.

9.5. OTHER PROVISIONS. As noted hereinafter:

9.5.1. The following Articles shall survive termination of this Agreement: 3 (Contract Times); 7 (Contractor's Representations); and 9 (Miscellaneous).

9.5.2. Headings and titles of Articles in this Agreement are included herein for convenience of reference only and shall not constitute a part of the Agreement for any other purpose and will not affect in any way the meaning or interpretation of this Agreement.

9.5.3. This Agreement as executed by authorized representatives of OWNER and CONTRACTOR constitutes the entire Agreement between the parties with respect to matters herein, and there are no oral or written understandings, representations, or commitments of any kind, express or implied, not expressly set forth herein.

9.5.4. This Agreement, its interpretation, and any disputes relating to, arising out of, or connected with this Agreement, shall be governed by the laws of the State of Texas, without regard to conflicts of law provisions. Any dispute relating to, arising out of, or connected with this Agreement shall be filed and maintained in the state or federal courts located in Harris County, Texas, unless otherwise agreed by the parties in connection with an Alternative Dispute Resolution Agreement.

9.5.5. Each party hereto represents and warrants that the person executing this Agreement on its behalf is duly authorized and empowered to do so and that all formalities necessary for its approval of this Agreement have been satisfied.

9.5.6. CONTRACTOR undertakes performance of the Work as an independent contractor. Nothing herein shall create a relationship of employer and employee, joint venture, or partnership between OWNER and CONTRACTOR, its agents, representatives, employees, or subcontractors for any purpose whatsoever. Nothing herein shall create a relationship of principal and agent between OWNER and CONTRACTOR, its agents, employees, representatives, or subcontractors. Neither party shall have the authority to bind or obligate the other in any manner as a result of the relationship created hereby.

9.5.7. Upon payment of a portion of the Work, CONTRACTOR shall be deemed to have sold and conveyed to OWNER, and OWNER shall be deemed to have purchased from CONTRACTOR all of CONTRACTOR's right, title, and interest in the Work. From and after the date of such payment, within fifteen (15) days of the request of OWNER, CONTRACTOR shall execute and deliver such bills of sale and other instruments of conveyance, assignment, transfer, and delivery as OWNER may reasonably request in order to convey such right, title, and interest to OWNER. From and after the date of such payment, title to the Work shall remain with OWNER.

9.5.8. CONTRACTOR fully understands, and will assure that its subcontractors and suppliers fully understand that OWNER is a public entity and thus (1) an entity against which no mechanics lien may be asserted, and (2) an entity that can be bound only by agents with actual authority and (3) an entity that can only be bound to make payments from funds actually available for the performance of this Agreement.

9.5.9. Waiver of any breach of the Contract shall not constitute waiver of a subsequent breach.

9.5.10. Although the Contract Documents have been largely drafted by OWNER, in the event of any disputes over meaning and application, the Contract Documents shall be interpreted fairly and reasonably neither more strongly for nor against either party.

**North Harris County Regional Water Authority**

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IN WITNESS WHEREOF, OWNER and CONTRACTOR have signed this Agreement in triplicate. One counterpart each has been delivered to OWNER, CONTRACTOR, and PROJECT MANAGER. All portions of the Contract Documents have been signed, initialed, or identified by OWNER and CONTRACTOR or identified by PROJECT MANAGER on their behalf.

This Agreement will be effective on \_\_\_\_\_, (which is the Effective Date of the Agreement).

OWNER North Harris County CONTRACTOR \_\_\_\_\_  
Regional Water Authority \_\_\_\_\_

By: \_\_\_\_\_ By: \_\_\_\_\_

[CORPORATE SEAL]

[CORPORATE SEAL]

Attest \_\_\_\_\_ Attest \_\_\_\_\_

Address for giving notices

Address for giving notice

3648 Cypress Creek Pkwy, Suite 110 \_\_\_\_\_

Houston, TX 77068 \_\_\_\_\_

(OWNER is public body. Evidence of authority to sign and resolution or other documents authorizing execution of Agreement is attached.)

If CONTRACTOR is a corporation, attach evidence of authority to sign).

APPROVED:

\_\_\_\_\_  
Mr. Jimmie Schindewolf, P.E.  
General Manager

**END OF SECTION**

**CONSTRUCTION PERFORMANCE BOND**

Any singular reference to Contractor, Surety, OWNER, or other party shall be considered plural where applicable.

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CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

North Harris County Regional Water Authority  
3648 Cypress Creek Pkwy., Suite 110  
Houston, Texas 77068

CONSTRUCTION CONTRACT

Date:

Amount (In Numbers and Words):

Description (Name and Location):

BOND

Date (Not earlier than Contract Date):

Amount (In Numbers and Words):

Modifications to this Bond Form:

CONTRACTOR AS PRINCIPAL

Company:

(Corp. Seal)

SURETY

Company:

(Corp. Seal)

Signature: \_\_\_\_\_

Name and Title

Signature: \_\_\_\_\_

Name and Title

**WHEREAS:**

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their officers, directors, shareholders, partners, heirs, executors, administrators, successors, and assigns to the OWNER for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the CONTRACTOR performs the Construction Contract, the Surety and the CONTRACTOR shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1 hereinafter.
3. If there is no OWNER Default, the Surety's obligation under this Bond shall arise after:
  - 3.1. The OWNER has notified the CONTRACTOR and the Surety at its address (described on signature page) that the OWNER is considering declaring a CONTRACTOR Default and that the OWNER has requested and attempted to arrange a conference with the CONTRACTOR and Surety to be held not later than fifteen (15) days after receipt of such notice to discuss methods of performing the Construction Contract. If the OWNER, the CONTRACTOR, and Surety agree, the CONTRACTOR shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the OWNER's right, if any, subsequently to declare a CONTRACTOR Default; and
  - 3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the contract. Such CONTRACTOR Default shall not be declared earlier than twenty (20) days after the CONTRACTOR and the Surety have received notice as provided in Subparagraph 3.1; and
  - 3.3. The OWNER has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the OWNER.
4. When the OWNER has satisfied the conditions of Paragraph 3, the Surety shall, within thirty (30) days after notice of default, and at the Surety's expense, take one of the following actions:
  - 4.1. Arrange for the CONTRACTOR, with consent of the OWNER, to perform and complete the Construction Contract; or
  - 4.2. Undertake to perform and complete the Construction Contract itself, through its agents, or through independent contractors; or
  - 4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the OWNER for a contract for performance and completion of the Construction Contract; arrange for a contract to be prepared for execution by the OWNER and the contractor selected with the OWNER's concurrence to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract; and pay to the OWNER the amount of damages, as described in Paragraph 6 hereinafter, in excess of the balance of the Contract Price incurred by the OWNER resulting from the CONTRACTOR's default; or



4.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor with reasonable promptness under the circumstances:

4.4.1. After investigation, determine the amount for which it may be liable to the OWNER and, as soon as practicable after the amount is determined, tender payment therefor to the OWNER; or

4.4.2. Deny liability in whole or in part and notify the OWNER citing reasons therefor.

5. If the Surety does not proceed as provided in Paragraph 4, the Surety shall be deemed to be in default on this Bond. The OWNER shall be entitled to enforce any remedy available to the OWNER. If the Surety proceeds as provided in Subparagraph 4.4 above, and the OWNER refuses the payment tendered, or the Surety has denied liability, in whole or in part, without further notice, the OWNER shall be entitled to enforce any remedy available to the OWNER.

6. After the OWNER has terminated the CONTRACTOR's right to complete the Construction Contract, and if the Surety elects to act under Subparagraph 4.1, 4.2 or 4.3 above, then the responsibilities of the Surety to the OWNER shall not be greater than those of the CONTRACTOR under the Construction Contract, and the responsibilities of the OWNER to the Surety shall not be greater than those of the OWNER under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the OWNER of the Balance of the Contract Price, and subject to mitigation of costs and damages on the Construction Contract, the Surety is obligated and subject without duplication for:

6.1. The responsibilities of the CONTRACTOR for correction of defective work and completion of the Construction Contract;

6.2. Additional legal, design professional, and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4 above; and

6.3. Liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or nonperformance of the CONTRACTOR.

7. The Surety shall not be liable to the OWNER or others for obligations of the CONTRACTOR that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontractors, purchase orders, and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within one year after CONTRACTOR Default, or within one year after the CONTRACTOR ceased working, or within two years after the Surety refuses or fails to perform its

obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER, or the CONTRACTOR shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom, and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. This Bond shall remain in effect one year beyond the date of approval of the project by the engineer of the political subdivision, or as provided otherwise by Laws or Regulations, or by the Contract Documents.

13. Definitions.

13.1. Balance of the Contract Price. The total amount payable by the OWNER to the CONTRACTOR under the Construction Contract after all contractual adjustments, have been made, including allowance to the CONTRACTOR of any amounts received or to be received by the OWNER in settlement of insurance or other claims for damages to which the CONTRACTOR is entitled, reduced by all valid and proper payments made to which the CONTRACTOR, in accordance with the Contract, is due.

13.2. Construction Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

13.3. CONTRACTOR Default: Failure of the CONTRACTOR, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

13.4. OWNER Default: Failure of the OWNER, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

**END OF SECTION**



ATTEST, SEAL: (if a corporation)

WITNESS: (if not a corporation)

\_\_\_\_\_  
(Name of Contractor)

By: \_\_\_\_\_

Name:

Title:

By: \_\_\_\_\_

Name:

Title:

Date:

ATTEST/WITNESS (SEAL)

\_\_\_\_\_  
(Full Name of Surety)

By: \_\_\_\_\_

Name:

Title:

Date:

\_\_\_\_\_  
(Address of Surety for Notice)

By: \_\_\_\_\_

Name:

Title:

Date

**ONE-YEAR MAINTENANCE BOND**

Any singular reference to Contractor, Surety, OWNER, or other party shall be considered plural where applicable.

---

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

North Harris County Regional Water Authority  
3648 Cypress Creek Pkwy., Suite 110  
Houston, Texas 77068

CONSTRUCTION CONTRACT

Date:

Amount (In Numbers and Words):

Description (Name and Location):

BOND

Date (Not earlier than Contract Date):

Amount (In Numbers and Words):

Modifications to this Bond Form:

CONTRACTOR AS PRINCIPAL

Company:

(Corp. Seal)

SURETY

Company:

(Corp. Seal)

Signature: \_\_\_\_\_  
Name and Title

Signature: \_\_\_\_\_  
Name and Title

**WHEREAS:**

1. The CONTRACTOR and the Surety, jointly and severally, bind themselves, their officers, directors, shareholders, partners, heirs, executors, administrators, successors, and assigns to the OWNER for the performance of the Construction Contract during the warranty and guarantee periods, which is incorporated herein by reference.
2. If the CONTRACTOR repairs any and all Defects in Work during the maintenance period, the Surety and the CONTRACTOR shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1.
3. If there is no OWNER Default, the Surety's obligation under this Bond shall arise after:
  - 3.1. The OWNER has notified the CONTRACTOR and the Surety at its address described on signature page that the OWNER is considering declaring a CONTRACTOR Default and has requested and attempted to arrange a conference with the CONTRACTOR and Surety to be held not later than fifteen (15) days after receipt of such notice to discuss methods of performing the Construction Contract. If the OWNER, the CONTRACTOR, and the Surety agree, the CONTRACTOR shall be allowed a reasonable time to perform the Warranty Work, but such an agreement shall not waive the OWNER's right, if any, subsequently to declare a CONTRACTOR Default; and
  - 3.2. The OWNER has declared a CONTRACTOR Default and formally terminated the CONTRACTOR's right to complete the Warranty Work. Such CONTRACTOR Default shall not be declared earlier than twenty (20) days after the CONTRACTOR and the Surety have received notice as provided in Subparagraph 3.1; and
4. When the OWNER has satisfied the conditions of Paragraph 3 above, the Surety shall, within thirty (30) days after notice of default, and at the Surety's expense, take one of the following actions:
  - 4.1. Arrange for the CONTRACTOR, with consent of the OWNER, to perform and complete the Warranty Work; or
  - 4.2. Undertake to perform and complete the Warranty Work itself, through its agents or through independent contractors; or
  - 4.3. Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:
    - 4.3.1 After investigation, determine the amount for which it may be liable to the OWNER, and as soon as practicable after the amount is determined, tender payment therefor to the OWNER; or
    - 4.3.2 Deny liability in whole or in part and notify the OWNER citing reasons therefor.

5. If the Surety does not proceed as provided in Paragraph 4, the Surety shall be deemed to be in default on this Bond fifteen (15) days after receipt of an additional written notice from the OWNER to the Surety demanding that the Surety perform its obligations under this Bond, and the OWNER shall be entitled to enforce any remedy available to the OWNER. If the Surety proceeds as provided in Subparagraph 4.3, and the OWNER refuses the payment tendered, or the Surety has denied liability, in whole or in part, without further notice, the OWNER shall be entitled to enforce any remedy available to the OWNER.

6. After the OWNER has terminated the CONTRACTOR's right to complete the Warranty Work, and if the Surety elects to act under Subparagraph 4.1 or 4.2 above, then the responsibilities of the Surety to the OWNER shall not be greater than those of the CONTRACTOR under the Construction Contract, and the responsibilities of the OWNER to the Surety shall not be greater than those of the OWNER under the Construction Contract. To the limit of the amount of this Bond, the Surety is obligated without duplication for:

6.1. The responsibilities of the CONTRACTOR for correction of defective work;

6.2. Additional legal, design professional, and delay costs resulting from the CONTRACTOR's Default, and resulting from the actions or failure to act of the Surety under Paragraph 4 above; and

7. The Surety shall not be liable to the OWNER or others for obligations of the CONTRACTOR that are unrelated to the Construction Contract. No right of action shall accrue on this Bond to any person or entity other than the OWNER or its heirs, executors, administrators, or successors.

8. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontractors, purchase orders and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within one year after CONTRACTOR Default, or within one year after the CONTRACTOR ceased working, or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law; the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the OWNER, or the CONTRACTOR shall be mailed or delivered to the address shown on the signature page.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom, and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common-law bond.

12. Definitions.

12.1. Construction Contract: The agreement between the OWNER and the CONTRACTOR identified on the signature page, including all Contract Documents and changes thereto.

12.2. CONTRACTOR Default: Failure of the CONTRACTOR, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

12.3. OWNER Default: Failure of the OWNER, which has neither been remedied nor waived, to pay the CONTRACTOR as required by the Construction Contract, or to perform and complete or comply with the other terms thereof.

**END OF SECTION**



**SECTION 00700**  
**GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT**  
**TABLE OF CONTENTS**

	<u><b>PAGE NO.</b></u>
 <b>ARTICLE 1 DEFINITIONS</b>	
1.01. Addenda	1
1.02. Agreement	1
1.03. Application for Payment	1
1.04. Asbestos	1
1.05. Bid	1
1.06. Bidder	1
1.07. Bidding Documents	1
1.08. Bidding Requirements	1
1.09. Bonds	1
1.10. Change Order	1
1.11. Contract Documents	1
1.12. Contract Price	2
1.13. Contract Times	2
1.14. Contractor	2
1.15. Days	2
1.16. Defective	2
1.17. Effective Date of the Agreement	2
1.18. Engineer	2
1.19. Engineer's Subconsultant	2
1.20. Field Order	2
1.21. General Requirements	2
1.22. Hazardous Waste	2
1.23. Issuing Office	3
1.24. Laws and Regulations; Laws or Regulations	3
1.25. Liens	3
1.26. Milestone	3
1.27. Notice of Award	3
1.28. Notice to Proceed	3
1.29. OWNER	3
1.30. Partial Utilization	3
1.31. PCBs	3
1.32. Petroleum	4
1.33. PLANS	4
1.34. Project	4
1.35. Project Manager	4
1.36. Radioactive Material	4
1.37. Samples	4
1.38. Shop Drawings	4
1.39. Specifications	4
1.40. Subcontractor	4
1.41. Substantial Completion	4

	<b><u>PAGE NO.</u></b>
1.42. Successful Bidder	4
1.43. Supplementary Conditions	4
1.44. Supplier	5
1.45. Underground Facilities	5
1.46. Unit Price Work	5
1.47. Work	5
1.48. Work Change Directive	5

**ARTICLE 2 PRELIMINARY MATTERS**

2.1. Delivery of Bonds	5
2.2. Copies of Documents	5
2.3. Commencement of Contract Times, Notice to Proceed	5
2.4. Before Starting Construction	6
2.5. Pre-construction Conference	7
2.6. Initially Acceptable Schedules	7

**ARTICLE 3 CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE**

3.1. Intent	7
3.2. Reference to Standards and Specifications of Technical Societies, Reporting and Resolving Discrepancies	8
3.3. Amending and Supplementing Contract Documents	9
3.4. Reuse of Documents	9

**ARTICLE 4 AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL  
CONDITIONS; REFERENCE POINTS**

4.1. Availability of Lands	10
4.2. Subsurface and Physical Conditions	10
4.3. Physical Conditions - Underground Facilities	12
4.4. Reference Points	14
4.5. Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material	14

**ARTICLE 5 BOND AND INSURANCE**

5.1. Construction Performance Bond, Payment Bond, and One-Year Maintenance Bond	15
5.2. Licensed Sureties and Insurers; Certificates of Insurance	15
5.3. Contractor's Liability Insurance	16
5.4. OWNER's Liability Insurance	19
5.5. Waiver of Rights	19
5.6. Receipt and Application of Insurance Proceeds	20

	<b><u>PAGE NO.</u></b>
5.7. Option to Replace	20
5.8. Partial Utilization - Property Insurance	20
5.9. Risk of Loss	20
 <b>ARTICLE 6 CONTRACTOR'S RESPONSIBILITY</b>	
6.1. Supervision and Superintendence	21
6.2. Labor, Materials, and Equipment	21
6.3. Progress Schedule	22
6.4. "Or-Equal" Items	22
6.5. Concerning Subcontractors, Suppliers, and Others	23
6.6. Patent Fees and Royalties	24
6.7. Permits	25
6.8. Laws and Regulations	25
6.9. Taxes	26
6.10. Use of Premises	26
6.11. Record Documents	27
6.12. Safety and Protection	27
6.13. Safety Representative	28
6.14. Hazard Communication Programs	28
6.15. Emergencies	28
6.16. Shop Drawings and Samples	29
6.17. Shop Drawings and Samples Submittal Procedures	29
6.18. Continuing the Work	30
6.19. Contractor's General Warranty and Guarantee	31
6.20. Indemnification	31
6.21. Survival of Obligations	33
 <b>ARTICLE 7 OTHER WORK</b>	
7.1. Related Work at Site	33
 <b>ARTICLE 8 OWNER'S RESPONSIBILITIES</b>	
8.1. Replacement of PROJECT MANAGER or ENGINEER	34
8.2. Furnish Data	34
8.3. Lands and Easements; Reports and Tests	34
8.4. Limitations on OWNER's Responsibilities	35
 <b>ARTICLE 9 PROJECT ENGINEER'S/ENGINEER'S STATUS DURING CONSTRUCTION</b>	
9.1. OWNER's Representative	35
9.2. Visits to Site	35
9.3. Clarifications and Interpretations	36

	<b><u>PAGE NO.</u></b>
9.4. Authorized Variations in Work	36
9.5. Rejecting Defective Work	36
9.6. Shop Drawings, Change Orders, and Payments	36
9.7. Determinations for Unit Prices	37
9.8. Limitations on PROJECT MANAGER'S and ENGINEER's Authority and Responsibilities	37
 <b>ARTICLE 10 CHANGES IN THE WORK</b>	
10.1. Changes in the Work	38
 <b>ARTICLE 11 CHANGE OF CONTRACT PRICE</b>	
11.1. Change of Contract Price	39
11.2. Cost of the Work	40
11.3. Allowances	44
11.4. Unit Price Work	44
 <b>ARTICLE 12 CHANGE OF CONTRACT TIMES</b>	
12.1. Claim for Adjustment	45
12.2. Time of the Essence	46
12.3. Compensatory Delays	46
12.4. Excusable Delays	46
 <b>ARTICLE 13 DISPUTE RESOLUTION</b>	
13.1. Claims	46
13.2. Claims Handling During Construction	46
13.3. Claims Handling Following Construction	47
 <b>ARTICLE 14 TESTS AND INSPECTIONS, CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK</b>	
14.1. Notice of Defects	47
14.2. Access to Work	47
14.3. Tests and Inspections	47
14.4. Uncovering Work	48
14.5. OWNER May Stop the Work	49
14.6. Correction or Removal of Defective Work	49
14.7. Correction Period	49
14.8. Acceptance of Defective Work	49

**PAGE NO.**

14.9.	OWNER May Correct Defective Work	50
-------	----------------------------------	----

**ARTICLE 15 PAYMENTS TO CONTRACTOR AND COMPLETION**

15.1.	Schedule of Values	50
15.2.	Application for Progress Payment	51
15.3.	Contractor's Warranty of Title	51
15.4.	Review of Applications for Progress Payment	51
15.5.	Substantial Completion	53
15.6.	Partial Utilization	54
15.7.	Final Inspection	54
15.8.	Final Application for Payment	54
15.9.	Final Payment and Acceptance	55
15.10.	Waiver of Claims	56

**ARTICLE 16 SUSPENSION OF WORK AND TERMINATION**

16.1.	OWNER May Suspend Work	56
16.2.	OWNER May Terminate	56
16.3.	Contractor May Stop Work or Terminate	58
16.4.	Termination Conversion	58

**ARTICLE 17 MISCELLANEOUS**

17.1.	Giving Notice	58
17.2.	Computation of Times	58
17.3.	Notice of Claim	59
17.4.	Cumulative Remedies	59
17.5.	Setoff	59
17.6.	Voluntary Agreement	59
17.7.	Invalidities	60
17.8.	Multiple Counterparts	60
17.9.	No Third Party Beneficiaries	60
17.10.	Governing Law	60

**GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT**

**ARTICLE 1 DEFINITIONS**

Whenever used in these GENERAL CONDITIONS or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

1.01. *Addenda*-Written or graphic instruments issued by ENGINEER prior to the receipt of bids which clarify, correct, or change the Bidding Requirements or the Contract Documents.

1.02. *Agreement*-The written contract between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provided therein.

1.03. *Application for Payment*-A request from CONTRACTOR for a progress or final payment on the form accepted by ENGINEER and which is accompanied by such supporting documentation as is required by the Contract Documents.

1.04. *Asbestos*-Any material that contains more than one percent (1%) asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

1.05. *BID*-The offer or proposal of the BIDDER submitted on the prescribed form setting forth the required information, including prices for the Work to be performed.

1.06. *Bidder* - one who submits a bid directly to OWNER as distinct from a sub-bidder, who submits a bid to a BIDDER.

1.07. *Bidding Documents*-The advertisement or Invitation to Bid, Instructions to Bidders, the Bid form, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids).

1.08. *Bidding Requirements*-The information requested by and conditions for bidding set forth in the advertisement or Invitation to Bid, Instructions to Bidders, and the Bid form.

1.09. *Bonds*-Performance and Payment bonds and other instruments of security.

1.10. *Change Order*-A document prepared by ENGINEER, which is signed by CONTRACTOR and OWNER and authorizes an addition, deletion, or revision in the Work, or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

1.11. *Contract Documents*-Contract Documents are those documents listed at Article 8 of the Agreement. Shop Drawing submittals approved pursuant to Paragraphs 6.17.4 and 6.17.5 and the reports referred to in Paragraphs 4.2.1 and 4.2.2 are not Contract Documents.

1.12. *Contract Price*-The amount agreed to by OWNER and CONTRACTOR for completion of the Work, in accordance with the Contract Documents, as stated in Article 4 of the Agreement (subject to the provisions of Paragraph 11.3.1 in the case of Unit Price Work), and as adjusted by any Change Orders.

1.13. *Contract Times*-The numbers of days following the date for starting performance set out in a Notice to Proceed, if any, or the dates stated in the Agreement: (i) to achieve Substantial Completion, and (ii) to complete the Work so that it is ready for final payment as evidenced by ENGINEER's written recommendation of final payment in accordance with Paragraph 15.9.1.

1.14. *CONTRACTOR*-The person, firm, or corporation with whom OWNER has entered into the Agreement.

1.15. *Days*-When days are used in the documents, it is implied to be calendar days, unless otherwise noted.

1.16. *Defective*-An adjective which, when modifying the word Work, refers to Work that is unsatisfactory, faulty, or deficient, in that it does not conform to, or has not been performed in accordance with, the Contract Documents to the extent that such Work is not capable of performing its intended function in an efficient manner, or does not meet the requirements of any inspection, reference standard, test, or approval referred to in the Contract Documents, or has been damaged prior to the making of final payment.

1.17. *Effective Date of the Agreement*-The date indicated in the Agreement on which it becomes effective; but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

1.18. *ENGINEER*-The person, firm, or corporation named as such in the Agreement who has performed the designed work for the Project.

1.19. *ENGINEER's Subconsultant*-A person, firm, or corporation having a contract with ENGINEER to furnish services as ENGINEER's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

1.20. *Field Order*-A written order issued by PROJECT MANAGER which orders minor changes in the Work in accordance with Paragraph 9.4 but which does not involve a change in the Contract Price or the Contract Times.

1.21. *General Requirements*-Sections of Division 1 of the Specifications.

1.22. *Hazardous Waste*-The term Hazardous Waste shall mean (i) any hazardous materials, hazardous wastes, hazardous substances, and toxic substances as those or similar terms are defined under any Environmental Laws; (ii) any Asbestos or any material which contains any hydrated mineral silicate, including chrysolite, amosite, crocidolite, tremolite, anthophyllite, and/or actinolite, whether friable or non-friable; (iii) any PCBs or PCB-containing materials, or fluids; (iv) radon; (v)

any other hazardous, radioactive, toxic, or noxious substance, material, pollutant, or solid, liquid, or gaseous waste; (vi) any pollutant or contaminant (including petroleum, petroleum hydrocarbon, petroleum products, crude oil, and any fractions thereof; any oil or gas exploration or production waste, and natural gas, synthetic gas, and any mixtures thereof) that in its condition, concentration, or area of release could have a significant effect on human health, the environment, or natural resources; (vii) any substance that, whether by its nature or its use, is subject to regulation under any Environmental Law or, with respect to which any Environmental Law or Governmental Authority, requires environmental investigation, monitoring, or remediation; (viii) any Radioactive Material; and (ix) any underground storage tanks, as defined in 42 U.S.C. Section 699(1)(A)(I) (including those defined by Section 9001[1] of the 1984 Hazardous and Solid Waste Amendments to the Resource Conservation Act, 42 U.S.C. Section 6901 et seq.; the Texas Water Code Annotated Section 26.344; and Title 30 of the Texas Administrative Code Sections 334.3 and 334.4), whether empty, filled, or partially filled with any substance.

1.23. *Issuing Office* - the office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

1.24. *Laws and Regulations; Laws or Regulations*-Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction over the Work, the Project, and/or the CONTRACTOR's performance of the Work.

1.25. *Liens*-Liens, charges, security interests, or encumbrances upon real property or personal property.

1.26. *Milestone*-A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

1.27. *Notice of Award*-The written notice by OWNER to the apparent Successful Bidder stating that, upon compliance by the apparent Successful Bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

1.28. *Notice to Proceed*-A written notice given by OWNER to CONTRACTOR (with a copy to PROJECT MANAGER) fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR's obligation under the Contract Documents.

1.29. *OWNER*-The North Harris County Regional Water Authority (Authority) which is a party to the Agreement and for whom the Work is to be provided.

1.30. *Partial Utilization*-Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work in accordance with Paragraph 15.6.

1.31. *PCBs*-Polychlorinated biphenyls.



1.32. *Petroleum*-Petroleum, including crude oil or any fraction thereof, which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Wastes and crude oils.

1.33. *PLANS*-The PLANS which show the scope, extent, and character of the Work to be furnished and performed by CONTRACTOR and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents. Shop drawings are not PLANS.

1.34. *Project*-The total construction of which the Work to be provided under the Contract Documents may be the whole, or a part as indicated elsewhere in the Contract Documents.

1.35. *PROJECT MANAGER*-The person, firm, or corporation named as such in the Agreement.

1.36. *Radioactive Material*-Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

1.37. *Samples*-Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

1.38. *Shop Drawings*-All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR to illustrate some portion of the Work.

1.39. *Specifications*-Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

1.40. *Subcontractor*-An individual, firm, or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

1.41. *Substantial Completion*-The Work (or a specified part thereof) has progressed to the point where, in the opinion of PROJECT MANAGER and OWNER as evidenced by PROJECT MANAGER's and OWNER's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

1.42. *Successful Bidder*-the BIDDER submitting the lowest responsive, responsible and best BID to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

1.43. *Supplementary Conditions*-The part of the Contract Documents which amends or supplements these GENERAL CONDITIONS.

1.44. *Supplier*-A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated into the Work by CONTRACTOR or any Subcontractor.

1.45. *Underground Facilities*-All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities which have been installed underground.

1.46. *Unit Price Work*-Work to be paid for on the basis of unit prices.

1.47. *Work*-The entire completed construction or the various separately identifiable parts thereof required to be furnished by the CONTRACTOR under the Contract Documents. Work includes and is the result of the CONTRACTOR performing or furnishing all labor, furnishing and incorporating all materials and equipment into the construction, performing or furnishing all services, and furnishing all documents, all as required by the Contract Documents.

1.48. *Work Change Directive*-A written directive to CONTRACTOR, issued on or after the Effective date of the Agreement and signed by OWNER and prepared by ENGINEER, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed, as provided in Paragraph 4.2 or 4.3, or to emergencies under Paragraph 6.15. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change directed or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times as provided in Paragraph 10.1.2.

## **ARTICLE 2 PRELIMINARY MATTERS**

### **2.1. Delivery of Bonds**

2.1.1 When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as CONTRACTOR may be required to furnish in accordance with Paragraph 5.1.

### **2.2. Copies of Documents**

OWNER shall furnish to CONTRACTOR, with the Notice to Proceed, up to five (5) copies (unless otherwise specified in the Supplementary Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

### **2.3. Commencement of Contract Times, Notice to Proceed**

If the Contract specifies calendar dates for Substantial Completion and/or Final Completion, the Contract Times shall expire on those dates. If the Contract specifies a number of days following a

date for starting performance set out in a Notice to Proceed, the Contract Times shall expire accordingly. CONTRACTOR shall not begin performance of Work on the Site without receiving permission to do so from the OWNER. However, if OWNER has not given permission to begin Work on the site by 30 days after the Effective Date of the Agreement, CONTRACTOR may begin Work at the Site on that date.

#### **2.4. Before Starting Construction**

2.4.1. Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and check and verify all applicable field measurements. CONTRACTOR shall promptly report in writing to PROJECT MANAGER any conflict, error, ambiguity, or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from PROJECT MANAGER before proceeding with any Work affected thereby; **NEITHER OWNER, PROJECT MANAGER, NOR ENGINEER SHALL BE LIABLE TO CONTRACTOR, AND CONTRACTOR SHALL NOT BE ENTITLED TO AN INCREASE IN THE CONTRACT PRICE OR THE CONTRACT TIMES, FOR ANY COSTS, EXPENSES, DAMAGES, OR DELAYS ASSOCIATED WITH ANY CONFLICT, ERROR, AMBIGUITY, OR DISCREPANCY IN THE CONTRACT DOCUMENTS WHICH CONTRACTOR KNEW OR SHOULD HAVE KNOWN THEREOF BUT FAILED TO REPORT PURSUANT TO THIS PARAGRAPH 2.4.1, EVEN IF SUCH COSTS, EXPENSES, DAMAGES, OR DELAYS ARE DUE TO THE NEGLIGENCE, OTHER FAULT, STRICT LIABILITY WITHOUT REGARD TO FAULT, OR BREACH OF CONTRACT OF OWNER, PROJECT MANAGER, OR ENGINEER.**

2.4.2. Within ten (10) days after the Effective Date of the Agreement and before any work at the site is started (unless otherwise specified in the General Requirements), CONTRACTOR shall submit to PROJECT MANAGER for review:

2.4.2.1. a preliminary progress schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;

2.4.2.2. a preliminary schedule of Shop Drawing and Sample submittals which will list each required submittal and the times for submitting, reviewing, and processing such submittals.

2.4.2.3. a preliminary schedule of values for all of the Work which will include quantities and prices of items aggregating the Contract Price and will subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.4.3. Before any Work at the site is started, CONTRACTOR shall deliver to the OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance

(and other evidence of insurance which OWNER or any additional insured may reasonably request) which CONTRACTOR is required to purchase and maintain in accordance with this Contract.

## **2.5. Pre-construction Conference**

At the sole option of OWNER before any Work at the site is started, a conference attended by CONTRACTOR, PROJECT MANAGER, ENGINEER, and others, as appropriate, may be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.4.2.2, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining records and other items that are required by OWNER, PROJECT MANAGER, or CONTRACTOR.

## **2.6. Initially Acceptable Schedules**

At the sole option of OWNER ten (10) days before submission of the first Application for Payment, a conference attended by CONTRACTOR, PROJECT MANAGER, and others as appropriate may be held to review for acceptability to OWNER as provided below the schedules submitted in accordance with Paragraph 2.4.2. CONTRACTOR shall have an additional ten (10) days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to CONTRACTOR until the schedules are submitted to and acceptable to OWNER as provided below. The progress schedule shall provide for an orderly progression of the Work to completion within any specified Milestones and the Contract Times. Any acceptance of the progress schedule by OWNER will neither impose on OWNER responsibility for the sequencing, scheduling, or progress of the Work, nor interfere with, nor relieve CONTRACTOR from CONTRACTOR's full responsibility therefor. CONTRACTOR's schedule of Shop Drawing and Sample submissions shall provide for a workable arrangement for reviewing and processing the required submittals, but in no event shall OWNER, ENGINEER and PROJECT MANAGER have less than 3 weeks for review of such submittals. CONTRACTOR's schedule of values shall be acceptable to OWNER as to form and substance.

# **ARTICLE 3 CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE**

## **3.1. Intent**

3.1.1. The Contract Documents comprise the entire agreement between OWNER and CONTRACTOR concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. In the event of any discrepancies between the parties of the Contract Documents, or likewise, in the event of any doubt as to the meaning and intent of any portion of the Contract Documents, ENGINEER shall define that which is intended to apply to the Work, if instructed to do so by the OWNER.

3.1.2. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials, or equipment that may reasonably be inferred from the Contract Documents, or from prevailing custom or trade usage as being required to produce the intended result, will be furnished and performed by

the CONTRACTOR whether or not specifically called for. When words or phrases which have a well-known technical or construction industry or trade meaning are used to describe Work, materials or equipment, such words or phrases shall be interpreted in accordance with that meaning. Clarifications and interpretations of the Contract Documents shall be issued by PROJECT MANAGER as provided in Paragraph 9.3.

**3.2. Reference to Standards and Specifications of Technical Societies; Reporting and Resolving Discrepancies:**

3.2.1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of BIDs (or, on the Effective Date of the Agreement if there were no BIDs), except as may be otherwise specifically stated in the Contract Documents.

3.2.2. If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such Law or Regulation applicable to the performance of the Work or of any such standard, specification, manual or code or of any instruction of any Supplier referred to in Paragraph 6.2.3, CONTRACTOR shall report it to PROJECT MANAGER in writing at once, and, CONTRACTOR shall not proceed with the work affected thereby (except in an emergency as authorized by Paragraph 6.15) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.3.1 or 3.3.2; **NEITHER OWNER, PROJECT MANAGER, NOR ENGINEER SHALL BE LIABLE TO CONTRACTOR, AND CONTRACTOR SHALL NOT BE ENTITLED TO AN INCREASE IN THE CONTRACT PRICE OR THE CONTRACT TIME, FOR ANY COSTS, EXPENSES, DAMAGES, OR DELAYS ASSOCIATED WITH ANY SUCH CONFLICT, ERROR, AMBIGUITY, OR DISCREPANCY WHICH CONTRACTOR KNEW OR SHOULD HAVE KNOWN THEREOF BUT FAILED TO REPORT PURSUANT TO THIS PARAGRAPH 3.2.2, EVEN IF SUCH COSTS, EXPENSES, DAMAGES, OR DELAYS ARE DUE TO THE NEGLIGENCE, OTHER FAULT, STRICT LIABILITY WITHOUT REGARD TO FAULT, OR BREACH OF CONTRACT OF OWNER, PROJECT MANAGER, OR ENGINEER.**

3.2.3. Except as otherwise specifically stated in the Contract Documents or as may be provided by amendment or supplement thereto issued by one of the methods indicated in Paragraph 3.3, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

3.2.3.1. the provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

3.2.3.2. the provisions of any such Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

No provision of any such standard, specification, manual, code, or instruction shall be effective to change the duties and responsibilities of OWNER, CONTRACTOR, PROJECT MANAGER or ENGINEER, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to OWNER, ENGINEER, or any of PROJECT MANAGER's or ENGINEER's Consultants, agents, or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of Paragraph 9.8 or any other provision of the Contract Documents.

3.2.4. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed," "as approved," or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper," or "satisfactory," or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review, or judgment will be solely to evaluate, in general, the completed Work for compliance with the requirements of and information in the Contract Documents and conformance with the design concept of the completed Project as a functioning whole, as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective shall not be effective to assign to OWNER, PROJECT MANAGER or ENGINEER any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.8 or any other provision of the Contract Documents.

### **3.3. Amending and Supplementing Contract Documents**

3.3.1. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:

3.3.1.1. a written amendment to the Contract,

3.3.1.2. a Change Order (pursuant to Paragraph 10.1.4), or

3.3.1.3. a Work Change Directive (pursuant to Paragraph 10.1.1).

3.3.2. In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

3.3.2.1. a Field Order (pursuant to Paragraph 9.4),

3.3.3.2. PROJECT MANAGER's written interpretation or clarification (pursuant to Paragraph 9.3).

### **3.4. Reuse of Documents**

CONTRACTOR and any Subcontractor, or Supplier, or other person, or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER (i) shall

not have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER or ENGINEER's subconsultant and, (ii) shall not reuse any of such Drawings, Specifications, other documents, or copies on extensions of the Project or any other project without written consent of OWNER and ENGINEER and specific written verification or adaption by ENGINEER. CONTRACTOR and any Subcontractor, or Supplier, or other person, or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER shall use the PLANS, Specifications, or other documents only in connection with performance of the Work; shall not provide the Drawings, Specifications, or other documents (or any copies thereof) to any third party except as required for performance of the Work; and shall return all copies of the Drawings, Specifications, or other documents to OWNER upon completion of the Work or termination of the Agreement, whichever is earlier.

#### **ARTICLE 4 AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS**

##### **4.1. Availability of Lands**

OWNER shall furnish, as indicated in the Contract Documents, the lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and such other lands which are designated for the use of CONTRACTOR. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

CONTRACTOR shall thoroughly review any easement document, deed or any side agreement with the grantor of the easement if furnished by OWNER to ascertain any special terms or conditions to be followed in connection with any part of the Work.

##### **4.2. Subsurface and Physical Conditions**

4.2.1. *Reports:* Reference is made to the Supplementary Conditions for identification of those reports of explorations and tests of subsurface conditions at or contiguous to the site that have been utilized by ENGINEER in preparing the Contract Documents.

4.2.2. *Limited Reliance by CONTRACTOR Authorized; Technical Data:* CONTRACTOR may rely upon the general accuracy of the "technical data" contained in such reports, but such reports are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. CONTRACTOR may not rely upon or make any claim against OWNER, PROJECT MANAGER, ENGINEER, or any of PROJECT MANAGER's or ENGINEER's Subconsultants with respect to:

4.2.2.1. the completeness of such reports for CONTRACTOR's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by CONTRACTOR and safety precautions and programs incident thereto, or

- 4.2.2.2. other data, interpretations, opinions, and information contained in such reports, or
  - 4.2.2.3. any CONTRACTOR interpretation of or conclusion drawn from any “technical data” or any such data, interpretations, opinions, or information.
- 4.2.3. *Notice of Differing Subsurface or Physical Conditions:* If CONTRACTOR believes that any subsurface or physical condition at or contiguous to the site that is uncovered or revealed either:
- 4.2.3.1. is of such a nature as to establish that any “technical data” on which CONTRACTOR is entitled to rely as provided in Paragraphs 4.2.1 and 4.2.2 is materially inaccurate, or
  - 4.2.3.2. is of such a nature as to require a change in the Contract Documents, or
  - 4.2.3.3. differs materially from that shown or indicated in the Contract Documents, or
  - 4.2.3.4. is of an unusual nature and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then
- CONTRACTOR shall, promptly after becoming aware (within twenty-four [24] hours) thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as permitted by Paragraph 6.15), notify OWNER and PROJECT MANAGER in writing about such condition. CONTRACTOR shall not further disturb such conditions or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.
- 4.2.4. *PROJECT MANAGER’s Review:* If instructed to do so by OWNER, PROJECT MANAGER and/or ENGINEER will promptly review the pertinent conditions, determine the necessity of OWNER’s obtaining additional exploration or tests with respect thereto, and advise OWNER in writing (with a copy to CONTRACTOR) of PROJECT MANAGER’s finding and conclusions.
- 4.2.5. *Possible Contract Documents Change:* If a change in the Contract Documents is required as a result of a condition that meets one or more of the categories in Paragraph 4.2.3., a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document the consequences of such change.
- 4.2.6. *Possible Price and Times Adjustments:* An adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such uncovered or revealed condition directly causes a material increase or decrease in CONTRACTOR’s cost of, or time required for performance of, the Work; subject, however, to the following:
- 4.2.6.1 any adjustment is subject to all of the requirements of Articles 11 and 12.
  - 4.2.6.2. such condition must meet any one or more of the categories described in Paragraphs 4.2.3.1 through 4.2.3.4, inclusive;



4.2.6.3. a change in the Contract Documents pursuant to Paragraph 4.2.5 will not be an automatic authorization of, nor a condition precedent to entitlement to any such adjustment;

4.2.6.4. with respect to Work that is paid for on a Unit Price Basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.7; and

4.2.6.5. CONTRACTOR shall not be entitled to any adjustment in the Contract Price or Times, and neither OWNER, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, nor ENGINEER's Subconsultants shall be liable to CONTRACTOR for any costs, losses, expenses, or damages if:

4.2.6.5.1. CONTRACTOR knew or should have known of the existence of such conditions at the time CONTRACTOR submitted a bid or became bound under a contract to OWNER; or

4.2.6.5.2. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the site and contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for CONTRACTOR prior to CONTRACTOR's making such bid or entering into such contract;

4.2.6.5.3. CONTRACTOR failed to give the written notice within the time and as required by Paragraph 4.2.3.

**EVEN IF SUCH COSTS, EXPENSES, OR DAMAGES ARE DUE TO THE NEGLIGENCE, OTHER FAULT, STRICT LIABILITY WITHOUT REGARD TO FAULT OR BREACH OF CONTRACT OF OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, OR ENGINEER'S SUBCONSULTANTS.**

If OWNER and CONTRACTOR are unable to agree on entitlement to, or as to the amount or length of, any such adjustment in the Contract Price or Contract Times, a claim may be made therefor as provided in Articles 11 and 12.

#### **4.3. Physical Conditions—Underground Facilities**

4.3.1. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is based on information and data furnished to OWNER, PROJECT MANAGER, or ENGINEER by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

4.3.1.1. OWNER, PROJECT MANAGER, and ENGINEER shall not be responsible for the accuracy or completeness of any such information or data; and

4.3.1.2. The cost of all of the following will be included in the Contract Price, and CONTRACTOR shall have full responsibility for: (i) reviewing and checking all such information and data, (ii) locating all Underground Facilities shown or indicated in the Contract Documents, (iii) coordination of the Work with the owners of such Underground Facilities during construction, and (iv) the safety and protection of all such Underground Facilities as provided in Paragraph 6.12 and repairing any damage thereto resulting from the Work.

OWNER, PROJECT MANAGER, and ENGINEER expressly disclaim any and all warranties that the information, data, interpretations, and opinions shown, indicated, or contained in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site is accurate, correct, complete, or fit for its intended purpose.

4.3.2. *Not Shown or Indicated:* If an Underground Facility is uncovered or revealed at or contiguous to the site which was not shown or indicated in the Contract Documents or is in a location materially different from that shown or indicated in the Contract Documents, CONTRACTOR shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.15), identify the owner of such Underground Facility and give written notice to that owner and to OWNER and PROJECT MANAGER. If instructed to do so by the OWNER, PROJECT MANAGER and/or ENGINEER will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the consequences of the existence or different location of the Underground Facility. If ENGINEER concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued as provided in Article 10 to reflect and document such consequences. During such time, CONTRACTOR shall be responsible for the safety and protection of such Underground Facility as provided in Paragraph 6.12. CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, to the extent that the Contract Price or Contract Times are directly and materially affected by the existence or different location of any Underground Facility that was not shown or indicated, or was inaccurately shown or indicated in the Contract Documents, and that CONTRACTOR did not know of, and could not reasonably have been expected to be aware of, or to have anticipated. If OWNER and CONTRACTOR are unable to agree on entitlement to or the amount or length of any such adjustment in Contract Price or Contract Times, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12. **HOWEVER, OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, AND ENGINEER'S CONSULTANTS SHALL NOT BE LIABLE TO CONTRACTOR, OR CONTRACTOR SHALL NOT BE ENTITLED TO AN INCREASE IN THE CONTRACT PRICE OF THE CONTRACT TIMES FOR ANY COSTS, EXPENSES, DAMAGES, OR DELAYS ASSOCIATED WITH ANY SUCH UNDERGROUND FACILITY WHICH CONTRACTOR KNEW OR SHOULD HAVE KNOWN THEREOF, NOR SHALL OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, OR ENGINEER'S CONSULTANTS BE LIABLE TO CONTRACTOR FOR ANY CLAIMS, COSTS, LOSSES, OR DAMAGES SUSTAINED BY CONTRACTOR ON OR IN CONNECTION WITH ANY OTHER PROJECT OR ANTICIPATED PROJECT, IF**

**CONTRACTOR KNEW OR SHOULD HAVE KNOWN THEREOF, EVEN IF SUCH EXPENSES, COSTS, CLAIMS, LOSSES, DAMAGES, OR DELAYS ARE DUE TO THE NEGLIGENCE, OTHER FAULT, STRICT LIABILITY WITHOUT REGARD TO FAULT, OR BREACH OF CONTRACT OF OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, OR ENGINEER'S SUBCONSULTANTS.**

#### **4.4. Reference Points**

OWNER shall provide engineering surveys to establish reference points for construction which in ENGINEER's judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for laying out the Work, shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to PROJECT MANAGER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for and pay costs associated with the accurate replacement or relocation of such reference points by professionally qualified personnel.

#### **4.5. Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material**

4.5.1. OWNER shall be responsible for any Hazardous Waste uncovered or revealed at the site which was not shown or indicated within the PLANS or Specifications, identified in the Contract Documents to be within the scope of the Work or which CONTRACTOR could not have discovered in CONTRACTOR'S inspection of the property in preparing any Bid, and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. OWNER shall not be responsible for any such materials brought to the site by CONTRACTOR, Subcontractor, Suppliers or anyone else for whom CONTRACTOR is responsible.

4.5.2. CONTRACTOR shall immediately: (i) stop all Work in connection with such Hazardous Waste and in any area affected thereby (except in an emergency as required by Paragraph 6.15), and (ii) notify OWNER (and thereafter confirm such notice in writing). CONTRACTOR shall not be required to resume Work in connection with such Hazardous Waste or in any such affected area until after OWNER has obtained any required permits related thereto and delivered to CONTRACTOR special written notice: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (ii) specifying any special conditions under which such Work may be resumed safely. If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in Contract Price or Contract Times as a result of such Work stoppage or such special conditions under which Work is agreed by CONTRACTOR to be resumed, either party may make a claim therefor as provided in Articles 11 and 12.

4.5.3. If after receipt of such special written notice CONTRACTOR does not agree to resume such Work because to do so would be unsafe, or does not agree to resume such Work under such special conditions, then OWNER may order such portion of the Work that is in connection with such Hazardous Waste or in such affected area to be deleted from the Work. If OWNER and CONTRACTOR cannot agree as to entitlement to or the amount or extent of an adjustment, if any, in

Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a claim therefor as provided in Articles 11 and 12. OWNER may have such deleted portion of the Work performed by OWNER's own forces or others in accordance with Article 7.

4.5.4 In the event that the Hazardous Waste uncovered or revealed at the site is such that CONTRACTOR discovered or should have discovered it in CONTRACTOR's inspection of the property in preparing any Bid, the provisions of Sections 4.5.2 and 4.5.3 shall apply, but the OWNER's cost of removal of such Hazardous Waste shall be deducted from the contract.

4.5.5. The provisions of Paragraphs 4.2 and 4.3 are not intended to apply to Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Materials uncovered or revealed at the site.

## **ARTICLE 5 BOND AND INSURANCE**

### **5.1. Construction Performance Bond, Payment Bond, and One-Year Maintenance Bond**

5.1.1. CONTRACTOR shall furnish Construction Performance Bond, Payment Bond and an One-Year Maintenance Bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date when final payment becomes due, or as provided otherwise by Laws or Regulations or by the Contract Documents. CONTRACTOR shall also furnish such other Bonds as are required by the Supplementary Conditions. All Bonds shall be in the forms prescribed by the Contract Documents and be provided by sureties that are qualified to do business in the State of Texas and have an excellent rating of A+ A, or A- according to the A.M. Best Key Rating Guide. If the surety company does not have such a rating due to the length of time it has existed, the surety company must be eligible to participate and must participate in the surety bond guarantee program of the Small Business Administration and must be an approved surety listed in the current U.S. Dept. of Treasury Circular 570 and must meet all related rules and regulations of the U.S. Treasury Dept. All Bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

5.1.2. If the surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.1.1, CONTRACTOR shall within ten (10) days thereafter substitute another Bond and surety, both of which must be acceptable to OWNER.

### **5.2. Licensed Sureties and Insurers; Certificates of Insurance**

5.2.1. All Bonds and insurance required by the Contract Documents to be purchased and maintained by OWNER or CONTRACTOR shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in the State of Texas to issue Bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.2.2. CONTRACTOR shall deliver to OWNER, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by OWNER or any other additional insured) which CONTRACTOR is required to purchase and maintain in accordance with Paragraph 5.3. Each certificate issued will contain waiver provisions in accordance with paragraph 5.5.

**5.3. CONTRACTOR's Liability Insurance**

CONTRACTOR shall, at its sole expense, maintain in effect at all times during the full term of the Work under the Agreement and as otherwise required under the Contract Documents, insurance coverages with limits not less than those set forth below in the Supplemental Conditions and in Paragraph 5.3.14 hereof with insurers licensed to do business in the state in which the Project is located and acceptable to OWNER and under forms of policies satisfactory to OWNER. None of the requirements contained herein as to types, limits or OWNER'S approval of insurance coverage to be maintained by CONTRACTOR is intended to and shall not in any manner limit, qualify or quantify the liabilities and obligations assumed by CONTRACTOR under the Agreement or otherwise provided by law. In the event of any failure by CONTRACTOR to comply with the provisions of this Paragraph, OWNER may, without in any way comprising or waiving any right or remedy at law or in equity, on notice to CONTRACTOR, purchase such insurance, at CONTRACTOR'S expense, provided that OWNER shall have no obligation to do so and if OWNER shall do so, CONTRACTOR shall not be relieved of or excused from the obligation to obtain and maintain such insurance amounts and coverages. Such insurance shall protect against:

5.3.1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

5.3.2. claims for damages because of bodily injury, occupational sickness or disease, or death of CONTRACTOR's employees;

5.3.3. claims for damages because of bodily injury, sickness or disease, or death of any person other than CONTRACTOR's employees;

5.3.4. claims for damages insured by customary personal injury liability coverage which are sustained: (i) by any person as a result of an offense directly or indirectly related to the employment of such person by CONTRACTOR, or (ii) by any other person for any other reason;

5.3.5. claims for damages, other than to the Work itself, because of injury to, or destruction of, tangible property wherever located, including loss of use resulting therefrom; and

5.3.6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle.

The policies of insurance so required by this Paragraph 5.3 to be purchased and maintained shall:

5.3.7. with respect to insurance required by Paragraphs 5.3.3 through 5.3.6 inclusive, include as additional insured (subject to any customary exclusion in respect of professional liability) OWNER,

PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, ENGINEER's Subconsultants, and any other persons or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, include coverage for the respective officers and employees of all such additional insureds, and state that this insurance is primary insurance as regards any other insurance carried by any indemnitee under this Agreement;

5.3.8. include the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater.

5.3.9. include completed operations insurance for a period of two (2) years after completion of the project;

5.3.10. include broad form contractual liability insurance covering CONTRACTOR's indemnity obligations under Paragraphs 6.6, 6.8.2, 6.10.1, 6.12.2, and 6.20.1;

5.3.11. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least thirty (30) days, prior written notice has been given to OWNER and CONTRACTOR and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the CONTRACTOR pursuant to Paragraph 5.2.2 will so provide);

5.3.12. remain in effect at least until final payment and at all times thereafter when CONTRACTOR may be correcting, removing, or replacing Defective Work and

5.3.13. with respect to completed operations insurance, and any insurance coverage written on a claims-made basis, remain in effect for at least two (2) years after final payment (and CONTRACTOR shall furnish OWNER and each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued evidence satisfactory to OWNER and any such additional insured of continuation of such insurance at final payment and one year thereafter).

5.3.14 CONTRACTOR shall maintain, at its sole expense, all-risk builder's risk insurance as follows:

Completed value form builder's risk property insurance (subject to a deductible per loss not to exceed \$10,000.00) upon the entire Work for 100% of the full replacement cost value thereof (100% includes additional costs of architectural and engineering services in the event of a loss). This policy shall include the interests of the OWNER and the other indemnitees, CONTRACTOR, and Subcontractors in the Work as named insureds, as their interests may appear, and shall be on an "All Risk" basis for physical loss or damage including without limitation, fire, flood, earthquake, subsidence, hail, theft, vandalism and malicious mischief and shall include, without limitation, coverage for portions of the Work while it is stored off the site or is in transit. This policy shall provide, by endorsement or otherwise, that CONTRACTOR shall be solely responsible for the payment of all premiums under the policy, and that the OWNER and the other indemnitees shall have no obligation for the payment thereof, notwithstanding that OWNER and the other indemnitees are

named insureds under the policy. Any insured loss or claim of loss shall be adjusted by the OWNER, and any settlement payments shall be made payable to the OWNER, as trustee for the insureds, as their interests may appear, subject to the requirements of any applicable mortgagee clause. Upon the occurrence of an insured loss or claim of loss, monies received will be held by OWNER who shall make distribution in accordance with an agreement to be reached in such event between OWNER and CONTRACTOR. If the parties are unable to agree between themselves on the settlement of the loss, such dispute shall be submitted to a court of competent jurisdiction to determine ownership of the disputed amounts but the Work of the Project shall nevertheless progress during any such period of dispute without prejudice to the rights of any party to the dispute. The CONTRACTOR shall be responsible for any loss within the deductible. The builder's risk policy described herein shall include a Waiver of Subrogation in favor of the indemnitees.

**5.3.15 CONTRACTOR'S Equipment Policy.** Any insurance policy covering CONTRACTOR'S or Subcontractor's equipment against loss by physical damage shall include an endorsement waiving the insurer's right of subrogation against the indemnitees. Such insurance shall be CONTRACTOR'S and Subcontractor's sole and complete means of recovery for any such loss, **SHOULD CONTRACTOR OR SUBCONTRACTORS CHOOSE TO SELF INSURE THE RISK, IT IS EXPRESSLY AGREED THAT THE CONTRACTOR AND SUBCONTRACTORS HEREBY WAIVE ANY CLAIM FOR DAMAGE OR LOSS TO SAID EQUIPMENT IN FAVOR OF THE INDEMNITEES, EVEN IF SUCH DAMAGE OR LOSS TO SAID EQUIPMENT IN FAVOR OF THE INDEMNITEES, EVEN IF SUCH DAMAGE OR LOSS ARISES FROM OR IS ATTRIBUTED TO THE CONCURRENT NEGLIGENCE OF ANY INDEMNITEE.**

**5.3.16 Evidence of Insurance.** Evidence of the insurance coverage required to be maintained by CONTRACTOR under this Article 5, must be represented by Certificates of Insurance issued by the insurance carrier and must be furnished to the OWNER prior to CONTRACTOR starting Work. Certificates of insurance shall specify the insured status mentioned above in this Paragraph, as well as the waivers of subrogation. Such certificates of insurance shall state that OWNER will be notified in writing sixty (60) days prior to cancellation, material change, or non-renewal of insurance. CONTRACTOR shall provide to OWNER a certified copy of any and all applicable insurance policies upon request of OWNER. Timely renewal certificates will be provided to OWNER as the coverage renews.

**5.3.17 Subcontractors' Insurance.** Insurance similar to that required of CONTRACTOR shall be provided by or on behalf of all Subcontractors to cover their operations performed under the Contract; provided, however, that the limits of such insurance may be adjusted in accordance with the nature of each Subcontractor's operations. CONTRACTOR shall in any event be held responsible for any modifications in these insurance requirements as they apply to Subcontractors. CONTRACTOR shall maintain certificates of insurance from all Subcontractors, enumerating, among other things, the waivers in favor of, and insured status of, the indemnitees, as required herein, and shall provide to OWNER a copy of each certificate of insurance from each Subcontractor before that Subcontractor is permitted to begin Work on the Project.

**5.4. OWNER's Liability Insurance**

In addition to the insurance required to be provided by CONTRACTOR under Paragraph 5.3, OWNER, at OWNER's option, may purchase and maintain at OWNER's expense OWNER's own liability insurance as will protect OWNER against claims which may arise from operations under the Contract Documents.

**5.5. Waiver of Rights**

5.5.1. OWNER and CONTRACTOR intend that all policies purchased in accordance with Paragraphs 5.2.1 and 5.2.2 will protect OWNER, CONTRACTOR, Subcontractors, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, ENGINEER's Subconsultants, and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds in such policies and will provide primary coverage for all losses and damages caused by the perils covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage, the insurers will have no rights of recovery against any of the insureds or additional insureds thereunder. OWNER and CONTRACTOR waive all rights against each other and their respective officers, directors, employees and agents for all losses and damages caused by, arising out of, or resulting from, any of the perils covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, ENGINEER's Consultants, and all other persons or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by OWNER as trustee or otherwise payable under any policy so issued.

5.5.2. In addition, OWNER waives all rights against CONTRACTOR, Subcontractors, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, ENGINEER's Subconsultants, and the officers, directors, employees, and agents of any of them, for loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from, fire or other insured peril covered by any property insurance maintained on the completed Project or part thereof by OWNER during partial utilization pursuant to Paragraph 15.6, after substantial completion pursuant to Paragraph 15.5, or after final payment pursuant to Paragraph 15.9.

Any insurance policy maintained by OWNER covering any loss or damage, referred to in this Paragraph 5.5.2 shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against any of CONTRACTOR, Subcontractors, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, ENGINEER's Consultants, and the officers, directors, employees, and agents of any of them.



**5.6. Receipt and Application of Insurance Proceeds**

5.6.1. Any insured loss under the policies of insurance required by Paragraph 5.3.14 will be adjusted with OWNER and made payable to OWNER subject to the requirements of any applicable mortgage clause and of Paragraph 5.6.2. OWNER shall distribute any money so received in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order or Written Amendment.

5.6.2. OWNER shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within fifteen (15) days after the occurrence of loss to OWNER's exercise of this power. If such objection be made, OWNER shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, OWNER shall adjust and settle the loss with the insurers and retain all monies received until agreement is reached for the cost of reconstruction.

**5.7. Option to Replace**

If CONTRACTOR does not acquire and maintain insurance or Bonds meeting the requirements of the Contract Documents, without prejudice to any other right or remedy, the OWNER may elect to obtain equivalent Bonds or insurance to protect OWNER's interests at the expense of CONTRACTOR who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

**5.8. Partial Utilization—Property Insurance**

If OWNER finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with Paragraph 15.6 provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice hereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

**5.9 Risk of Loss**

Until there has been Final Acceptance of the Work, CONTRACTOR shall have the risk of loss to all of the Work material and equipment for the Project.

## **ARTICLE 6 CONTRACTOR'S RESPONSIBILITY**

### **6.1. Supervision and Superintendence**

6.1.1. CONTRACTOR shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. CONTRACTOR shall be responsible for seeing that the complete Work complies accurately with the Contract Documents.

6.1.2. CONTRACTOR shall keep on the Work at all times during its progress a competent English speaking resident superintendent who shall not be replaced without written notice to OWNER except under extraordinary circumstances. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications to the superintendent shall be as binding as if given to CONTRACTOR.

### **6.2. Labor, Materials, and Equipment**

6.2.1. CONTRACTOR shall provide competent, suitably qualified personnel to survey, lay out, and construct the Work as required by the Contract Documents. CONTRACTOR shall at all times maintain good discipline and order at the site. Except as otherwise required for the safety or protection of the persons or the Work or property at the site or adjacent thereto, and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit overtime work or the performance of Work on Saturday, Sunday, or any legal holiday (holidays as recognized by the OWNER) without OWNER's written consent. CONTRACTOR must make such written request forty-eight (48) hours prior to start of such work.

6.2.2. Unless otherwise specified in the General Requirements, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up, and completion of the Work.

6.2.3. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. All warranties and guarantees specifically called for by the Specifications shall expressly run to the benefit of OWNER. If required by OWNER and/or PROJECT MANAGER, CONTRACTOR shall furnish satisfactory evidence (including reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

**6.3. Progress Schedule**

6.3.1. CONTRACTOR shall adhere to the progress schedule established in accordance with Paragraph 2.6 as it may be adjusted from time to time as provided below:

6.3.1.1. CONTRACTOR shall submit to PROJECT MANAGER for acceptance (to the extent indicated in Paragraph 2.6) proposed adjustments in the progress schedule that will not change the Contract Times (or Milestones). Such adjustments will conform generally to the progress schedule then in effect and, additionally, will comply with any provisions of the General Requirements applicable thereto.

6.3.1.2. Proposed adjustments in the progress schedule that will change the Contract Times (or Milestones) shall be submitted in accordance with the requirements of Paragraph 12.1. Such adjustments may only be made by a Change Order or Written Amendment in accordance with Article 12.

**6.4. “Or-Equal” Items**

6.4.1. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent or “or-equal” item, or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be accepted by ENGINEER under the following circumstances:

6.4.1.1. “*Or-Equal*”: If CONTRACTOR is able to demonstrate conclusively to the OWNER, PROJECT MANAGER and ENGINEER that equipment proposed is equal in function and quality to that named and sufficiently similar so that no substantial change in related Work will be required, it may be considered as an “or-equal” item, in which case review and approval of the proposed item may be accomplished as provided herein.

6.4.1.2. *Procedure for Consideration of “Or-Equal” Items*: If CONTRACTOR wishes to have an item considered as an “or-equal” item, CONTRACTOR shall submit within 15 days after award of contract sufficient information as provided below to allow ENGINEER to determine that the item of material or equipment proposed is qualified as an “or-equal” item. The procedure for review will include at least the following requests, with such additional requests as are appropriate to the circumstances may decide. Requests for review of proposed substitute items of material or equipment will not be accepted by PROJECT MANAGER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment, CONTRACTOR shall first make written application to PROJECT MANAGER for acceptance thereof, certifying that the proposed substitute will be equal in function and quality to the specified product. The application will state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice CONTRACTOR’s achievement of Substantial Completion on time, whether or not

acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) to adapt the design to the proposed substitute, and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified will be identified in the application and available maintenance and repair and replacement service will be indicated.

6.4.1.3. *CONTRACTOR's Expense:* All data to be provided by CONTRACTOR in support of any proposed "or-equal" will be at CONTRACTOR's expense.

6.4.2. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is shown or indicated in, and expressly required by, the Contract Documents, CONTRACTOR may furnish or utilize a substitute means, methods, technique, sequence, or procedure or construction acceptable to OWNER, ENGINEER and PROJECT MANAGER. CONTRACTOR shall submit sufficient information to allow OWNER, ENGINEER and/or PROJECT MANAGER, to reasonably determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review will be similar to that provided in subparagraph 6.4.1.2.

6.4.3. *Evaluation:* A reasonable time will be allowed within which to evaluate each proposal or submittal to be pursuant to Paragraphs 6.4.1.2 and 6.4.2. No "or-equal" will be ordered, installed, or utilized without OWNER, ENGINEER or PROJECT MANAGER's prior written acceptance, which will be evidenced by either a Change Order or an approved Shop Drawing. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any "or-equal". PROJECT MANAGER will record time required by PROJECT MANAGER, ENGINEER, and ENGINEER's Consultants in evaluating substitutes proposed or submitted by CONTRACTOR pursuant to Paragraphs 6.4.1.2. and 6.4.2 and in making changes in the Contract Documents (or in the provisions of any other direct contract with OWNER for work on the Project) occasioned thereby. Whether or not a substitute item so proposed or submitted by CONTRACTOR, CONTRACTOR shall reimburse OWNER for the charges of PROJECT MANAGER, ENGINEER, and ENGINEER's Consultants for evaluating each such proposed substitute item.

## **6.5. Concerning Subcontractors, Suppliers, and Others**

6.5.1. CONTRACTOR shall not employ any Subcontractor, Supplier, or other person or organization (including those acceptable to OWNER as indicated in Paragraph 6.5.2), whether initially, or as a substitute, against whom OWNER may have reasonable objection. CONTRACTOR shall not be required to employ any Subcontractor, Supplier, or other person or organization to furnish or perform any of the Work against whom CONTRACTOR has reasonable objection.

6.5.2. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other persons or organizations (including those who are to furnish the principal items of materials or equipment) to be submitted to OWNER in advance of a specified date prior to the Effective Date of the

Agreement for acceptance by OWNER and if CONTRACTOR has submitted a list thereof in accordance with the Supplementary Conditions, OWNER's or ENGINEER's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the bidding documents or the Contract Documents) of any such Subcontractor, Supplier, or other person or organization so identified may be revoked on the basis of reasonable objection after due investigation, in which case CONTRACTOR shall submit an acceptable substitute, the Contract Price will be adjusted by the difference in the cost occasioned by such substitution and an appropriate Change Order will be issued or Written Amendment signed. No acceptance by OWNER of any such Subcontractor, Supplier, or other person or organization shall constitute a waiver of any right of OWNER to reject Defective Work.

6.5.3. CONTRACTOR shall be fully responsible to OWNER and PROJECT MANAGER for all acts and omissions of the Subcontractors, Suppliers, and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier, or other person or organization any contractual relationship between OWNER, ENGINEER or PROJECT MANAGER and any such Subcontractor, Supplier, or other person or organization, nor shall it create any obligation on the part of the OWNER, ENGINEER or PROJECT MANAGER to pay, or to see to, the payment of any moneys due any such Subcontractor, Supplier, or other person or organization except as may otherwise be required by Laws and Regulations. There are no third party beneficiaries to the Agreement or Contract Documents.

6.5.4. CONTRACTOR shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR. CONTRACTOR shall require all Subcontractors, Suppliers, and such other persons and organizations performing or furnishing any of the Work to communicate with the OWNER, PROJECT MANAGER and ENGINEER through CONTRACTOR.

6.5.5. The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing the Work among Subcontractors or Suppliers or in delineating the Work to be performed by any specific trade.

6.5.6. All Work performed for CONTRACTOR by a Subcontractor or Supplier will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of OWNER.

## **6.6. Patent Fees and Royalties**

CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights, copyrights, trade secret, trademark, or other

intellectual property rights of any third party. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER, PROJECT MANAGER, or ENGINEER its use is subject to patent rights, copyrights, trade secret, trademark, or other intellectual property rights of any third party calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, ENGINEER'S SUBCONSULTANTS, AND THE OFFICERS, DIRECTORS, EMPLOYEES, AGENTS AND OTHER CONSULTANTS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES ARISING OUT OF, OR RESULTING FROM, ANY INFRINGEMENT OF PATENT RIGHTS, COPYRIGHTS, TRADE SECRET, TRADE MARK, OR OTHER INTELLECTUAL PROPERTY RIGHTS OF ANY THIRD PARTY INCIDENT TO THE USE IN THE PERFORMANCE OF THE WORK OR RESULTING FROM THE INCORPORATION IN THE WORK OF ANY INVENTION, DESIGN, PROCESS, PRODUCT, OR DEVICE NOT SPECIFIED IN THE CONTRACT DOCUMENTS.**

#### **6.7. Permits**

Unless otherwise provided in the Supplementary Conditions, CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist

CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of BIDs, or, if there are no BIDs, on the Effective Date of the Agreement. CONTRACTOR shall pay all charges of utility owners for connections to the Work.

#### **6.8. Laws and Regulations**

6.8.1. CONTRACTOR shall give all notices and comply with all Laws and Regulations applicable to furnishing and performing the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither OWNER nor PROJECT MANAGER shall be responsible for monitoring CONTRACTOR's compliance with any Laws or Regulations.

CONTRACTOR shall advise OWNER of changes or pending changes to any Laws or Regulations of which CONTRACTOR is aware so that OWNER may make any changes to the Contract Documents or the Project required to comply with such Laws or Regulations.

6.8.2. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to Laws and Regulations, CONTRACTOR shall bear all claims, costs, losses, and damages caused by, arising out of, or resulting therefrom, **AND, TO THE FULLEST EXTENT ALLOWED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY, HOLD HARMLESS AND DEFEND OWNER, PROJECT MANAGER, AND ENGINEER FROM AND AGAINST ANY**

**GOVERNMENT ASSESSED PENALTIES, FINES AND CHARGES, AND ASSOCIATED DAMAGES, COSTS, LOSSES, AND EXPENSES (INCLUDING, WITHOUT LIMITATION, COURT COSTS AND ATTORNEYS' FEES) OF WHATEVER KIND WHICH OWNER, PROJECT MANAGER, OR ENGINEER MAY INCUR, BE REQUIRED TO PAY, OR BE LIABLE FOR, AS A RESULT OF, IN CONNECTION WITH, ARISING OUT OF, OR RELATED TO, ANY SUCH PERFORMANCE OF THE WORK BY CONTRACTOR CONTRARY TO LAWS AND REGULATIONS.** However, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and PLANS are in accordance with Laws and Regulations, but this shall not relieve CONTRACTOR of CONTRACTOR's obligations under Paragraph 3.2.2.

#### **6.9. Taxes**

6.9.1. CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by CONTRACTOR in accordance with all Laws and Regulations which are applicable during the performance of the Work.

#### **6.10. Use of Premises**

6.10.1. CONTRACTOR shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the site and land and areas identified in, and permitted by, the Contract Documents and other land areas permitted by Laws and Regulations, rights-of-way, and permits, easements, side agreements with the grantor of any easement, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work. CONTRACTOR shall comply with all such special terms and conditions contained in any easement document, deed or side agreement in connection with the Work. Should any claim be made by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim. **CONTRACTOR SHALL, TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, INDEMNIFY AND HOLD HARMLESS OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, ENGINEER'S CONSULTANT, AND ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES ARISING OUT OF, OR RESULTING FROM, ANY CLAIM OR ACTION, LEGAL OR EQUITABLE, BROUGHT BY ANY SUCH OWNER OR OCCUPANT AGAINST OWNER, ENGINEER, OR ANY OTHER PARTY INDEMNIFIED HEREUNDER TO THE EXTENT CAUSED BY OR BASED UPON CONTRACTOR'S PERFORMANCE OF THE WORK EVEN IF DUE IN PART TO THE NEGLIGENCE, OTHER FAULT, STRICT LIABILITY WITHOUT REGARD TO FAULT OR BREACH OF CONTRACT OF OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, ENGINEER'S CONSULTANTS OR ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM.**

6.10.2. During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish, and other debris resulting from the Work or otherwise. At the completion of the Work, CONTRACTOR shall remove all waste materials, rubbish, and debris from and about the premises, as well as all tools, appliances, construction equipment and machinery, and surplus materials. CONTRACTOR shall leave the site clean and ready for occupancy by OWNER at Substantial Completion of the Work. CONTRACTOR shall restore to original condition all property not designated for alteration by the Contract Documents.

6.10.3. CONTRACTOR shall not load, nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall the CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger, cause damage to, or alter it.

#### **6.11. Record Documents**

CONTRACTOR shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications (issued pursuant to Paragraph 9.4) in good order and annotated to show all changes made during construction. These record documents, together with all approved Samples and a counterpart of all approved Shop Drawings, will be available to OWNER, ENGINEER and/or PROJECT MANAGER for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to PROJECT MANAGER for OWNER.

#### **6.12. Safety and Protection**

6.12.1. CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.12.1.1. all persons on the Work site or who may be affected by the Work;

6.12.1.2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

6.12.1.3. other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.

6.12.2. CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property. All damage, injury or loss to any



property referred to in Paragraph 6.12.1.2. or 6.12.1.3. caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor, Supplier, or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR, **EVEN IF DUE IN PART TO THE CONCURRENT NEGLIGENCE, OTHER FAULT, STRICT LIABILITY WITHOUT REGARD TO FAULT, OR BREACH OF CONTRACT OF OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, ENGINEER, ENGINEER'S SUBCONSULTANTS OR ANYONE EMPLOYED BY ANY OF THEM, OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, EXCEPT DAMAGE OR LOSS SOLELY ATTRIBUTABLE TO THE FAULT OF DRAWINGS OR SPECIFICATIONS OR TO THE ACTS OR OMISSIONS OF OWNER, PROJECT MANAGER, PROJECT MANAGER'S SUBCONSULTANTS, OR ENGINEER OR ENGINEER'S SUBCONSULTANT OR ANYONE EMPLOYED BY ANY OF THEM OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE, AND NOT ATTRIBUTABLE, DIRECTLY OR INDIRECTLY, IN WHOLE OR IN PART, TO THE FAULT OR NEGLIGENCE OF CONTRACTOR OR ANY SUBCONTRACTOR, SUPPLIER OR OTHER PERSON OR ORGANIZATION DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM.** CONTRACTOR's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and PROJECT MANAGER has issued a notice to OWNER and CONTRACTOR in accordance with Paragraph 15.9.1. that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

### **6.13. Safety Representative**

CONTRACTOR shall designate a qualified and experienced safety representative at the site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

### **6.14. Hazard Communication Programs**

CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with all applicable Laws or Regulations.

### **6.15. Emergencies**

In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from OWNER, ENGINEER or PROJECT MANAGER, is obligated to act promptly, efficiently and reasonably to prevent threatened damage, injury or loss. CONTRACTOR shall give PROJECT MANAGER prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If PROJECT MANAGER determines that a change in the Contract Documents is required because of the action taken by

CONTRACTOR in response to such an emergency, a Work Change Directive or Change Order will be issued to document the consequences of such action.

#### **6.16. Shop Drawings and Samples**

6.16.1. CONTRACTOR shall submit Shop Drawings to PROJECT MANAGER for review and approval in accordance with the accepted schedule of Shop Drawings and Sample submittals (see Paragraph 2.6). All submittals must be in accordance with Specification Section 01330 Submittals of the Contract Specifications. The data shown on the Shop Drawings shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data necessary to show ENGINEER the materials and equipment CONTRACTOR proposes to provide and to enable ENGINEER to review the information for the limited purposes required by Paragraph 6.17.4.

6.16.2. CONTRACTOR shall also submit Samples to PROJECT MANAGER for review and approval in accordance with Specification Section 01330 Submittals of the Contract Specifications. Each Sample will be identified clearly as to material, Supplier, pertinent data such as catalog number and the use for which it is intended, and otherwise as ENGINEER may require to enable ENGINEER to review the submittal for the limited purposes required by Paragraph 6.17.4. The Contractor shall submit the number of each Sample specified in the Specifications.

#### **6.17. Shop Drawings and Sample Submittal Procedures**

6.17.1. Before submitting each Shop Drawing or Sample, CONTRACTOR shall determine and verify:

6.17.1.1. all field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto; and

6.17.1.2. all materials with respect to intended use, fabrication, shipping, handling, storage, assembly and installation pertaining to the performance of the Work, and all information relating to CONTRACTOR's sole responsibilities for or in connection with means, methods, techniques, sequences and procedures of construction and safety precautions and programs incident thereto.

CONTRACTOR shall also review, coordinate, and ensure the compatibility of each Shop Drawing or Sample with other Shop Drawings and Samples and compliance with the requirements of the Work and the Contract Documents.

6.17.2. Each submittal shall bear a stamp or specific written indication that CONTRACTOR has satisfied CONTRACTOR's obligations as required by Specification Section 01330 of the Contract Documents.

6.17.3. At the time of each submission, CONTRACTOR shall give PROJECT MANAGER specific written notice of any and all variations that the Shop Drawing or Sample submitted has from the requirements of the Contract Documents, such notice to be in a written communication separate from

the submittal; and, in addition, shall cause a specific notation of any and all such variations to be made on each Shop Drawing and Sample submitted to PROJECT MANAGER for review and approval of each such variation.

6.17.4. ENGINEER will review and approve Shop Drawings and Samples in accordance with the schedule of Shop Drawings and Sample submittals accepted by ENGINEER as required by Paragraph 2.6. ENGINEER's review and approval will be limited to determination of whether the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. ENGINEER's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item, as such, will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit as required new Samples for review and approval. CONTRACTOR shall direct ENGINEER's specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

6.17.5. ENGINEER's review and approval of Shop Drawings or Samples shall not relieve CONTRACTOR from (i) responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR in writing has called ENGINEER's attention to each such variation at the time of submission as required by Paragraph 6.17.3 and ENGINEER has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample approval or (ii) responsibility for complying with the requirements of Paragraph 6.17.1.

6.17.6. Where a Shop Drawing or Sample is required by the Contract Documents or the schedule of Shop drawings and Sample submissions accepted by PROJECT MANAGER as required by Paragraph 2.6, any related Work performed prior to ENGINEER's review and approval of the pertinent submittal will be at the sole expense, risk, and responsibility of CONTRACTOR. CONTRACTOR shall pay any and all costs and expenses associated with any rework, changes, or results of CONTRACTOR performing work related to a submittal prior to ENGINEER's review and approval of the pertinent submittals.

## **6.18. Continuing the Work**

CONTRACTOR shall carry on the Work and adhere to the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 16.3 or as OWNER and CONTRACTOR may otherwise agree in writing.

**6.19. CONTRACTOR's General Warranty and Guarantee**

6.19.1. CONTRACTOR warrants and guarantees the Work including equipment installed to be performed in accordance with the standard of care set forth in Article 1 of the Agreement. CONTRACTOR further warrants and guarantees the Work including equipment installed to be free from Defects due to faulty workmanship or faulty materials for a period of 12 months from the date as noted in writing from PROJECT MANAGER or OWNER, of Beneficial Use, Substantial Completion, or Final Acceptance which ever occurs first. Upon notice from OWNER, CONTRACTOR shall promptly repair any and all Defects in all work which develop during such 12-month period at no cost to OWNER. Neither final acceptance nor final payment nor any provision in the CONTRACT DOCUMENTS relieves CONTRACTOR of the above warranty and guarantee. Notice of observed Defects will be given with reasonable promptness. Failure of CONTRACTOR to repair or replace a Defect upon notice entitles OWNER to repair or replace the same and to recover reasonable costs and expenses associated with such repair or replacement from CONTRACTOR and/or surety.

6.19.2. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

- 6.19.2.1. observations by OWNER, PROJECT MANAGER or ENGINEER;
- 6.19.2.2. payment of any progress or final payment;
- 6.19.2.3. the issuance of a certificate of Substantial Completion or any payment by OWNER to CONTRACTOR under the Contract Documents;
- 6.19.2.4. use or occupancy of the Work or any part thereof by OWNER;
- 6.19.2.5. any acceptance by OWNER or any failure to do so;
- 6.19.2.6. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by ENGINEER pursuant to Paragraph 15.9.1;
- 6.19.2.7. any inspection, test, or approval by others; or
- 6.19.2.8 any correction of Defective Work by OWNER.

**6.20. Indemnification**

**6.20.1. TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, CONTRACTOR SHALL AND DOES AGREE TO INDEMNIFY, PROTECT, DEFEND AND HOLD HARMLESS THE OWNER, PROJECT MANAGER, ENGINEER, AND EACH OF THE AFOREMENTIONED PARTIES' RESPECTIVE AFFILIATED COMPANIES, PARTNERS,**

SUCCESSORS, ASSIGNS, HEIRS, LEGAL REPRESENTATIVES, DEVISEES, OFFICERS, DIRECTORS, SHAREHOLDERS, EMPLOYEES AND AGENTS (COLLECTIVELY, "INDEMNITEES") FOR, FROM AND AGAINST ALL LIABILITIES, CLAIMS, DAMAGES, LOSSES, LIENS, CAUSES OF ACTION, SUITS, JUDGMENTS AND EXPENSES (INCLUDING COURT COSTS, ATTORNEY FEES AND COSTS OF INVESTIGATION), OF ANY NATURE, KIND OR DESCRIPTION OF ANY PERSON OR ENTITY, DIRECTLY OR INDIRECTLY ARISING OUT OF, CAUSED BY, OR RESULTING FROM (IN WHOLE OR IN PART), (1) THE WORK PERFORMED HEREUNDER, OR ANY PART THEREOF, (2) THE AGREEMENT, OR (3) ANY ACT OR OMISSION OF CONTRACTOR, ANY SUBCONTRACTOR, ANYONE DIRECTLY OR INDIRECTLY EMPLOYED BY THEM, OR ANYONE THAT THEY CONTROL, OR EXERCISE CONTROL OVER (COLLECTIVELY, "LIABILITIES"), INCLUDING ALL CLAIMS, COSTS, LOSSES, DAMAGES, SUITS AND CAUSES OF ACTION, AND ANY AND ALL LIABILITY, COSTS, EXPENSES, SETTLEMENTS, DAMAGES, AND JUDGMENTS INCURRED IN CONNECTION THEREWITH (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF PROJECT MANAGER, ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS, AND ALL COURT OR ARBITRATION OR OTHER DISPUTES RESOLUTION COSTS) WHETHER ARISING IN EQUITY, AT COMMON LAW, OR BY STATUTE, INCLUDING THE TEXAS DECEPTIVE TRADE PRACTICES ACT OR SIMILAR STATUTE OF OTHER JURISDICTIONS, OR UNDER THE LAW OF CONTRACTS, TORTS (INCLUDING WITHOUT LIMITATION, NEGLIGENCE AND STRICT LIABILITY WITHOUT REGARD TO FAULT) OR PROPERTY, OF EVERY KIND OR CHARACTER. UNLESS OTHERWISE SET FORTH IN THIS PARAGRAPH 6.20, THE OBLIGATIONS OF CONTRACTOR UNDER THIS INDEMNIFICATION SHALL APPLY TO LIABILITIES EVEN IF SUCH LIABILITIES ARISE FROM OR ARE ATTRIBUTED TO THE CONCURRENT NEGLIGENCE OF ANY INDEMNITEE. THE ONLY LIABILITIES WITH RESPECT TO WHICH CONTRACTOR'S OBLIGATION TO INDEMNIFY THE INDEMNITEES DOES NOT APPLY IS WITH RESPECT TO LIABILITIES RESULTING FROM THE SOLE NEGLIGENCE OR WILLFUL MISCONDUCT OF AN INDEMNITEE. CONTRACTOR SHALL PROMPTLY ADVISE OWNER IN WRITING OF ANY ACTION, ADMINISTRATIVE OR LEGAL PROCEEDING OR INVESTIGATION AS TO WHICH THIS INDEMNIFICATION MAY APPLY, AND CONTRACTOR, AT CONTRACTOR'S EXPENSE, SHALL ASSUME ON BEHALF OF OWNER (AND THE OTHER INDEMNITEES) AND CONDUCT WITH DUE DILIGENCE AND IN GOOD FAITH THE DEFENSE THEREOF WITH COUNSEL SATISFACTORY TO OWNER; PROVIDED, HOWEVER, THAT OWNER SHALL HAVE THE RIGHT, AT ITS OPTION, TO BE REPRESENTED THEREIN BY ADVISORY COUNSEL OF ITS OWN SELECTION AND AT ITS OWN EXPENSE. IN THE EVENT OF FAILURE BY CONTRACTOR TO FULLY PERFORM IN ACCORDANCE WITH THIS INDEMNIFICATION PARAGRAPH, OWNER, AT ITS OPTION, AND WITHOUT RELIEVING CONTRACTOR OF ITS OBLIGATIONS HEREUNDER, MAY SO PERFORM, BUT ALL COSTS AND EXPENSES SO INCURRED BY OWNER IN THAT EVENT SHALL BE REIMBURSED BY CONTRACTOR TO OWNER, TOGETHER WITH INTEREST ON THE SAME FROM THE DATE ANY SUCH EXPENSE

WAS PAID BY OWNER UNTIL REIMBURSED BY CONTRACTOR, AT THE RATE OF INTEREST PROVIDED TO BE PAID ON JUDGMENTS, BY THE LAW OF THE JURISDICTION TO WHICH THE INTERPRETATION OF THE CONTRACT IS SUBJECT. THIS INDEMNIFICATION SHALL NOT BE LIMITED TO DAMAGES, COMPENSATION OR BENEFITS PAYABLE UNDER INSURANCE POLICIES, WORKERS' COMPENSATION ACTS, DISABILITY BENEFIT ACTS OR OTHER EMPLOYEES' BENEFIT ACTS. IT IS AGREED WITH RESPECT TO ANY LEGAL LIMITATIONS NOW OR HEREAFTER IN EFFECT AND AFFECTING THE VALIDITY OR ENFORCEABILITY OF THE INDEMNIFICATION OBLIGATION UNDER THIS SECTION, SUCH LEGAL LIMITATIONS ARE MADE A PART OF THE INDEMNIFICATION OBLIGATION AND SHALL OPERATE TO AMEND THE INDEMNIFICATION OBLIGATION TO THE MINIMUM EXTENT NECESSARY TO BRING THE PROVISION INTO CONFORMITY WITH THE REQUIREMENTS OF SUCH LIMITATIONS, AND AS SO MODIFIED, THE INDEMNIFICATION OBLIGATION SHALL CONTINUE IN FULL FORCE AND EFFECT. NOTHING IN THIS CLAUSE IS INTENDED TO INDEMNIFY THE ENGINEER OR PROJECT MANAGER FROM RESPONSIBILITY FOR EITHER OF THEIR ACTS OF PROFESSIONAL NEGLIGENCE EXCEPT AS EXPRESSLY PROVIDED OTHERWISE. IT IS THE SPECIFIC INTENT OF THIS INDEMNITY THAT THE INDEMNITOR IS INDEMNIFYING THE INDEMNITEES FROM ACTS OF NEGLIGENCE OF INDEMNITEES.

6.20.2. In any and all claims against OWNER, PROJECT MANAGER, or ENGINEER or any of their respective consultants, agents, officers, directors, or employees by any employee (or the survivor or personal representative of such employee of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.1 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier, or other person or organization under workers' compensation acts, disability benefit acts or other employees benefit acts.

#### **6.21. Survival of Obligations**

All representations, indemnifications, warranties, and guarantees made in, required by, or given in, accordance with the Contract Documents as well as all continuing obligations indicated in the Contract Documents, shall survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

### **ARTICLE 7 OTHER WORK**

#### **7.1. Related Work at Site**

7.1.1. OWNER may perform other work related to the Project at the site by OWNER's own forces or let other direct contracts therefor which shall contain GENERAL CONDITIONS similar to these or have other work performed by utility owners.

7.1.2. CONTRACTOR shall afford each other contractor who is a party to such a direct contract with OWNER and each utility owner (and OWNER, if OWNER is performing the additional work with OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with that of such other CONTRACTORS. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting, and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of OWNER, ENGINEER or PROJECT MANAGER and the others whose work will be affected. The duties and responsibilities of CONTRACTOR under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of CONTRACTOR in said direct contracts between OWNER and such utility owners and other contractors.

7.1.3. If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to PROJECT MANAGER in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results and performance of CONTRACTOR's Work. CONTRACTOR's failure so to report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work.

## **ARTICLE 8 OWNER'S RESPONSIBILITIES**

### **8.1. Replacement of PROJECT MANAGER or ENGINEER**

In case of termination of the employment of PROJECT MANAGER or ENGINEER, OWNER shall appoint a replacement PROJECT MANAGER or ENGINEER or perform the remaining Work to be done by the terminated professional with the staff of OWNER.

### **8.2. Furnish Data**

OWNER shall promptly furnish the data required of OWNER under the Contract Documents.

### **8.3. Lands and Easements; Reports and Tests**

OWNER shall provide lands and easements and engineering surveys to establish reference points and special terms and conditions of the Work or any portion thereof in accordance with and for the purpose set forth in Paragraphs 4.1 and 4.4. OWNER shall identify and make available to CONTRACTOR copies of reports of explorations and tests of subsurface conditions at the site that have been utilized by ENGINEER in preparing the Contract Documents in accordance with Paragraph 4.2.

**8.4. Limitations on OWNER's Responsibilities**

OWNER shall not supervise, direct or have control or authority over, nor be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. OWNER will not be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

**ARTICLE 9 PROJECT MANAGER'S AND ENGINEER'S STATUS DURING CONSTRUCTION**

**9.1. OWNER's Representative**

PROJECT MANAGER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of PROJECT MANAGER as OWNER's representative during construction are set forth in the Contract Documents and shall not be extended without written consent of OWNER and PROJECT MANAGER. OWNER may also provide for some of the duties prescribed herein for performance by the PROJECT MANAGER to be performed by project representatives employed directly by the OWNER. OWNER may also employ testing firms directly.

**9.2. Visits to Site**

ENGINEER will make visits to the site at intervals appropriate to the various stages of construction as ENGINEER deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, ENGINEER will endeavor, for the benefit of OWNER, to determine, in general, if the Work is proceeding in accordance with the Contract Documents. ENGINEER will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. ENGINEER's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations, ENGINEER will keep PROJECT MANAGER informed of the progress of the Work and will endeavor to guard OWNER against Defective Work. ENGINEER's visits and on-site observations are subject to all the limitations on ENGINEER's authority and responsibility set forth in Paragraph 9.8, and particularly, but without limitation, during or as a result of ENGINEER's on-site visits or observations of CONTRACTOR'S Work, ENGINEER will not supervise, direct, control, or have authority over, or be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work, for any failure of CONTRACTOR to comply with the Contract Documents.



**9.3. Clarifications and Interpretations**

Written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) will be issued as OWNER, ENGINEER or PROJECT MANAGER may determine necessary, which shall be consistent with the intent of, and reasonably inferable from, the Contract Documents. If CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Price or the Contract Time and the parties are unable to agree to the amount or extent thereof, if any, CONTRACTOR may make a written claim therefor as provided in Article 11 or Article 12.

**9.4. Authorized Variations in Work**

Minor variations in the Work from the requirements of the Contract Documents may be authorized which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on CONTRACTOR who shall perform the Work involved promptly. If OWNER or CONTRACTOR believes that a Field Order justifies an adjustment in the Contract Price or the Contract Times and the parties are unable to agree as to the amount or extent thereof, OWNER or CONTRACTOR may make a written claim therefor as provided in Article 11 or 12.

**9.5. Rejecting Defective Work**

PROJECT MANAGER or ENGINEER will have authority, but not the obligation, to disapprove or reject Work which PROJECT MANAGER or ENGINEER believes (i) to be Defective, or (ii) will not produce a completed Project that conforms to the Contract Documents, or (iii) will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. PROJECT MANAGER or ENGINEER will also have authority to require special inspection or testing of the Work as provided in Paragraph 14.4.2, whether or not the Work is fabricated, installed or completed.

**9.6. Shop Drawings, Change Orders, and Payments**

9.6.1. PROJECT MANAGER's and ENGINEER's authority and responsibility with respect to Shop Drawings and Samples is set forth in Paragraphs 6.16 through 6.17.6 inclusive.

9.6.2. PROJECT MANAGER's and ENGINEER's authority and responsibility with respect to Change Orders is set forth in Articles 10, 11, and 12.

9.6.3. PROJECT MANAGER's and ENGINEER's authority and responsibility with respect to Applications for Payment, is set forth in Article 15.

**9.7. Determinations for Unit Prices**

OWNER or PROJECT MANAGER will determine the actual quantities and classifications of Unit Price Work performed by CONTRACTOR and review with CONTRACTOR the determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). The written decision thereon will be final and binding upon CONTRACTOR, unless, within ten (10) days after the date of any such decision, CONTRACTOR delivers to the owner and to PROJECT MANAGER written notice of intention that it disagrees with the decision. Any disagreement will be resolved according the Requests of Articles 11 and 12.

**9.8. Limitations on PROJECT MANAGER's and ENGINEER's Authority and Responsibilities**

9.8.1. Neither PROJECT MANAGER's nor ENGINEER's authority, nor responsibility under this Article 9, nor under any other provision of the Contract Documents, nor any decision made by PROJECT MANAGER nor ENGINEER in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by PROJECT MANAGER or ENGINEER shall create, impose, or give rise to any duty owed by PROJECT MANAGER or ENGINEER to CONTRACTOR, any Subcontractor, any Supplier, any other person or organization, or to any surety for or employee or agent of any of them. **PROJECT MANAGER AND ENGINEER EXPRESSLY DISCLAIM ANY DUTY TO CONTRACTOR ARISING OUT OF PROJECT MANAGER'S OR ENGINEER'S PERFORMANCE OF ITS CONTRACT WITH OWNER. CONTRACTOR AGREES AND ACKNOWLEDGES THAT CONTRACTOR IS NOT A THIRD-PARTY BENEFICIARY TO THE CONTRACT BETWEEN ENGINEER AND OWNER OR BETWEEN PROJECT MANAGER AND OWNER.**

9.8.2. Neither PROJECT MANAGER nor ENGINEER will supervise, direct, control, or have authority over, or be responsible for, CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of the Work. Neither PROJECT MANAGER nor ENGINEER will be responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents.

9.8.3. Neither PROJECT MANAGER nor ENGINEER will be responsible for the acts or omissions of CONTRACTOR or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9.8.4. PROJECT MANAGER's review of Applications for Payment, including the final application for payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals, and other documentation required to be delivered by the Contract Documents will only be to determine generally that their content complies with the requirements of, and, in the case of certificates of

inspections, tests, and approvals, that the results certified indicate compliance with, the Contract Documents.

9.8.5. The limitations upon authority and responsibility set forth in this Paragraph 9.8 also apply to PROJECT MANAGER's and ENGINEER's Subconsultants, Resident Project Representative and assistants.

## **ARTICLE 10 CHANGES IN THE WORK**

### **10.1. Changes in the Work**

10.1.1. Without invalidating the Agreement and without notice to any surety, OWNER may, at any time, or from time to time, order additions, deletions, or revisions in the Work. Such additions, deletions, or revisions will be authorized by a Written Amendment, a Change Order, or a Work Change Directive. Upon receipt of any such document, CONTRACTOR shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided), even if CONTRACTOR and OWNER have been unable to agree upon the extent, if any, of adjustments to the contract price or contract times resulting from such addition, revision, or deletion.

10.1.2. If OWNER and CONTRACTOR are unable to agree as to the extent, if any, of an adjustment in the Contract Price or an adjustment of the Contract Times that should be allowed as a result of a Work Change Directive, a claim may be made therefor as provided in Article 11 or Article 12.

10.1.3. CONTRACTOR shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any change to the Work performed that is not the subject of an amendment, modification or supplement to the Contract by one of the methods provided in Paragraph 3.3.1. and 3.3.2., issued in advance of the performance of the change Work except in the case of an emergency as provided in Paragraph 6.15 or in the case of uncovering Work as provided in Paragraph 14.4.2.

10.1.4. OWNER and CONTRACTOR shall execute appropriate Change Orders (or Written Amendments) covering:

10.1.4.1. changes in the Work which are (i) ordered by OWNER pursuant to Paragraph 10.1.1, (ii) required because of acceptance of Defective Work under Paragraph 14.8 or correcting Defective Work under Paragraph 14.9, or (iii) agreed to by the parties;

10.1.4.2. changes in the Contract Price or Contract Times which are agreed to by the parties; and

10.1.5. If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

**ARTICLE 11 CHANGE OF CONTRACT PRICE**

**11.1. Change of Contract Price**

11.1.1. The Contract Price constitutes the total compensation (subject to authorized adjustments) payable to CONTRACTOR for performing the Work. All duties, responsibilities, and obligations assigned to, or undertaken by, CONTRACTOR shall be at CONTRACTOR'S expense without change in the Contract Price.

11.1.2. It is intended that the provisions of Article 11 govern any claim or demand by the CONTRACTOR for a change in the Contract Price, or for recovery from the OWNER outside the Contract related to the Project, including recovery by Change Order, recovery for Work Change Directives, claims, disputes of all kinds, including quantum meruit, which arise from the Project claims to which Article 11 applies include any demand or assertion that CONTRACTOR's performance has been delayed, interrupted or interfered with, that CONTRACTOR's performance has been accelerated, constructively accelerated, or suspended, that CONTRACTOR's performance has been wrongfully terminated, that the Contract Documents have been misinterpreted, that there has been a failure of payment, that CONTRACTOR has encountered concealed or unknown conditions, that CONTRACTOR has encountered hazardous materials, that there are problems with the Contract Documents, or the time of approvals or decisions, that actions of the OWNER have been intentionally wrongful or deceptive, that OWNER is directly or indirectly guilty of negligence or an intentional tort related in any way to the Work, that the amount of time or money granted in a Construction Change Directive is inadequate, that an item treated as a minor change in the Work should have been treated as a Change Order, that a time extension granted was inadequate, or that Contractor is entitled to any other relief, on any legal theory, related to the Work and the Contract. Nothing contained in this subparagraph shall be construed as creating any CONTRACTOR right to make a claim, where no such right otherwise exists. Any claim for an adjustment in the Contract Price shall be based on written notice delivered by the CONTRACTOR to the OWNER and to PROJECT MANAGER promptly (but in no event later than thirty [30] days) after the start of the occurrence or event giving rise to the claim and stating the general nature of the claim. Notice of the amount of the claim with supporting data shall be delivered within sixty (60) days after the start of such occurrence or event and shall be accompanied by claimant's written representation that the adjustment claimed covers all known amounts to which the claimant is entitled as a result of said occurrence or event. In addition to the 30 day and 60 day requirements set out herein, it is also agreed that any claim for a change in the Contract price is void and waived unless the CONTRACTOR give OWNER a specific written statement of the basis of the claim of the amount of change sought within 91 days of the date of the event giving rise to the claim. No claim for an adjustment in the Contract Price will be valid if not submitted in accordance with Article 11.

11.1.3. The value of any Work covered by a Change Order or of any claim for an adjustment in the Contract Price will be determined as follows:

11.1.3.1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.4, inclusive);

11.1.3.2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.2.3.2.);

11.1.3.3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 11.1.3.2., on the basis of the Cost of the Work (determined as provided in Paragraphs 11.2.1. and 11.2.2.) plus a CONTRACTOR's fee for overhead and profit (determined as provided in Paragraph 11.2.3.).

## **11.2. Cost of the Work**

11.2.1. The term Cost of the Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in an amount no higher than those prevailing in the locality of the Project, shall include only the following items, and shall not include any of the costs itemized in Paragraph 11.2.2.:

11.2.1.1. Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work under schedules of job classifications agreed upon by OWNER and CONTRACTOR. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full-time on the site. The payroll costs for employees not employed full-time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, worker's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work after regular working hours, on Saturday, Sunday or legal holidays, shall be recoverable costs under this Paragraph 11.2.1.1. to the extent authorized by OWNER.

11.2.1.2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Supplier's field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds, and returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

11.2.1.3. Payments made by CONTRACTOR to the Subcontractors for Work performed or furnished by Subcontractors. If required by OWNER, CONTRACTOR shall obtain

competitive bids from subcontractors acceptable to OWNER and CONTRACTOR and shall deliver such bids to OWNER who will then determine, with the advice of PROJECT MANAGER and/or ENGINEER, which bids, if any, will be accepted. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractors cost of the work and fee shall be determined in the same manner as CONTRACTOR'S Cost of the Work and fee as provided in Paragraphs 11.2.1., 11.2.2., 11.2.3., and 11.2.4.

All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

**11.2.1.4. Supplemental costs including the following:**

11.2.1.4.1. The proportion of necessary transportation, travel, and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

11.2.1.4.2. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery appliances, office, and temporary facilities at the site and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of CONTRACTOR.

11.2.1.4.3. Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of PROJECT MANAGER and/or ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling, and removal thereof, all in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

11.2.1.4.4. Sales Tax. Costs of any applicable sales tax.

11.2.1.4.5. Deposits lost for causes other than negligence, other fault, or breach of contract of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments, and fees for permits and licenses.

11.2.1.4.6. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the performance and furnishing of the Work, provided they have resulted from causes other than the negligence, other fault, strict liability without regard to fault, breach of contract, or breach of warranty of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the

written consent and approval of OWNER. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining CONTRACTOR's fee. If however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in Paragraph 11.2.3.

11.2.1.4.7. The cost of utilities, fuel, and sanitary facilities at the site.

11.2.1.4.8. Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage, and similar petty cash items in connection with the Work.

11.2.1.4.9. Cost of premiums for additional Bonds and insurance required because of changes in the Work.

11.2.2. The term Cost of the Work shall not include any of the following:

11.2.2.1 Payroll costs and other compensation of CONTRACTOR's officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by CONTRACTOR whether at the site or in CONTRACTOR's principal or a branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.2.1.1. or are to be considered administrative costs covered by the CONTRACTOR's fee.

11.2.2.2. Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.

11.2.2.3. Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

11.2.2.4. Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same except for the cost of premiums covered by subparagraph 11.2.1.4.9. above).

11.2.2.5. Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of Defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

11.2.2.6. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 11.2.1.

11.2.3. The CONTRACTOR's fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

11.2.3.1 A mutually acceptable fixed fee; or

11.2.3.2 If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

11.2.3.2.1. For costs incurred under Paragraphs 11.2.1.1. and 11.2.1.2., the CONTRACTOR's fee shall be ten (10) percent;

11.2.3.2.2. For costs incurred under Paragraph 11.2.1.3., the CONTRACTOR's fee shall be five (5) percent:

11.2.3.2.3. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee, and no fixed fee is agreed upon, the intent of Paragraphs 11.2.1.1., 11.2.1.2., 11.2.1.3. and 11.2.3.2 is that the Subcontractor who actually performs or furnishes the Work, at whatever tier, will be paid a fee of ten (10) percent of the costs incurred by such Subcontractor under Paragraphs 11.2.1.2. and 11.2.3 and that any higher tier Subcontractor and CONTRACTOR will each be paid a fee of five (5) percent of the amount paid to the next lower tier Subcontractor.

11.2.3.2.4. No fee shall be payable on the basis of costs itemized under Paragraphs 11.2.1.4. and 11.2.2.;

11.2.3.2.5. The amount of credit to be allowed by CONTRACTOR to OWNER for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in CONTRACTOR's fee by an amount equal to five (5) percent of such net decrease; and

11.2.3.2.6. When both additions and credits are involved in any one change, the adjustment in CONTRACTOR's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.2.3.2.1. through 11.2.3.2.5., inclusive.

11.2.4. Whenever the cost of any Work is to be determined pursuant to Paragraphs 11.2.1. and 11.2.2., CONTRACTOR will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in form acceptable to PROJECT MANAGER an itemized cost breakdown together with supporting data.

11.2.5. In calculating the amount of any Change of Contract Price, the following standards shall apply:

11.2.5.1 No indirect or consequential damages will be allowed.



11.2.5.2. All damages must be directly and specifically shown to be caused by a proven wrong. No recovery shall be based on a comparison of planned expenditures to total actual expenditures, or on estimated losses of labor efficiency, or on a comparison of planned manloading to actual manloading, or any other analysis that is used to show damages indirectly.

11.2.5.3 Damages are limited to extra costs specifically shown to have been directly caused by a proven wrong.

11.2.5.4 The maximum delay limit on any recovery for delay shall be the amount established by the Contractor for job overhead costs, defined in the Schedule of Values, divided by the total number of calendar days of Contract Time called for in the original Contract. Absent an overhead amount in the Schedule of Values, the amount estimated by CONTRACTOR for job overhead cost shall be used.

### **11.3. Allowances**

11.3.1. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be furnished and performed for such sums as may be acceptable to OWNER. CONTRACTOR agrees that:

11.3.1.1. The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site and all applicable taxes; and

11.3.1.2. CONTRACTOR's costs for unloading and handling on the site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

11.3.2 Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due CONTRACTOR on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted, provided that CONTRACTOR shall not be entitled to a change order in an amount greater than the allowances.

### **11.4. Unit Price Work**

11.4.1. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include, for all Unit Price Work, an amount equal to the sum of the established unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for comparison of bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by CONTRACTOR will be made by OWNER or PROJECT MANAGER in accordance with Paragraph 9.7. CONTRACTOR represents that its profits are not based upon the estimated

quantities of Unit Price Work and agrees that neither PROJECT MANAGER, ENGINEER nor OWNER shall be liable to CONTRACTOR if the actual amount of Unit Price Work differs from the estimated quantities of Unit Price Work, even if OWNER or CONTRACTOR was negligent in making such estimates.

11.4.2. Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

11.4.3. OWNER or CONTRACTOR may make a claim for an adjustment in the Contract Price in accordance with Article 11 if:

11.4.3.1. The quantity of any item of Unit Price Work performed by CONTRACTOR differs by more than twenty-five (25) percent (over or under) from the estimated quantity of such item indicated in the Agreement; and

11.4.3.2. There is no corresponding adjustment with respect to any other item of Work; and

11.4.3.3. If CONTRACTOR believes that CONTRACTOR is entitled to an increase in Contract Price as a result of having incurred additional expense or OWNER believes that OWNER is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

## **ARTICLE 12 CHANGE OF CONTRACT TIMES**

### **12.1 Claim for Adjustment**

The Contract Times (or Milestones) may only be changed by a Change Order. Any claim for an adjustment of the Contract Times (or Milestones) shall be based on written notice delivered by CONTRACTOR to PROJECT MANAGER promptly (but in no event later than thirty [30] days) after the occurrence of the event giving rise to the claim and stating the general nature of the claim. Notice of the extent of the claim, with supporting data, shall be delivered within sixty (60) days after such occurrence and shall be accompanied by the claimant's written representation that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled as a result of the occurrence of said event. No claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this Paragraph 12.1. CONTRACTOR must submit, as a minimum, the following supporting data:

12.1.1. Information showing that time requested is not included in the existing Contract and is an addition to the Contract.

12.1.2. Information documenting that the number of days requested is accurate for the event.

12.1.3. Revised, current construction schedule showing that the time requested affects the project's critical path.

## **12.2. Time of the Essence**

All time limits stated in the Contract Documents are of the essence of the Agreement.

## **12.3. Compensatory Delays**

When the Critical Path of the Project is delayed by a compensatory delay event, and there is no concurrent delay that is not a compensatory delay event, Contract Times (or Milestones) will be extended in an amount equal to the time lost due to such delay if a claim is made therefor as provided in Paragraph 12.1. Compensatory delay events are (1) delays caused by acts or neglect of OWNER, and (2) acts of neglect other contractors performing other work for OWNER. No adjustment to the Contract time will be allowed unless the matter on which the claim for an adjustment is based had an impact on the Critical Path of the Project equal to the adjustment sought.

## **12.4. Excusable Delays**

When the Critical Path of the Project is delayed by an excusable delay event, and there is no concurrent reason for the delay that is the fault of CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay. CONTRACTOR shall not be entitled to any increase in Contract Price as a result of such delay. Excusable delay events include delays for fire, flood, acts of God, unusually severe adverse weather when the weather over the entire Contract Time is considered and any other causes beyond the reasonable control of the CONTRACTOR when acting as a reasonably prudent CONTRACTOR.

# **ARTICLE 13 DISPUTE RESOLUTION**

## **13.1 Claims**

In the event the parties are not able to resolve claims for changes in Contract Price under Article 11 or claims for changes of Contract Time under Article 12, the matter is subject to the provisions of Article 13.

## **13.2 Claims Handling During Construction.**

After receipt of a Notice of Claim, the Owner may elect to refer the matter to the PROJECT MANAGER or ENGINEER or another party for review. CONTRACTOR will attend meeting called to review and discuss the Claims and mitigation of the problem, and shall furnish any reasonable factual backup for the Claim requested. The OWNER may also elect to defer consideration of the Claim until the Work is completed, in which case the same review options shall be available to the OWNER at the completion of the Work. At any stage, the OWNER is entitled to refer a Claim to mediation under the Construction Industry Mediation Rules of the American Arbitration Association, and if this reference is made, CONTRACTOR will take part in the mediation process. The filing, mediation or rejection of a Claim does not entitle CONTRACTOR to stop performance of the Work. The CONTRACTOR shall proceed diligently with performance of the Contract during the pendency

of any claim, excepting termination or under OWNER's direction to stop the Work. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof. The parties shall share the Mediator's fee and any filing fees equally, and the Mediation shall be held in Houston, Texas.

### **13.3 Claims Handling Following Construction**

The acceptance of final payment shall constitute a waiver of Claims by the CONTRACTOR which have not previously been identified in a timely Notice of Claim and specifically reserved in the final Application for Payment. If a Claim has not been resolved within six (6) months of the date of the final Application for Payment through Claim review procedures, mediation, or other Claim settlement negotiations, then CONTRACTOR at that time, but not before, shall be entitled to institute litigation on the Claim in a State Court of competent jurisdiction in Harris County, Texas and in no other forum.

## **ARTICLE 14 TESTS AND INSPECTIONS, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**

### **14.1. Notice of Defects**

Notice of all Defective Work of which OWNER, PROJECT MANAGER, or ENGINEER have actual knowledge will be given to CONTRACTOR. All Defective Work may be rejected, corrected or accepted as provided in this Article 14.

### **14.2. Access to Work**

OWNER, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, ENGINEER, ENGINEER's Subconsultants, other representatives and personnel of OWNER, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting, and testing. CONTRACTOR shall provide them proper and safe conditions for such access and shall advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.

### **14.3. Tests and Inspections**

14.3.1. CONTRACTOR shall give PROJECT MANAGER timely notice of readiness of the Work for all required inspections, tests or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

14.3.2. OWNER shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

14.3.2.1. For inspections, test or approvals covered by Paragraph 14.3.3 below;

14.3.2.2. That costs incurred in connection with tests or inspections conducted pursuant to Paragraph 14.4.2 below shall be paid as provided in said Paragraph 14.4.2; and

14.3.2.3. as otherwise specifically provided in the Contract Documents.

14.3.3. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, CONTRACTOR is to assume full responsibility for arranging and obtaining such inspections, tests, or approvals; pay all costs in connection therewith; and furnish OWNER the required certificates of inspection or approval. CONTRACTOR shall also be responsible for arranging and obtaining and paying all costs in connection with any inspections, tests, or approvals required for OWNER's, PROJECT MANAGER's, and ENGINEER's acceptance of materials or equipment to be incorporated in the Work or of materials, mix designs, or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work.

14.3.4. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by CONTRACTOR without written concurrence of PROJECT MANAGER, it must, if requested by PROJECT MANAGER, be uncovered for observation.

14.3.5. Uncovering Work as provided in Paragraph 14.3.4. shall be at CONTRACTOR's expense unless CONTRACTOR has given PROJECT MANAGER timely notice of CONTRACTOR's intention to cover the same and PROJECT MANAGER has not acted with reasonable promptness in response to such notice.

#### **14.4. Uncovering Work**

14.4.1. If any Work is covered contrary to the written request of PROJECT MANAGER, it must, if requested by PROJECT MANAGER, be uncovered for PROJECT MANAGER's observation and replaced at CONTRACTOR's expense.

14.4.2. If OWNER or PROJECT MANAGER considers it necessary or advisable that covered Work be observed by PROJECT MANAGER or inspected or tested by others, CONTRACTOR, at OWNER or PROJECT MANAGER's request, shall uncover, expose or otherwise make available for observation, inspection, or testing, as OWNER or PROJECT MANAGER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. If it is found that Work uncovered is Defective, CONTRACTOR shall pay all claims, costs, losses, and damages caused by, arising out of, or resulting from, such uncovering, exposure, observation, inspection, and testing and of satisfactory replacement or reconstruction of Defective work (including, but not limited to, all costs of repair or replacement of work of others). If, however, such Work is not found to be Defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Times (or Milestones), or both, to the limited extent the Contract Price and/or contract times are directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction, and, if the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in Articles 11 and 12.

#### **14.5. OWNER May Stop the Work**

If the Work is Defective or CONTRACTOR fails to supply a sufficient number of skilled workers or suitable materials or equipment or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any surety or other party.

#### **14.6. Correction or Removal of Defective Work**

If required by OWNER or PROJECT MANAGER, CONTRACTOR shall promptly, as directed, either correct all Defective Work, whether or not fabricated, installed or completed, or if the Work has been rejected by OWNER or PROJECT MANAGER, remove it from the site and replace it with Work that is not Defective.

#### **14.7. Correction Period**

14.7.1. If, within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be Defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions: (i) correct such Defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with Work that is not Defective, and (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom. If CONTRACTOR does not promptly comply with the terms of such instructions or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the Defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by, or resulting from, such removal and replacement (including but not limited to, all costs of repair or replacement of Work of others) will be paid by CONTRACTOR.

14.7.2. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period set forth in Paragraph 14.7.1 for the item may start to run from an earlier date if so provided in the Specifications or by Written Amendment.

14.7.3. Where Defective Work (and damage to other Work resulting therefrom) has been corrected, removed or replaced under this Paragraph 14.7.1, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

#### **14.8 Acceptance of Defective Work**

If, instead of requiring correction or removal and replacement of Defective Work, OWNER prefers to accept it, OWNER may do so. CONTRACTOR shall pay all claims, cost, losses, and damages

attributable to OWNER's evaluation of, and determination to, accept such Defective Work. If any such acceptance occurs prior to PROJECT MANAGER's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and OWNER shall be entitled to an appropriate decrease in the Contract Price.

#### **14.9. OWNER May Correct Defective Work**

Prior to final acceptance, if CONTRACTOR fails, within a reasonable time after written notice from OWNER or PROJECT MANAGER to correct Defective Work or to remove and replace rejected Work as required by OWNER or PROJECT MANAGER in accordance with Paragraph 14.6 or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven (7) days' written notice to CONTRACTOR, correct and remedy any such deficiency. In exercising the rights and remedies under this Paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment, and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees, OWNER's other contractors, PROJECT MANAGER, PROJECT MANAGER's Subconsultants, and ENGINEER and ENGINEER's Consultants access to the site to enable OWNER to exercise the rights and remedies under this Paragraph. All claims, costs, losses, and damages incurred or sustained by OWNER in exercising such rights and remedies will be charged against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work. OWNER shall be entitled to an appropriate decrease in the Contract Price. Such claims, cost, losses, and damages will include, but not be limited to, all costs of repair or replacement of work of others destroyed or damaged by correction, removal, or replacement of CONTRACTOR's Defective Work. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones) because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies hereunder.

### **ARTICLE 15 PAYMENTS TO CONTRACTOR AND COMPLETION**

#### **15.1 Schedule of Values**

The schedule of values established as provided in Paragraph 2.4.2.3 will serve as the basis of progress payments and will be incorporated into a form of application for payment acceptable to OWNER or PROJECT MANAGER. Progress payments on account of Unit Price Work will be based on the number of units completed.

## **15.2 Application for Progress Payment**

At least twenty (20) days before the date established for each progress payment (but not more often than once a month), CONTRACTOR shall submit to PROJECT MANAGER for review an Application for Payment completed and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. CONTRACTOR'S application for payment shall include a sworn representation and warranty by CONTRACTOR that it has paid all of its subcontractors and suppliers for all work performed and materials and equipment supplied to the extent covered by prior applications for payment. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that OWNER has received the materials and equipment free and clear of all Liens and evidence that the materials and other arrangements to protect OWNER's interest therein, all of which will be satisfactory to OWNER. Payment for such materials shall be a OWNER's sole discretion. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

## **15.3. CONTRACTOR's Warranty of Title**

CONTRACTOR warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER no later than the time of payment and free and clear of all liens.

## **15.4. Review of Applications for Progress Payment**

15.4.1. PROJECT MANAGER will, within ten (10) days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to OWNER, or return the Application to CONTRACTOR indicating in writing PROJECT MANAGER's reasons for refusing payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application. Ten (10) days after presentation of the Application for Payment to OWNER with PROJECT MANAGER's recommendation, the amount recommended by PROJECT MANAGER, less amounts withheld by OWNER pursuant to Paragraph 15.4.4, will become due and when due will be paid by OWNER to CONTRACTOR.

15.4.2. PROJECT MANAGER's recommendation of any payment requested in an Application for Payment will constitute a representation by PROJECT MANAGER to OWNER, based on PROJECT MANAGER's on-site observations of the executed Work as an experienced and qualified design professional and on PROJECT MANAGER's review of the Application for Payment and the accompanying data and schedules, that to the best of PROJECT MANAGER's knowledge, information, and belief:

15.4.2.1. the Work has progressed to the point indicated,



15.4.2.2. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work under Paragraph 9.7, and to any other qualifications stated in the recommendation),

15.4.2.3. in the case of Unit Price Work that there are not unbalanced Unit Prices that would, as a result of the payment to be made, result in a situation where the amount due CONTRACTOR to date would be a percentage of the total Contract Price substantially exceeding CONTRACTOR's percentage of overall completion on the Project.

15.4.2.4. the conditions precedent to CONTRACTOR's being entitled to such payment appear to have been fulfilled in so far as it is PROJECT MANAGER's responsibility to observe the Work.

However, by recommending any such payment PROJECT MANAGER will not thereby be deemed to have represented that: (i) exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to PROJECT MANAGER in the Contract Documents or (ii) that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

15.4.3. PROJECT MANAGER's recommendations of any payment, including final payment, shall not mean that PROJECT MANAGER is responsible for, and shall not relieve CONTRACTOR from, its responsibility for CONTRACTOR's means, methods, techniques, sequences, or procedures of construction, or the safety precautions or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of CONTRACTOR to comply with Laws and Regulations applicable to the furnishing or performance of Work, or for any failure of CONTRACTOR to perform or furnish Work in accordance with the Contract Documents or that PROJECT MANAGER is representing that CONTRACTOR has complied with Laws and Regulations or performed or furnished the work in accordance with the Contract Documents.

15.4.4. PROJECT MANAGER may refuse to recommend the whole or any part of payment if, in PROJECT MANAGER's opinion, it would be incorrect to make the representations to OWNER referred to in Paragraph 15.4.2. PROJECT MANAGER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended, to such extent as may be necessary in PROJECT MANAGER's opinion to protect OWNER from loss because:

15.4.4.1. the Work is Defective, or completed Work has been damaged requiring correction or replacement,

15.4.4.2. the Contract price has been reduced by Written Amendment or Change Order,

15.4.4.3. OWNER has been required to correct Defective Work or complete Work in accordance with Paragraph 14.9, or

15.4.4.4. PROJECT MANAGER has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 16.2.1 through 16.2.1.4 inclusive.

OWNER may refuse to make payment of the full amount recommended by PROJECT MANAGER because:

15.4.4.5. claims have been made against OWNER on account of CONTRACTOR's performance or furnishing of the Work.

15.4.4.6. Notices have been received from Subcontractor, Suppliers or Workman indicating that CONTRACTOR is not current in its obligations,

15.4.4.7. there are other items entitling OWNER to a set-off against the amount recommended, or

15.4.4.8. OWNER has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 15.4.4.1 through 15.4.4.3 or Paragraphs 16.2.1.1. through 16.2.1.4 inclusive;

The amount so withheld, or any adjustment thereto agreed to by OWNER and CONTRACTOR, shall be paid when CONTRACTOR corrects to OWNER's satisfaction the reasons for such action. Any amount not recommended for payment or approved for payment by OWNER pursuant to this Paragraph 15.4 shall not be due to CONTRACTOR and shall not be subject to interest under the Contract Document.

## **15.5. Substantial Completion**

15.5.1. When CONTRACTOR considers the entire Work ready for its intended use, CONTRACTOR shall notify OWNER and PROJECT MANAGER in writing that the entire Work is substantially complete (except for items specifically listed by CONTRACTOR as incomplete) and shall request that PROJECT MANAGER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR, PROJECT MANAGER, and ENGINEER shall make an inspection of the Work to determine the status of completion. If PROJECT MANAGER, ENGINEER and/or OWNER do not consider the Work substantially complete, PROJECT MANAGER will notify CONTRACTOR in writing giving the reasons therefor. If PROJECT MANAGER, ENGINEER and OWNER considers the Work substantially complete, PROJECT MANAGER will prepare and deliver to CONTRACTOR a certificate of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. The Certificate of Substantial Completion shall set out a division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, heat, utilities, insurance, and warranties and guarantees.

15.5.2. OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list used until final acceptance. CONTRACTOR shall complete or correct such items in a diligent and expeditious manner.

15.5.3 If it is necessary for the OWNER, ENGINEER and PROJECT MANAGER are required to respond to more than two Notices from CONTRACTOR that the Work is Substantially Completed before the Work is reasonably found to be Substantially Complete, the cost of all evaluations of the state of completion beyond the second evaluation shall be charged to CONTRACTOR.

#### **15.6. Partial Utilization**

Use by OWNER at OWNER's option of any substantially completed part of the Work which (i) has specifically been identified in the Contract Documents, or which (ii) OWNER, PROJECT MANAGER, ENGINEER, and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all of the Work subject to the following:

15.6.1. OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete.

15.6.2. No occupancy or separate operation of part of the Work will be accomplished prior to compliance with the requirements of Paragraph 5.8 in respect of property insurance.

#### **15.7. Final Inspection**

Upon written notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, OWNER, PROJECT MANAGER and/or ENGINEER will make a final inspection with OWNER and OWNER, PROJECT MANAGER and/or ENGINEER will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the Work is incomplete in that the Work is not capable of performing its intended function in an efficient matter or is Defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

#### **15.8. Final Application for Payment**

After CONTRACTOR has completed all such corrections described in Paragraph 15.7 to the satisfaction of PROJECT MANAGER, ENGINEER and OWNER and has delivered in accordance with the Contract Documents all maintenance and operating instructions, schedules, guarantees, Bonds, certificates, or other evidence of insurance required by Paragraph 5.3, certificates of inspection, marked-up record documents (as provided in Paragraph 6.11), and other documents reasonably required by OWNER, CONTRACTOR may make application for final payment following the procedure for progress payments. The Final Application for Payment shall be

accompanied (except as previously delivered) by: (i) all documentation called for in the Contract Documents, including, but not limited to, the evidence of insurance required by subparagraph 5.3.13, (ii) consent of the surety, if any, to final payment, and (iii) complete and legally effective releases or waivers (satisfactory to OWNER) of all liens arising out of, or filed in connection with, the Work. In lieu of such releases or waivers of liens and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full and an affidavit of CONTRACTOR that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed, and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or OWNER's property might in any way be responsible have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien. **CONTRACTOR AGREES TO INDEMNIFY, PROTECT, DEFEND, AND HOLD HARMLESS OWNER, ITS PARTNERS, DIRECTORS, OFFICERS, EMPLOYEES, AND AGENTS FROM AND AGAINST ANY AND ALL DEMANDS, OR OTHER ENCUMBRANCES ON OWNER OR ITS PROPERTY FILED IN CONNECTION WITH THE WORK, AND ANY AND ALL CLAIMS, SUITS AND CAUSES OF ACTION, LIABILITY, COSTS, EXPENSES, SETTLEMENTS, AND JUDGMENTS INCURRED IN CONNECTION THEREWITH (INCLUDING, BUT NOT LIMITED TO, ALL FEES AND CHARGES OF PROJECT MANAGER, ENGINEERS, ARCHITECTS, ATTORNEYS AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS).**

#### **15.9. Final Payment and Acceptance**

15.9.1. If, on the basis of PROJECT MANAGER's and/or ENGINEER's observation of the Work during construction and final inspection and OWNER or PROJECT MANAGER's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, OWNER and/or PROJECT MANAGER are satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled, OWNER or PROJECT MANAGER will, within ten (10) days after receipt of the final Application for Payment, indicate in writing if it is timely for Final Payment. At the same time, OWNER or PROJECT MANAGER also will give written notice to CONTRACTOR that the Work is acceptable subject to the provisions of Paragraph 15.10. Otherwise, OWNER or PROJECT MANAGER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application and accompanying documentation in appropriate form and substance, and the final payment will be come due and will be paid by OWNER to CONTRACTOR.

15.9.2. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of PROJECT MANAGER and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully complete or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in Paragraph 5.1.1, the

written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to PROJECT MANAGER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

**15.10. Waiver of Claims**

The acceptance of final payment will constitute a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and complying with all requirements of Article 11 and still unsettled.

**ARTICLE 16 SUSPENSION OF WORK AND TERMINATION**

**16.1. OWNER May Suspend Work**

At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than ninety (90) days by notice in writing to CONTRACTOR. CONTRACTOR shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes an approved claim therefor as provided in Articles 11 and 12.

**16.2. OWNER May Terminate**

16.2.1. Upon the occurrence of any one or more of the following events:

16.2.1.1. if, in the opinion of the OWNER, CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply a sufficient number of or sufficiently skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under Paragraph 2.6 as adjusted from time to time pursuant to Paragraph 6.3);

16.2.1.2. if CONTRACTOR disregards Laws or Regulations of any public body having jurisdiction over the project, the work of CONTRACTOR'S performance of the work;

16.2.1.3. if CONTRACTOR disregards the authority of PROJECT MANAGER or ENGINEER; or

16.2.1.4. if CONTRACTOR otherwise violates, in any substantial way, any provisions of the Contract Documents;

16.2.1.5. if Hazardous Waste is uncovered or revealed at the site which was not shown or indicated within the plans or specifications identified in the Contract Documents to be within the scope of the Work or which CONTRACTOR discovered or should have discovered in CONTRACTOR'S inspection of the property in preparing any Bid and which may present a

substantial danger to persons or property exposed thereto in connection with the Work at the site.

OWNER may, after giving CONTRACTOR seven (7) days' written notice, and, to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages sustained by OWNER arising out of, or resulting from, completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses, and damages exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. When exercising any rights or remedies under this paragraph, OWNER shall not be required to obtain the lowest price for the Work performed.

16.2.2. Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

16.2.3. Upon seven (7) days' written notice to CONTRACTOR, PROJECT MANAGER, and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy of OWNER, elect to terminate the Agreement in whole or in part. In such case, CONTRACTOR shall be paid (without duplication of any items):

16.2.3.1. For completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work actually performed to the date of termination;

16.2.3.2. For expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

16.2.3.3. For all claims, costs, losses, and damages incurred in reasonable settlements of terminated contracts with Subcontractors, Suppliers, and others; and

16.2.3.4. For reasonable expenses directly attributable to termination.

CONTRACTOR shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of, or resulting from, such termination. **OWNER SHALL NOT BE LIABLE TO CONTRACTOR FOR ANY LOSS OF ANTICIPATED PROFITS OR REVENUE OR OTHER ECONOMIC LOSS ARISING OUT OF, OR RESULTING FROM, SUCH TERMINATION, EVEN IF SUCH LOSS IS DUE TO THE NEGLIGENCE, OTHER FAULT, BREACH OF CONTRACT OR WARRANTY, VIOLATION OF THE TEXAS**

**DECEPTIVE TRADE PRACTICES ACT, OR STRICT LIABILITY WITHOUT REGARD TO FAULT OF OWNER.**

**16.3. CONTRACTOR May Stop Work or Terminate**

If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety (90) days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within thirty (30) calendar days to pay CONTRACTOR any sum finally determined to be due, then CONTRACTOR may, upon seven (7) days' written notice to OWNER and PROJECT MANAGER, and provided OWNER or PROJECT MANGER do not remedy such suspension or failure within that time, terminate the Agreement and recover from OWNER, payment on the same terms as provided in Paragraph 16.2.3. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if PROJECT MANAGER has failed to act on an Application for Payment within thirty (30) days after it is submitted, or OWNER has failed for thirty (30) days to pay CONTRACTOR any sums finally determined to be due, CONTRACTOR may upon seven (7) day's written notice to OWNER and PROJECT MANAGER stop the Work until payment of all such amount due CONTRACTOR, including interest thereon. The provisions of this Paragraph 15.3 are not intended to preclude CONTRACTOR from making claim under Articles 11 and 12 for an increase in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping Work as permitted by this Paragraph.

**16.4. Termination Conversion**

If OWNER Terminates the Agreement pursuant to Paragraph 16.2 and such termination is subsequently determined to be wrongful or otherwise improper by a court of competent jurisdiction, such termination shall thereby be deemed as a termination under Paragraph 16.2.3. CONTRACTOR'S rights of recovery against OWNER shall be limited to the amounts set forth at Paragraphs 16.2.3.1, 16.2.3.2, 16.2.3.3, and 16.2.3.4 and as otherwise limited in Article 11.

**ARTICLE 17 MISCELLANEOUS**

**17.1. Giving Notice**

Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at, or sent by, registered or certified United States mail, postage prepaid, to the address set forth in the Agreement for the giving of the notice.

**17.2. Computation of Times**

17.2.1. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such

period falls on a Saturday or Sunday or on a day made a legal holiday (holiday recognized by OWNER) such day will be omitted from the computation.

17.2.2. A day of twenty-four (24) hours measured from midnight to the next midnight will constitute a day.

17.2.3. Unless specifically provided otherwise in Supplemental Conditions or the Contract, all count of days under the provisions of this Contract shall be calendar days.

### **17.3. Notice of Claim**

Should OWNER or CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, such claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this Paragraph shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

### **17.4. Cumulative Remedies**

The duties and obligations imposed by these GENERAL CONDITIONS and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees, and obligations imposed upon CONTRACTOR by Paragraphs 6.6, 6.8.2, 6.10.1, 6.12.2, 6.19, 6.20.1, 6.20.2, 12.4, 14.6, 14.7, 14.9, 15.8, and 16.2.3, and all of the rights and remedies available to OWNER, PROJECT MANAGER, and ENGINEER thereunder, are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents, and the provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply.

### **17.5. Setoff**

OWNER may, at its option, setoff any amounts otherwise due from OWNER to CONTRACTOR under this Agreement against any delinquent amounts or liabilities which are due to OWNER or its commonly controlled affiliates from CONTRACTOR. All of CONTRACTOR's claims for money due or to become due from OWNER under this Agreement shall be subject to deduction or set off by OWNER by reason of any counterclaim arising out of this or any other transaction with CONTRACTOR.

### **17.6. Voluntary Agreement**

The parties hereto enter into this Agreement as their free and voluntary act, with adequate opportunity to consult with counsel of their choice, without coercion or duress of any kind.



**17.7. Invalidities**

The invalidity of any part or provision of this Agreement shall not impair or affect in any manner whatsoever the validity, enforceability or effect of the remainder of this Agreement.

**17.8. Multiple Counterparts**

This Agreement shall be executed in multiple counterparts, each of which counterpart shall be considered an original counterpart of equal dignity with all other original counterparts.

**17.9. No Third Party Beneficiaries**

This Agreement shall be executed in multiple counterparts, each of which counterpart shall be considered an original counterpart of equal dignity with all other original counterparts.

**17.10. Governing Law**

This Agreement shall be governed by the laws of the state of Texas.

**END OF SECTION**

**SECTION 00800**

**SUPPLEMENTARY CONDITIONS  
TABLE OF CONTENTS**

**PART I - AMENDMENTS TO GENERAL CONDITIONS**

<u>Article</u>	<u>Title</u>	<u>Page No.</u>
1	Definition	
2	Preliminary Matters	
3	Contract Documents: Intent, Amending, Reuse	
4	Availability of Lands, Subsurface and Physical Conditions; Reference Points.....	1
5	Bond and Insurance.....	2
6	Contractor's Responsibility.....	4

**PART II TWDB SUPPLEMENTAL CONDITIONS AND FORMS**

TwDB Supplemental Conditions .....	5
Attachment	TwDB-0459 – Vendor Compliance with Reciprocity on Non-Resident Bidder
Attachment	ED-103 – Contractor's Act of Assurance
Attachment	ED-104 – Contractor's Act of Assurance Resolution
Attachment	WRD-255 – Bidder's Certifications
Attachment	TwDB-1105 – United States Iron and Steel (US I&S) Guidance for Projects Funded through State Programs

**PART III OTHER PROVISIONS**

Attachment "A-1"	Harris County Engineering Construction Prevailing Wages for the 2 <sup>nd</sup> Quarter 2020
Attachment "A-2"	Harris County Building Construction Prevailing Wages for the 2 <sup>nd</sup> Quarter 2020
Attachment "B-1"	Workers' Compensation Insurance Coverage
Attachment "C-1"	HB 914 Conflict Disclosures
Attachment "D-1"	Sample Permit Documents
Attachment "E-1"	Pipeline Permits

**SECTION 00800  
SUPPLEMENTARY CONDITIONS**

**PART I - AMENDMENTS TO GENERAL CONDITIONS**

These Supplemental Conditions amend or supplement the General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

**ARTICLE 1 DEFINITIONS**

Add to Definitions:

**Water Receiving Facilities (WRF):** Water Receiving Facility is an enclosed facility which receives, stores and re pumps surface water or a combination of surface and ground water.

**Stipulated Price Contract:** Stipulated Price Contract is a standard prime **contract** between Owner and prime Contractor that establishes a single, pre-determined fixed **price**, or lump sum, regardless of the Contractor's actual costs.

**ARTICLE 4 AVAILABILITY OF LANDS, SUBSURFACES, AND PHYSICAL  
CONDITION**

SC-4.2 Add to paragraph 4.2.1

4.2.1.1 The following reports have been utilized by the Engineer in the preparation of the Contract Documents.

4.2.1.2 HTS, Inc. Consultants, "Geotechnical Investigation Proposed NHCRWA Contract No. 28-B 2025 Water Distribution and Transmission System, Harris County, Texas, December 30, 2016," and is available for review at the offices of: AECOM Technical Services, Inc., 19219 Katy Freeway, Suite 100, Houston, Texas 77094. *(Add Phase II Report if completed)*

4.2.1.3 HTS, Inc. Consultants, "Phase I Environmental Site Assessment Proposed NHCRWA Contract No. 28-B 2025 Water Distribution And Transmission System, Harris County, Texas, November 30, 2016," and is available for review at the offices of: AECOM Technical Services, Inc., 19219 Katy Freeway, Suite 100, Houston, Texas 77094

AECOM Technical Services, Inc., 19219 Katy Freeway, Suite 100, Houston, Texas 77094.

SC-4.4 Add to paragraph 4.4

4.4.1 **Lines and Grades.** From bench marks and horizontal control references established by OWNER, CONTRACTOR shall stake out work, establish elevations, and be responsible for correctness of installation as to location and grade. Engineer will establish bench marks and references for horizontal control on various projects as follows:

4.4.1.1 **One Structure at Site.** Bench mark and reference hubs at two corners of structure.

4.4.1.2 **Two or More Structures.** Bench mark and base line at site.

4.4.1.3 **Sewer Lines.** Bench marks at intervals not exceeding 2,000 feet and reference hubs at manholes and on line at intervals not exceeding 200 feet.

4.4.1.4 **Waterlines.** Reference hubs at turns in line, valves, and fire hydrants, and bench marks at intervals not exceeding 2,000 feet.

4.4.1.5 **Pavements and Ditches.** Reference hubs on centerline or one right-of-way line at the P.C., P.I., and P.T. of curves and on tangents at intervals not exceeding 200 feet. Bench marks at intervals not exceeding 2,000 feet.

4.4.1.6 **OWNER will set stakes one time only.** Contractor must satisfy himself, before commencing work, as to the meaning or correctness of all stakes or marks, and no claim will be entertained for, or on account of, any alleged inaccuracies, or for alterations subsequently rendered necessary on account of such alleged inaccuracies, unless Contractor notifies PROJECT MANAGER in writing before commencing work thereon.

Contractor shall protect stakes and pay all costs involved in any restaking. Stakes, as described above, will be furnished as required by Contractor within 48 hours after written notification to PROJECT MANAGER by Contractor on stake-out request forms provided by Engineer. Contractor shall have a representative on the job at the time field party begins work.

**ARTICLE 5 INSURANCE**

SC-5 Add to paragraph 5.3.8

**INSURANCE TO BE PROVIDED BY CONTRACTOR**

*Risks and Limits of Liability:* Contractor shall provide at a minimum insurance coverage and limits of liability set out in Table 1.

If Limit of Liability for Excess Coverage is \$2,000,000 or more, Limit of Liability for Employer's Liability may be reduced to \$500,000.

**TABLE 1  
REQUIRED COVERAGE**

(Coverage)	(Limit of Liability)
1. Workers' Compensation	Statutory Limits for Workers' Compensation
2. Employer's Liability	Bodily Injury by Accident \$1,000,000 (each accident) Bodily Injury by Accident \$1,000,000 (policy limit) Bodily Injury by Disease \$1,000,000 (each employee)
3. Commercial General Liability: Including Contractor's Protective, Premises/Operations and Coverage for Independent Contractors, Broad Form Property Damage, Contractual and Employee Liability, Explosion, Underground and Collapse, Bodily Injury, Personal Injury, Products and Completed Operations (for a period of two (2) years following completion of the Work).	Combined single limit of \$1,000,000 (each occurrence), subject to general aggregate of \$2,000,000; Products and Completed Operations \$1,000,000 aggregate
4. Owner's and Contractor's Protective Liability	\$1,000,000 combined single limit each occurrence/aggregate
5. Installation Floater	Value of stored material or equipment, listed on Certificates of Payments, but not yet incorporated into the Work
6. Comprehensive Automobile Liability Insurance: (For automobiles furnished by Contractor in course of his performance under the Contract, including Owned, Non-owned, and Hired Auto coverage)	Property Damage \$1,000,000 combined per occurrence, or equivalent Bodily injury \$1,000,000 per person \$1,000,000 per occurrence
7. Excess Coverage	\$1,000,000 each occurrence/combined aggregate in excess of limits specified for Employer's Liability, Commercial General Liability, and Automobile Liability

(Coverage)	(Limit of Liability)
8. Property and Casualty Coverage: “All Causes of Loss” Builder’s Risk Form with completed value method of valuation for directing physical change to building or plant construction on the Work site and/or all land improvements including all work. (Including but not limited to earthquake, flood, boiler, and machinery for replacement cost value, and including testing, damage to existing or adjoining property, time element coverage, collapse, soft costs (management, architecture, financial costs, pre-opening cost, etc.), transit coverage, off-site storage).	100% of Contract Price, including change orders
9. Umbrella Excess Liability Insurance written on umbrella excess basis above coverage for Worker’s Compensation, Commercial General Liability and Comprehensive Automobile Liability	Bodily Injury Property Damage \$5,000,000 per occurrence \$5,000,000 aggregate
Defense costs are excluded from face amount of policy. Aggregate Limits are per 12-month policy period unless otherwise indicated.	

*Insured Parties:* Each policy, except those for Workers’ Compensation and Owner’s and Contractor’s Protective Liability, must name the Authority its officers, agents, and employees as additional insured parties on original policy and all renewals or replacements during term of the Contract. The Authority’s status as additional insured under Contractor’s insurance does not extend to instances of sole negligence of the Authority unmixed with any fault of Contractor.

*Subrogation:* Each policy except Owner’s and Contractor’s Protective Liability must contain endorsement to the effect that issuer waives any claim or right in nature of subrogation to recover against the Authority, its officers, agents, or employees.

*Endorsement of Primary Insurance:* Each policy must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising hereunder.

SC-5.1 Add to paragraph 5.1

5.1.1 The construction contract documents, bonds, insurance, etc. are to be completed and returned within eight (8) days after the date the contract documents are received by the contractor.

SC-5.2 Add to paragraph 5.2

5.2.1 The construction contract documents, bonds, insurance, etc. are to be completed and returned within eight (8) days after the date the contract documents are received by the contractor.

**ARTICLE 6 CONTRACTOR’S RESPONSIBILITY**

SC-6.7 Add to paragraph 6.7

- 6.7.1 Contractor is responsible to disclose certain relationships he may have with Board members or consultants of the Authority. Contractor is to complete the attached Conflict of Interest Questionnaire (the "Questionnaire") found in Attachment "C-1" at the end of this section and submit it with the bid. **FAILURE TO COMPLETE AND SUBMIT THE QUESTIONNAIRE WILL RESULT IN THE BID BEING DECLARED INCOMPLETE AND COULD LEAD TO CRIMINAL LIABILITY.** In the discretion of the Authority, an incomplete bid resulting from the failure to complete and submit the Questionnaire by the bid submission deadline may be waived provided that the Questionnaire is completed and submitted prior to award of the contract by the Authority.
- 6.7.2 The North Harris County Regional Water Authority has obtained the pipeline permits from Enterprise, Exxon, Genesis and Kinder Morgan. Copies of the Pipeline Permits are included in Attachment "E-1" at the end of this section. The Contractor shall abide by all provisions outlined in the agreement, and shall be responsible to pay any costs associated with those provisions.

SC-6.16 Add to paragraph 6.16.1

- 6.16.1 The Contractor will submit the shop drawings for the Standard sections of pipe within 15 days and for the special sections within 30 days after notice to proceed. This section overrides any other references to the required time to submit shop drawings for the pipe material in the specifications.

**PART II - TWDB SUPPLEMENTAL CONDITIONS AND FORMS**

**1. Supersession**

The OWNER and the CONTRACTOR agree that the TWDB Supplemental Conditions apply to the work eligible for Texas Water Development Board assistance to be performed under this contract and these clauses supersede any conflicting provisions of this contract.

**2. Privity of Contract**

Funding for this project is expected to be provided in part by a loan or grant from the Texas Water Development Board. Neither the state of Texas, nor any of its departments, agencies

or employees is, or will be, a party to this contract or any lower tier contract. This contract is subject to applicable provisions in 31 TAC Chapter 363 in effect on the date of the assistance award for this project.

**3. Definitions**

- (a) The term "OWNER" means the North Harris County Regional Water Authority (Authority).
- (b) The term "TWDB" means the Executive Administrator of the Texas Water Development Board, or other person who may be at the time acting in the capacity or authorized to perform the functions of such Executive Administrator, or the authorized representative thereof.
- (c) The term "ENGINEER" means the OWNER's authorized consulting ENGINEER for the project.

**4. Laws to be Observed**

In the execution of the contract, the CONTRACTOR must comply with all applicable local, state and federal laws, including but not limited to laws concerned with labor, safety, minimum wages, and the environment. The CONTRACTOR shall be familiar with and at all times shall observe and comply with all federal, state, and local laws, ordinances and regulations which in any manner affect the conduct of the work, and shall indemnify and save harmless the OWNER, Texas Water Development Board, and their representatives against any claim arising from violation of any such law, ordinance or regulation by the CONTRACTOR, their Subcontractor or their employees.

**5. Review by OWNER and TWDB**

- (a) The OWNER, authorized representatives and agents of the OWNER, and the TWDB shall, at all times have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this contract, provided, however that all instructions and approval with respect to the work will be given to the CONTRACTOR only by the OWNER through authorized representatives or agents.
- (b) Any such inspection or review by the TWDB shall not subject the state of Texas, or its representatives, to any action for damages.

**6. Performance and Payment Bonds**

Each CONTRACTOR awarded a construction contract must furnish performance and payment bonds:

- (a) the performance bond shall include without limitation guarantees that work done under the contract will be completed and performed according to approved plans and specifications and in accordance with sound construction principles and practices;
- (b) the performance and payment bonds shall be in a penal sum of not less than 100 percent of the contract price and remain in effect for one year beyond the date of approval by the ENGINEER of the political subdivision; and



- (c) the CONTRACTOR shall utilize a surety company that is authorized to do business in Texas in accordance with Surety Bonds and Related Instruments, Chapter 3503 of the Insurance Code.

## **7. Payments Schedule and Cost Breakdown**

- (a) The CONTRACTOR shall submit for approval immediately after execution of the Agreement, a carefully prepared Progress Schedule, showing the proposed dates of starting and completing each of the various sections of the work, the anticipated monthly payments to become due to the CONTRACTOR, and the accumulated percent of progress each month.
- (b) The following paragraph applies only to contracts awarded on a lump sum contract price:

**COST BREAKDOWN** - The CONTRACTOR shall submit to the OWNER a detailed breakdown of the estimated cost of all work to be accomplished under the contract, so arranged and itemized as to meet the approval of the OWNER or funding agencies. This breakdown shall be submitted promptly after execution of the agreement and before any payment is made to the CONTRACTOR for the work performed under the contract. After approval by the OWNER the unit prices established in the breakdown shall be used in estimating the amount of partial payments to be made to the CONTRACTOR.

## **8. Workers' Compensation Insurance Coverage (as applicable, consistent with Texas Labor Code § 406.096)**

- (a) The CONTRACTOR shall certify in writing that they provide workers' compensation insurance coverage for each employee of the CONTRACTOR employed on the public project.
- (b) Each Subcontractor on the public project shall provide such a certificate relating to coverage of the Subcontractor's employees to the general CONTRACTOR, who shall provide the Subcontractor's certificate to the governmental entity.
- (c) A CONTRACTOR who has a contract that requires workers' compensation insurance coverage may provide the coverage through a group plan or other method satisfactory to the governing body of the governmental entity.
- (d) The employment of a maintenance employee by an employer who is not engaging in building or construction as the employer's primary business does not constitute engaging in building or construction.
- (e) In this section:
  - (1) "Building or construction" includes:
    - i. erecting or preparing to erect a structure, including a building, bridge, roadway, public utility facility, or related appurtenance;
    - ii. remodeling, extending, repairing, or demolishing a structure; or
    - iii. otherwise improving real property or an appurtenance to real property through similar activities.
  - (2) "Governmental entity" means this state or a political subdivision of this state. The term includes a municipality.

## **9. Not Used**

## **10. Prevailing Wage Rates**

This contract is subject to Government Code Chapter 2258 concerning payment of Prevailing Wage Rates. The OWNER will determine what the general prevailing rates are in accordance with the statute. The applicable provisions include, but are not limited to the following:

### **§2258.021. Right to be Paid Prevailing Wage Rates**

- (a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
  - (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
  - (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.
- (b) Subsection (a) does not apply to maintenance work.
- (c) A worker is employed on a public work for the purposes of this section if the worker is employed by a CONTRACTOR or Subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

### **§2258.023. Prevailing Wage Rates to be Paid by CONTRACTOR and Subcontractor; Penalty**

- (a) The CONTRACTOR who is awarded a contract by a public body or a Subcontractor of the CONTRACTOR shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.
- (b) A CONTRACTOR or Subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, \$60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.
- (c) A CONTRACTOR or Subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.
- (d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.
- (e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

### **§2258. 024. Records**

- (a) A CONTRACTOR and Subcontractor shall keep a record showing:
  - (1) the name and occupation of each worker employed by the CONTRACTOR or Subcontractor in the construction of the public work; and
  - (2) the actual per diem wages paid to each worker.
- (b) The record shall be open at all reasonable hours to inspection by the officers and agents

of the public body.

**§2258. 025. Payment Greater Than Prevailing Rate Not Prohibited**

This chapter does not prohibit the payment to a worker employed on a public work an amount greater than the general prevailing rate of per diem wages.

**11. Not Used**

**12. Payments**

(a) Progress Payments:

- (1) The CONTRACTOR shall prepare their requisition for progress payment as of the last day of the month and submit it, with the required number of copies, to the ENGINEER for review. Except as provided in paragraph (3) of this subsection, the amount of the payment due the CONTRACTOR shall be determined by adding to the total value of work completed to date, the value of materials properly stored on the site and deducting: (1) five percent (5%) minimum of the total amount, as a retainage and (2) the amount of all previous payments. The total value of work completed to date shall be based on the actual or estimated quantities of work completed and on the unit prices contained in the agreement (or cost breakdown approved pursuant to section 7b relating to lump sum bids) and adjusted by approved change orders. The value of materials properly stored on the site shall be based upon the estimated quantities of such materials and the invoice prices. Copies of all invoices shall be available for inspection by the ENGINEER.
- (2) The CONTRACTOR shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the OWNER. Such payments shall not constitute a waiver of the right of the OWNER to require the fulfillment of all terms of the Contract and the delivery of all improvements embraced in this contract complete and satisfactory to the OWNER in all details.
- (3) This clause applies to contracts when the OWNER is a District or Authority. The retainage shall be ten percent of the amount otherwise due until at least fifty percent of the work has been completed. After the project is fifty percent completed, and if the District or Authority's Board finds that satisfactory progress is being made, then the District may authorize any of the remaining progress payments to be made in full. The District is not obligated to pay interest earned on the first 50% of work completed (Texas Water Code Sec. 49.276(d)).
- (4) The five percent (5%) retainage of the progress payments due to the CONTRACTOR may not be reduced until the building of the project is substantially complete and a reduction in the retainage has been authorized by the TWDB.

- (b) Withholding Payments. The OWNER may withhold from any payment otherwise due the CONTRACTOR so much as may be necessary to protect the OWNER and if so elects may also withhold any amounts due from the CONTRACTOR to any Subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the OWNER and will not require the OWNER to determine or adjust any claims or disputes between the CONTRACTOR

and their Subcontractors or Material dealers, or to withhold any monies for their protection unless the OWNER elects to do so. The failure or refusal of the OWNER to withhold any monies from the CONTRACTOR shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this contract.

(c) Payments Subject to Submission of Certificates. Each payment to the CONTRACTOR by the OWNER shall be made subject to submission by the CONTRACTOR of all written certifications required of the CONTRACTOR, their Subcontractors and other general and special conditions elsewhere in this contract.

(d) Final Payment.

(1) Upon satisfactory completion of the work performed under this contract, as a condition before final payment under this contract or as a termination settlement under this contract the CONTRACTOR shall execute and deliver to the OWNER a release of all claims against the OWNER arising under, or by virtue of, this contract, except claims which are specifically exempted by the CONTRACTOR to be set forth therein. Unless otherwise provided in this contract, by state law or otherwise expressly agreed to by the parties to this contract, final payment under this contract or settlement upon termination of this contract shall not constitute a waiver of the OWNER's claims against the CONTRACTOR or their sureties under this contract or applicable performance and payment bonds.

(2) After final inspection and acceptance by the OWNER of all work under the Contract, the CONTRACTOR shall prepare their requisition for final payment which shall be based upon the carefully measured or computed quantity of each item of work at the applicable unit prices stipulated in the Agreement or cost breakdown (if lump sum), as adjusted by approved change orders. The total amount of the final payment due to the CONTRACTOR under this contract shall be the amount computed as described above less all previous payments.

(3) The retainage and its interest earnings, if any, shall not be paid to the CONTRACTOR until the TWDB has authorized a reduction in, or release of, retainage on the contract work.

(4) Withholding of any amount due to the OWNER, under general and/or special conditions regarding "Liquidated Damages" shall be deducted from the final payment due the CONTRACTOR.

### **13. Archaeological Discoveries and Cultural Resources**

No activity which may affect properties listed or properties eligible for listing in the National Register of Historic Places or eligible for designation as a State Archeological Landmark is authorized until the OWNER has complied with the provisions of the National Historic Preservation Act and the Antiquities Code of Texas. The OWNER has previously coordinated with the appropriate agencies and impacts to known cultural or archeological deposits have been avoided or mitigated. However, the CONTRACTOR may encounter unanticipated cultural or archeological deposits during construction.

If archeological sites or historic structures which may qualify for designation as a State Archeological Landmark according to the criteria in 13 TAC Chapter 26, or that may be

eligible for listing on the National Register of Historic Places in accordance with 36 CFR Part 800, are discovered after construction operations are begun, the CONTRACTOR shall immediately cease operations in that particular area and notify the OWNER, the TWDB, and the Texas Historical Commission, 1511 N. Colorado St. , P. O. Box 12276, Capitol Station, Austin, Texas 78711-2276. The CONTRACTOR shall take reasonable steps to protect and preserve the discoveries until they have been inspected by the OWNER's representative and the TWDB. The OWNER will promptly coordinate with the State Historic Preservation Officer and any other appropriate agencies to obtain any necessary approvals or permits to enable the work to continue. The CONTRACTOR shall not resume work in the area of the discovery until authorized to do so by the OWNER.

#### **14. Endangered Species**

No activity is authorized that is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), and/or the State of Texas Parks and Wildlife Code on Endangered Species, or to destroy or adversely modify the habitat of such species.

If a threatened or endangered species is encountered during construction, the CONTRACTOR shall immediately cease work in the area of the encounter and notify the OWNER, who will immediately implement actions in accordance with the ESA and applicable State statutes. These actions shall include reporting the encounter to the TWDB, the U.S. Fish and Wildlife Service, and the Texas Parks and Wildlife Department, obtaining any necessary approvals or permits to enable the work to continue, or implement other mitigation actions. The CONTRACTOR shall not resume construction in the area of the encounter until authorized to do so by the OWNER.

#### **15. Hazardous Materials**

Materials utilized in the project shall be free of any hazardous materials, except as may be specifically provided for in the specifications.

If the CONTRACTOR encounters existing material on sites owned or controlled by the OWNER or in material sources that are suspected by visual observation or smell to contain hazardous materials, the CONTRACTOR shall immediately notify the ENGINEER and the OWNER. The OWNER will be responsible for the testing and removal or disposal of hazardous materials on sites owned or controlled by the OWNER. The OWNER may suspend the work, wholly or in part during the testing, removal or disposal of hazardous materials on sites owned or controlled by the OWNER.

#### **16. Changes**

- (a) The OWNER may at any time, without notice to any surety, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including but not limited to changes:
  - (1) In the specifications (including drawings and designs);
  - (2) In the time, method or manner of performance of the work;
  - (3) To decrease or increase the quantity of work to be performed or materials, equipment or supplies to be furnished;
- (b) The total price of a contract may not be increased by a change order unless provision has

been made for the payment of the added cost by the appropriation of current funds or bond funds for that purpose, by the authorization of the issuance of certificates, or by a combination of those procedures.

- (c) The aggregate of the change orders that increase the original contract price by more than 25 percent may be issued only as a result of unanticipated conditions encountered during construction, repair, or renovation or changes in regulatory criteria or to facilitate project coordination with other political entities.
- (d) A governing body may grant authority to an official or employee responsible for purchasing or for administering a contract to approve a change order that involves an increase or decrease of \$50,000 or less.
- (e) Changes that involve an increase in price will be supported by documentation of the cost components. For projects funded through the EDAP program, or with grant proceeds, TWDB staff may request this information to be provided in a format equivalent to the Cost and Pricing Information form (No. WRD-277).
- (f) Any change orders involving a change in the project requiring a relocation of project components, sizing, or process may require additional environmental approval. A map and description of the proposed changes should be sent to the TWDB Environmental Reviewer for coordination and approval as soon as possible to avoid any delay.

## **17. Operation and Maintenance Manuals and Training**

- (a) The CONTRACTOR shall obtain installation, operation, and maintenance manuals from manufacturers and suppliers for equipment furnished under the contract. The CONTRACTOR shall submit three copies of each complete manual to the ENGINEER within 90 days after approval of shop drawings, product data, and samples, and not later than the date of shipment of each item of equipment to the project site or storage location.
- (b) The OWNER shall require the ENGINEER to promptly review each manual submitted, noting necessary corrections and revisions. If the ENGINEER rejects the manual, the CONTRACTOR shall correct and resubmit the manual until it is acceptable to the ENGINEER as being in conformance with the design concept of the project and for compliance with information given in the contract documents. OWNER may assess CONTRACTOR a charge for reviews of same items in excess of three (3) times. Such procedure shall not be considered cause for delay.
- (c) Acceptance of manuals by ENGINEER does not relieve CONTRACTOR of any requirements of terms of Contract.
- (d) The CONTRACTOR shall provide the services of trained, qualified technicians to check final equipment installation, to assist as required in placing same in operation, and to instruct operating personnel in the proper manner of performing routine operation and maintenance of the equipment.
- (e) Operations and maintenance manuals specified hereinafter are in addition to any operation, maintenance, or installation instructions required by the CONTRACTOR to install, test, and start-up the equipment.

- (f) Each manual is to be bound in a folder and labeled to identify the contents and project to which it applies. The manual shall contain the following applicable items:
  - (1) A listing of the manufacturer's identification, including order number, model, serial number, and location of parts and service centers.
  - (2) A list of recommended stock of parts, including part number and quantity.
  - (3) Complete replacement parts list.
  - (4) Performance data and rating tables.
  - (5) Specific instructions for installation, operation, adjustment, and maintenance.
  - (6) Exploded view drawings for major equipment items.
  - (7) Lubrication requirements.
  - (8) Complete equipment wiring diagrams and control schematics with terminal identification.

## **18. As-built Dimensions and Drawings**

- (a) CONTRACTOR shall make appropriate daily measurements of facilities constructed and keep accurate records of location (horizontal and vertical) of all facilities.
- (b) Upon completion of each facility, the CONTRACTOR shall furnish the OWNER with one set of direct prints, marked with red pencil, to show as-built dimensions and locations of all work constructed. As a minimum, the final drawings shall include the following:
  - (1) Horizontal and vertical locations of work.
  - (2) Changes in equipment and dimensions due to substitutions.
  - (3) "Nameplate" data on all installed equipment.
  - (4) Deletions, additions, and changes to scope of work.
  - (5) Any other changes made.

## **19. Close-Out Procedures**

To close-out the contract and release final retainage, the following steps must be completed:

- (a) TWDB Staff must conduct a construction contract final inspection (CCFI).
- (b) The following submittals must be received, reviewed, and accepted by TWDB:
  - (1) The final change order, adjustment of quantities, or a statement that all change orders have previously been submitted and there will be no more change orders;
  - (2) The final pay request from the CONTRACTOR;
  - (3) An affidavit by the CONTRACTOR that all bills have been paid;
  - (4) Certification by the consulting ENGINEER that the work has been completed and was constructed in accordance with the approved plans and specifications and sound engineering principles and construction practices;
  - (5) Acceptance of the project by the OWNER in the form of a written resolution or other formal action;
  - (6) Notification of the beginning date of the warranty period for the contract; and
  - (7) Confirmation that the OWNER has received as-built drawings from the CONTRACTOR.

- (c) TWDB will issue a Certificate of Approval allowing the release of retainage.

## **20. Requirement to Provide Lump Sum Compliance Cost with TWDB-1105**

The OWNER in its continuing partnership with the TWDB is enlisting the assistance of the BIDDER in obtaining contractor cost data on the cost of compliance with TWDB-1105, Rev 11/07/2018 "United States Iron and Steel (US I&S) Guidance for Projects Funded through State Programs". In this regard the OWNER requires the BIDDER provide the LUMP SUM compliance cost on this Project to be used for information purposes only.

Attachment	TWDB-0459 – Vendor Compliance with Reciprocity on Non-Resident Bidder
Attachment	ED-103 – Contractor’s Act of Assurance
Attachment	ED-104 – Contractor’s Act of Assurance Resolution
Attachment	WRD-255 – Bidder’s Certifications
Attachment	TWDB-1105 – United States Iron and Steel (US I&S) Guidance for Projects Funded through State Programs

## **PART III - OTHER PROVISIONS**

Attachment “A-1” Harris County Engineering Construction Prevailing Wages for the  
2<sup>nd</sup> Quarter 2020

Attachment “A-2” Harris County Building Construction Prevailing Wages for the 2<sup>nd</sup> Quarter 2020

Attachment “B-1” Workers’ Compensation Insurance Coverage

Attachment “C-1” HB 914 Conflict Disclosures

Attachment “D-1” Sample Permit Documents

Attachment “E-1” Pipeline Permits

**END OF SECTION**



## VENDOR COMPLIANCE WITH RECIPROCITY ON NON- RESIDENT BIDDERS

Texas Government Code Section 2252.002 provides that in order for nonresident bidders to be awarded a governmental contract, the bidder must bid projects for construction, improvements, supplies, or services in Texas at an amount lower than the lowest Texas resident bidder by the same amount that a Texas resident bidder would be required to underbid the nonresident bidder in order to obtain a comparable contract in the nonresident bidder's state. A nonresident bidder is a person, including a contractor, whose principal place of business or corporate office is outside of the state of Texas. This requirement does not apply to a contract involving Federal funds. The appropriate blanks in Section A must be filled out by all nonresident bidders in order for your bid to meet specifications. The failure of a nonresident bidder to do so will automatically disqualify that bidder. Resident bidders must check the blank in Section B.

- A. Non-resident vendors in \_\_\_\_\_ (give state), our principal place of business, are required to be \_\_\_\_\_ percent lower than resident bidders by state law. A copy of the statute is attached.

Non-resident vendors in \_\_\_\_\_ (give state), our principal place of business, are not required to underbid resident bidders.

- B. Our principal place of business or corporate office is in the state of Texas:\_\_\_\_\_.

BIDDER:

\_\_\_\_\_  
Company

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip

\_\_\_\_\_  
By (print name)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Title (print)

**THIS FORM MUST BE RETURNED WITH THE BID**

[SEAL]

## CONTRACTOR'S ACT OF ASSURANCE RESOLUTION

I hereby certify that it was RESOLVED by a quorum of the directors of the \_\_\_\_\_ (Name of Corporation),  
meeting on the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_, that:

Authorized Representative(s):

--

be, and hereby is/are authorized to act on behalf of \_\_\_\_\_  
(Name of Corporation), as its representative in all business transactions conducted in the State of  
Texas, and;

That all above resolution was unanimously ratified by the Board of Directors at said  
meeting and that the resolution has not been rescinded or amended and is now in full forces and  
effect; and;

In authentication of the adoption of this resolution, I subscribe my name and affix the seal  
of the Corporation this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_(Secretary)

[SEAL]

## BIDDER'S CERTIFICATIONS

Project Name: \_\_\_\_\_

Project Number: \_\_\_\_\_

Contract For: \_\_\_\_\_

**The following certifications must be completed by the bidder for each contract.**

### A. EQUAL EMPLOYMENT OPPORTUNITY:

( ) I have developed and have on file at each establishment affirmative action programs pursuant to 41 CFR Part 60-1.7.

I have:

- ( ) participated in previous contract(s) or subcontract(s) subject to the equal opportunity clause under Executive Orders 11246 and 11375. I have filed all notices, contract specifications, and compliance reports due under the requirements contained in 41 CFR Part 60-4.
- ( ) **not** participated in previous contracts(s) subject to the equal opportunity clause under Executive Orders 11246 and 11375 and 41 CFR Chapter 60.

### B. NONSEGREGATED FACILITIES

( ) I certify that I do not and will not maintain any facilities provided for my employees in a segregated manner, or permit my employees to perform their services at any location under my control where segregated facilities are maintained; and that I will obtain a similar certification prior to the award of any federally assisted subcontract exceeding \$10,000 which is not exempt from the equal opportunity clause as required by 41 CFR Part 60-1.8.

I will obtain a similar certification from any proposed subcontractor(s), when appropriate.

I understand that a false statement on this certification may be grounds for rejection of this bid proposal or termination of the contract award.

\_\_\_\_\_  
Typed Name and Title of Bidder's Authorized Representative

\_\_\_\_\_  
Signature of Bidder's Authorized Representative

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name and Address of Bidder



**United States Iron and Steel  
(US I&S) Guidance for  
Projects Funded through  
State Programs**

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## Table of Contents

Overview.....	3
Definitions .....	3
Covered Iron and Steel Products.....	7
Projects exempt from US Iron and Steel .....	8
Compliance .....	8
TWDB Compliance Procedures.....	9
Recommendations and Best Management Practices .....	11
Waivers .....	12
Waivers Process.....	12
Attachment 1: Supplemental Guidance for the Agricultural Water Conservation Fund .....	13
Attachment 2: Certificate of Compliance with U.S. Iron and Steel Requirements.....	15
Attachment 3: Waiver Request .....	16
Attachment 4: Sample Certifications .....	18
Final Manufacturer Certification .....	19
Step Certification .....	20
Step Certification Letter .....	20
Step Certification Log.....	21

## Overview

United States Iron and Steel (US I&S) provisions are outlined in Texas Water Code § 17.183 and Texas Government Code (TGC), Chapter 2252, Subchapter F, as amended by Senate Bill (SB) 1289, 85<sup>th</sup> Legislative Session, and Texas Administrative Code (TAC) § 363.41. These provisions require recipients of financial assistance from the programs identified below, to use iron and steel products that are produced in the United States for projects for the construction, remodel, or alteration of a building, a structure, or infrastructure. These projects could include public water systems, treatment works, and flood control measures. This requirement applies to all bid documents submitted to the TWDB and contracts entered into on or after September 1, 2017, except for projects funded through the State Water Implementation Revenue Fund for Texas where the Board has adopted a resolution approving an application for financial assistance before May 1, 2019 for any portion of the project.<sup>1</sup>

It is the intent of the Texas Water Development Board (TWDB) to ensure that applicants, consultants, and contractors are provided with procedures and recommendations for implementation of the US I&S provisions for construction projects receiving financial assistance from the following accounts:

- ✓ Agricultural Water Conservation Fund (AWCF)<sup>2</sup>
- ✓ Economically Distressed Areas Program (EDAP)
- ✓ Rural Water Assistance Fund (RWAFF)
- ✓ State Participation (SP)
- ✓ Texas Water Development Fund II (WDF)

## Definitions

**Construction Contract:** A contract between the political subdivision and a construction contractor.

**Construction Material<sup>3</sup>:** For the purpose of US I&S requirements, construction materials are those articles, materials, or supplies made primarily of iron and steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. This includes, but is not limited to, the following products: wire rod, bar, angles, concrete reinforcing bar, wire, wire cloth, wire rope and cables, tubing, framing, joists, trusses, fasteners (i.e., nuts and bolts), welding rods, decking, grating, railings, stairs, access ramps, fire escapes, ladders, wall panels,

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<sup>1</sup> Texas Water Code §17.183 and Texas Government Code §2252 and Texas Water Code §15.432 or §15.472.

<sup>2</sup> Texas Water Code § 17.183 does not apply to the Agricultural Water Conservation Fund; however, the US I&S provisions in Texas Government Code, Chapter 2252, Subchapter F may apply to certain conservation projects funded through the Agricultural Water Conservation Fund. See **Attachment 1** for supplemental guidance regarding Agricultural Water Conservation Fund projects.

<sup>3</sup> Adopted from EPA's AIS Guidance

dome structures, roofing, ductwork, surface drains, cable hanging systems, manhole steps, fencing and fence tubing, guardrails, doors, and stationary screens.

EPA's AIS Guidance:: As used in this document, the term refers to the Environmental Protection Agency's State Revolving Fund American Iron and Steel (AIS) Requirement Guidance found at: <https://www.epa.gov/cwsrf/american-iron-and-steel-requirement-guidance-and-questions-and-answers>.

Manufacturing process: The application of a process to alter the form or function of materials or elements of a product in a manner that adds value and transforms the materials or elements into a new finished product functionally different from a finished product produced merely from assembling the materials into a product or elements into a product. Manufacturing process includes processes such as melting, refining, forming, rolling, drawing, finishing, fabricating and coating. Further, if a domestic iron and steel product is taken out of the US for any part of the manufacturing process, it becomes foreign source material. However raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a coating are similarly not covered. Non-iron or steel components of an iron and steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-iron and steel components do not have to be of domestic origin.<sup>4</sup>

Mechanical and electrical components, equipment, systems, and appurtenances<sup>5</sup>--Include, but are not limited to, pumps, motors, gear reducers, drives (including variable frequency drives), electric/pneumatic/manual accessories used to operate valves (such as electric valve actuators), mixers, gates, motorized screens (such as traveling screens), blowers/aeration equipment, compressors, meters, sensors, controls and switches, supervisory control and data acquisition (SCADA), membrane bioreactor systems, membrane filtration systems, filters, clarifiers and clarifier mechanisms, rakes, grinders, disinfection systems, presses (including belt presses), conveyors, cranes, HVAC (excluding ductwork), water heaters, heat exchangers, generators, cabinetry and housings (such as electrical boxes/enclosures), lighting fixtures, electrical conduit, emergency life systems, metal office furniture, shelving, laboratory equipment, analytical instrumentation, dewatering equipment, electrical supports/covers/shielding, and other appurtenances related to an electrical system necessary for operation or concealment. An electrical system includes all equipment, facilities, and assets owned by an electric utility, as that term is defined in Section 31.002 Utilities Code.

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<sup>4</sup> Adopted from EPA's AIS Guidance

<sup>5</sup> See **Attachment 1** for additional exceptions pertaining to the Agricultural Water Conservation Fund



Municipal castings<sup>6</sup>: Municipal castings are cast iron or steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and surface infrastructure. They are typically made of grey or ductile iron, or steel. Examples of municipal castings are:

- Access Hatches;
- Ballast Screen;
- Benches (Iron or Steel);
- Bollards;
- Cast Bases;
- Cast Iron Hinged Hatches, Square and Rectangular;
- Cast Iron Riser Rings;
- Catch Basin Inlet;
- Cleanout/Monument Boxes;
- Construction Covers and Frames;
- Curb and Corner Guards;
- Curb Openings;
- Detectable Warning Plates;
- Downspout Shoes (Boot, Inlet);
- Drainage Grates, Frames and Curb Inlets;
- Inlets;
- Junction Boxes;
- Lampposts;
- Manhole Covers, Rings and Frames, Risers;
- Meter Boxes;
- Service Boxes;
- Steel Hinged Hatches, Square and Rectangular;
- Steel Riser Rings;
- Trash receptacles;
- Tree Grates;
- Tree Guards;
- Trench Grates; and
- Valve Boxes, Covers and Risers.

Political subdivision: Includes a county, municipality, municipal utility district, water control and improvement district, special utility district, and other types of water districts created under Texas Constitution Article III, Section 52 or Article XVI, Section 59, and nonprofit water supply corporations created and operating under Texas Water Code, Chapter 67.<sup>7</sup>

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<sup>6</sup> Adopted from EPA's AIS Guidance

<sup>7</sup> Political subdivision is defined differently in Texas Water Code §17.871, which pertains to the Agricultural Water

Produced in the United States: With respect to iron or steel products, a product for which all manufacturing processes, from initial melting through application of coatings, occur in the United States, other than metallurgical processes to refine steel additives.

Project: A contract between the TWDB and a person or political subdivision.

Structural steel<sup>8</sup>: structural steel is rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees and zeos. Other shapes include H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

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Conservation Fund. See **Attachment 1** for supplemental guidance.

<sup>8</sup> Adopted from EPA's AIS Guidance

## Covered Iron and Steel Products

If a construction contract for which the TWDB provides funds must comply with the US I&S requirements, then all covered iron and steel products must be made in the United States, no matter whether the TWDB-provided-funds was the source to purchase a particular covered iron and steel product. The entity may not use other funding sources, including the entity's own funds, to pay for a non-compliant iron or steel product used in a TWDB funded construction contract.

US I&S requirements apply to products made primarily of iron or steel that are permanently incorporated into the public water system, treatment works, or agricultural water conservation project, such as

- lined or unlined pipes or fittings;
- manhole covers;
- municipal castings;
- hydrants;
- tanks;
- flanges;
- pipe clamps and restraints;
- valves;
- structural steel;
- reinforced precast concrete; and
- construction materials.

For one of the listed products to be considered subject to the US I&S requirements, it must be made of greater than 50% iron or steel, measured by cost. The cost should be based on the material costs.

The following components are exempt from complying with US I&S requirements:

- Iron or steel products that are not permanently incorporated into a Project.
- Mechanical and electrical components, equipment, systems, and appurtenances.<sup>9</sup>

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<sup>9</sup> See **Attachment 1** for additional exemptions pertaining to the Agricultural Water Conservation Fund.

## Projects exempt from US Iron and Steel

US I&S requirements do not apply to a SWIFT-funded project that:

- (As detailed in SB 1289) is subject of a resolution approving an application for financial assistance from any TWDB funding program adopted by the TWDB before May 1, 2019, for any portion of the financing of the project, including the planning phase.

## Compliance

To ensure compliance with the US I&S requirements, specific US I&S contract language must be included in each contract, including the construction material purchase agreements and bid documents.

It is the applicant's responsibility to assure that all construction and purchase contracts and associated bid documents are executed in compliance with US I&S, and a record of all forms and certifications necessary to demonstrate compliance with US I&S is maintained. To demonstrate compliance with US I&S requirements either the final manufacturer, supplier or vendor that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification asserting that all manufacturing processes occurred in the United States, or the applicant may use a step certification process similar to the Federal Highway Administration process.

TWDB relies on self-certification by the applicant to document compliance with US I&S. As release of funds for projects funded through the programs affected by US I&S requirements (and identified earlier in this guidance) are not subject to submittal of Outlay Requests, the applicant is required to maintain compliance certification records. These records should be available for TWDB staff inspection or request. TWDB staff may also request that the applicant submit interim Certificates of Compliance (TWDB-1105A) throughout the project construction. For each construction contract a final Certificate of Compliance with US I&S Requirements is required prior to the approval of final release of retainage and issuance of a Certificate of Approval by the TWDB Executive Administrator. Certificate of Compliance with US I&S requirements is attached as **Attachment 2**.

## TWDB Compliance Procedures

In order to comply with the requirements for implementation of US I&S, entities will need to do the following:

1. The applicant should submit any waiver request to the TWDB project engineer as soon as possible. Until a waiver is granted, US I&S requirements stand. A checklist detailing the types of information required for a waiver to be processed, and TWDB's waiver determination checklist is attached as **Attachment 3**.
2. Applicants shall include the following language in the advertisement for bids for all construction contracts funded by the TWDB's WDF, RWAF, EDAP, and SP programs. For appropriate language regarding projects funded through the AWCf, see Attachment 1.

*Any contract(s) awarded under this Invitation for Bids is/are subject to the United States Iron and Steel (US I&S) requirements of Texas Water Code § 17.183 and/or Texas Government Code, Chapter 2252, Subchapter F, as amended by SB 1289, 85<sup>th</sup> Legislative Session, as applicable.*

3. Applicants shall include the following US I&S requirements in all construction contracts:

*The Contractor acknowledges to and for the benefit of the **Applicant** ("Purchaser") and the Texas Water Development Board ("TWDB") that it understands the goods and services under this Agreement are being funded with monies made available by the Water Development Fund, Rural Water Assistance Fund, Economically Distressed Areas, State Participation Fund and/or Agricultural Water Conservation Fund. That these funds have statutory requirements commonly known as "United States Iron and Steel" that requires all of the iron and steel products used in the project to be produced in the United States ("United States Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the TWDB that (a) the Contractor has reviewed and understands the United States Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the United States Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the United States Iron and Steel Requirement, as may be requested by the Purchaser or the TWDB. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser to enforce this*

*Agreement and recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the TWDB or any damages owed to the TWDB by the Purchaser). Neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the TWDB.*

*In the execution of the Contract, the Contractor shall be familiar with and at all times shall observe and comply with all applicable federal, state, and local laws, ordinances and regulations concerned with the use of iron and steel made in the United States which in any manner affect the conduct of the work, and shall indemnify and save harmless the Texas Water Development Board against any claim arising from violation of any such law, ordinance or regulation by the Contractor or by their Subcontractor or their employees*

4. The applicant shall include the following language on the General Notes Plan Sheet(s).  
*This project is subject to the U.S. Iron and Steel (US I&S) requirements of Texas Water Code § 17.183 and/or Texas Government Code, Chapter 2252, Subchapter F, as amended by SB 1289, 85<sup>th</sup> Legislative Session, as applicable. All iron and steel products used in project construction must be produced in the United States.*
5. The applicant and prime construction contractor must obtain certifications from the final manufacturer that delivers the iron and steel product to the worksite, vendor, or contractor asserting that all manufacturing processes occurred in the United States.
6. The prime construction contractor and applicant will be required to maintain a file that contains the certifications from the final manufacturers and any TWDB approved waivers. This file must be available for review by TWDB representatives and/or State Auditors. Sample Certification letters and step certification log, are included as **Attachment 4**.
7. The applicant may be requested to submit interim certificates of compliance with US I&S requirements (TWDB-1105A) **Attachment 2**.
8. The applicant will provide a final Certificate of Compliance with US I&S requirements (TWDB-1105A), after the completion of the construction contract and prior to issuance of a Certificate of Approval by the TWDB, stating that the project was completed in compliance with the US I&S requirements.

## Recommendations and Best Management Practices

The following recommendations are not required but should be considered by the applicant in implementation of the US I&S requirements:

1. To any practical extent, the applicant and its consulting engineer should consider the applicability and availability of US I&S products during all phases of the projects. Whenever is clear that a waiver may be necessary, the entity should request that waiver as soon as possible.
2. While a waiver application may be submitted at any time during the project, the applicant should consider TWDB's review schedule (10 days public comment period plus review time) when scheduling projects. It is not recommended to request a waiver after the advertisement for bids or start of construction unless absolutely necessary.
3. Develop procedures for maintaining a record of US I&S documentation. TWDB recommends the entity maintain a record of either Step Certification or Final Vendor Certification documents.
4. Distinguish separate bid items that must comply with US I&S requirements on the Bid Form.
5. Consideration of US I&S compliance documentation when developing the contractor submittal procedures for shop drawings, material lists, and manufacturer certifications, etc.
6. Discuss US I&S requirements during pre-bid conference and pre-construction meetings, to address contractor's responsibilities, and availability of iron and steel products needed to complete the project.

## Waivers

TGC § 2252.203, as added by SB 1289, 85<sup>th</sup> Legislative Session, permits TWDB to issue waivers for a case or category where it is demonstrated that:

1. Iron and steel products produced in the United States are not:
  - a. produced in sufficient quantities,
  - b. reasonably available, or
  - c. of satisfactory quantity.
2. Use of iron and steel products produced in the United States will increase the cost of the overall project by more than 20 percent, or
3. Complying with the US I&S requirements is inconsistent with the public interest.

## Waivers Process

Waiver requests must be submitted by the applicant. It is not recommended to request a waiver after the advertisement for bids or start of construction unless absolutely necessary. If a waiver is requested after bid advertisement or start of construction, the US I&S requirements stand until TWDB grants a waiver.

To apply for a project waiver, the assistance recipient should email the request in the form of a Word document (.doc) or PDF to the TWDB project engineer (or the TWDB contract manager, in the case of an AWCf grant project). Proper and sufficient documentation must be provided by the assistance recipient.

After receiving an application for waiver of the US I&S requirements, TWDB will publish the request on its website for 10 days and receive informal comment. TWDB will then determine whether the application properly and adequately documents and justifies the statutory basis cited for the waiver, and will determine whether to grant the waiver.

TWDB will notify the applicant that a waiver request has been approved or denied as soon as such a decision has been made. Approved waivers will be posted on the TWDB's website. The applicant should keep a copy of the signed waiver in their US I&S Certification File.



## **Attachment 1: Supplemental Guidance for the Agricultural Water Conservation Fund**

### **Overview:**

The following information is provided as supplemental guidance for projects funded through the Agricultural Water Conservation Fund, in accordance with the United States Iron and Steel (US I&S) provisions outlined in Texas Government Code (TGC), Chapter 2252, Subchapter F, as amended by Senate Bill (SB) 1289, 85<sup>th</sup> Legislative Session, and Texas Water Code §§ 17.871–17.912.

### **Definitions:**

**Political subdivision:** Includes a district or authority created under Section 52, Article III, or Section 59, Article XVI, of the Texas Constitution, a municipality, a county, an institution of higher education as defined by Section 61.003, Education Code, any interstate compact commission to which the state is a party, and any nonprofit water supply corporation created and operating under Chapter 67.

**Person:** An individual, corporation, partnership, association, or other legal entity that is not a political subdivision.

### **Applicability:**

As applied to TWDB programs, the US I&S requirements of TGC, Chapter 2252, Subchapter F only pertain to contracts between the TWDB and a political subdivision to finance, refinance, or provide money to construct, remodel, or alter a building, a structure, or infrastructure. For the Agricultural Water Conservation Fund, these requirements would not apply to projects undertaken by “persons” (commonly referred to as “participants”) receiving money from the political subdivision funded by the TWDB.

### **Project Examples, Exemptions, and Construction Requirements:**

US I&S requirements only apply to projects to construct, remodel, or alter a building, a structure, or infrastructure. Explicit exemptions detailed in TGC § 2252.203 are discussed in the “Waivers” section on page 11 of this document. Furthermore, “mechanical and electrical components, equipment, systems, and appurtenances” such as those listed on page 3 of this document are not subject to US I&S requirements.

### **US Iron and Steel Required:**

Examples of the types of projects and project components funded through the Agricultural Water Conservation Fund that would be required to follow US I&S guidance include, but are not limited to: Rebar and structural steel used in canal lining projects, Pipes for canal-to-pipeline and pipeline replacement projects, and Well casing for projects involving well drilling activities.

**Exempt Components:**

In addition to the “mechanical and electrical components, equipment, systems, and appurtenances” listed on page 4, the following types of projects and project components would also be considered exempt from the US I&S provisions (this is not an exhaustive list):

Equipment cost share projects to purchase and install meters, surge-flow valves, soil-moisture probes, center pivots (including the pad/slab construction), center pivot and pumping plant efficiency improvements, pivot control, telemetry, remote monitoring, supervisory control and data acquisition (SCADA), automated gates (including fabrication and construction), and weather stations (including footings, foundations, pads or slabs)

**Provisions for Bid Documents:**

In addition to the Construction Requirements contained within Texas Administrative Code § 367.12, applicants shall include the following language in the advertisement for bids for all construction contracts funded through the AWCF:

*Any contract(s) awarded under this Invitation for Bids is/are subject to the United States Iron and Steel (US I&S) requirements of Texas Government Code, Chapter 2252, Subchapter F, as amended by SB 1289, 85th Legislative Session, as applicable.*

Attachment 2:1105-A

Certificate of Compliance with U.S. Iron and Steel Requirements

Certificate of Compliance with U.S. Iron and Steel Requirements

Compliance Submittal by Owner

TWDB Project: \_\_\_\_\_

Contract Name and ID: \_\_\_\_\_

TWDB Commitment Number: \_\_\_\_\_

This executed certificate must be submitted after the completion of construction and prior to the issuance of a Certificate of Approval.

I, \_\_\_\_\_ (Full Name Printed) swear or affirm under penalty of law that I  
am \_\_\_\_\_ (Title) of the  
\_\_\_\_\_ (Name of Entity)

and to the best of my knowledge and in reliance of the certifications provided by manufacturers, vendors, contractors and consultants, hereby certify that the above-mentioned entity is in full compliance with the U.S. Iron and Steel requirements of Texas Water Code Section 17.183 and/or Texas Government Code Chapter 2252, Subchapter F, as applicable and subject to any waivers granted by the Texas Water Development Board (TWDB).

I understand that a false statement herein may subject me and/or the Entity to any and all civil and criminal penalties available pursuant to applicable federal and state laws.

EXECUTED this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Printed Name)

\_\_\_\_\_  
(Title)

Sworn to and subscribed before me by \_\_\_\_\_ on this \_\_\_\_\_ day of  
\_\_\_\_\_, 20\_\_\_\_.

\_\_\_\_\_  
(Notary Public in and for the State of Texas)

(SEAL)

## Attachment 3: Waiver Request

### Information Checklist for Waiver Request

The purpose of this checklist is to help ensure that all appropriate and necessary information is submitted to TWDB. This checklist is for informational purposes only and does not need to be included as part of a waiver application

Items	<input checked="" type="checkbox"/>	Notes
<b>General</b> <ul style="list-style-type: none"> <li>Waiver request includes the following information: <ul style="list-style-type: none"> <li>Description of the foreign and domestic construction materials</li> <li>Unit of measure</li> <li>Quantity</li> <li>Price</li> <li>Time of delivery or availability</li> <li>Location of the construction project</li> <li>Name and address of the proposed supplier(s)</li> <li>Name of contact person(s) for the proposed supplier(s)</li> <li>A detailed justification for the use of foreign construction materials</li> </ul> </li> <li>Assistance recipient made a good faith effort to solicit bids for domestic iron and steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime contractor.</li> </ul>		
<b>Cost Waiver Requests</b> <ul style="list-style-type: none"> <li>Waiver request includes the following information: <ul style="list-style-type: none"> <li>Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products</li> <li>Relevant excerpts from the bid documents used by the contractors to complete the comparison</li> <li>Supporting documentation indicating that the contractor made a reasonable survey of the market, such as a description of the process for identifying suppliers and a list of contacted suppliers.</li> <li>Signed and sealed statement from the consulting engineer, indicating that he/she has reviewed the conditions for the waiver request and certify to their veracity.</li> </ul> </li> </ul>		
<b>Availability Waiver Requests</b> <ul style="list-style-type: none"> <li>Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested: <ul style="list-style-type: none"> <li>Supplier information or pricing information from a reasonable number of domestic suppliers indicating availability/delivery date for construction materials</li> <li>Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying suppliers and a list of contacted suppliers.</li> <li>Documentation of contacted suppliers' responses</li> <li>Project schedule</li> <li>Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of construction materials</li> </ul> </li> <li>Waiver request includes a statement from the applicant, engineer and/or prime contractor and/or supplier, with supporting documentation, confirming the non-availability of the domestic construction materials for which the waiver is sought</li> </ul> <p>To the best of your knowledge, has the State received other waiver requests for the materials described in this waiver request, for comparable projects?</p>		

## ***TWDB Checklist for Waiver Request***

Instructions: To be completed by TWDB. Review all waiver requests using the questions in the checklist, and mark the appropriate box as Yes, No or N/A. Marks that fall inside the shaded boxes may be grounds for denying the waiver. If none of your review markings fall into a shaded box, the waiver is eligible for approval if it indicates that one or more of the following conditions applies to the domestic product for which the waiver is sought:

1. The iron and/or steel products are not produced in the United States in sufficient and reasonably available quantities and of a satisfactory quality.
2. The inclusion of iron and/or steel products produced in the United States will increase the cost of the overall project by more than 20 percent ("cost of the project" means the total amount of the Board's funding commitment for the construction portion of the project)

<b>Review Items</b>	<b>Yes</b>	<b>No</b>	<b>N/A</b>	<b>Notes</b>
<b>Cost of Waiver Request</b> <ul style="list-style-type: none"> <li>• Does the waiver request include the following information? <ul style="list-style-type: none"> <li>o Comparison of overall cost of project with domestic iron and steel products to overall cost of project with foreign iron and steel products</li> </ul> </li> </ul>				
<ul style="list-style-type: none"> <li>o Relevant excerpts from the bid documents used by the contractors to complete the comparison</li> </ul>				
<ul style="list-style-type: none"> <li>o A sufficient number of bid documents or pricing information from domestic sources to constitute a reasonable survey of the market</li> </ul>				
<ul style="list-style-type: none"> <li>• Does the Total Domestic Project exceed the Total Foreign Project Cost by more than 20%?</li> </ul>				
<b>Availability Waiver Requests</b> <ul style="list-style-type: none"> <li>• Does the waiver request include supporting documentation sufficient to show the availability, quantity, and/or quality of the iron and/or steel product for which the waiver is requested? <ul style="list-style-type: none"> <li>o Supplier information or other documentation indicating availability/delivery date for materials</li> <li>o Project schedule</li> <li>o Relevant excerpts from project plans, specifications, and permits indicating the required quantity and quality of materials</li> </ul> </li> </ul>				
<ul style="list-style-type: none"> <li>• Contractors made a reasonable effort to locate domestic suppliers of materials, such as a description of the process for identifying suppliers and a list of contacted suppliers?</li> </ul>				
<ul style="list-style-type: none"> <li>• Based on the materials delivery/availability date indicated in the supporting documentation, will the materials be unavailable when they are needed according to the project schedule? (By item, list schedule date and domestic delivery quote date or other relevant information)</li> </ul>				
<ul style="list-style-type: none"> <li>• Is TWDB aware of any other evidence indicating the non-availability of the materials for which the waiver is requested? Examples include: <ul style="list-style-type: none"> <li>o Multiple waiver requests for the materials described in this waiver request, for comparable projects in Texas</li> <li>o Multiple waiver requests for the materials described in this waiver request, for comparable projects in other States</li> <li>o Correspondence with construction trade associations indicating the non-availability of the materials</li> </ul> </li> <li>• Are the available domestic materials indicated in the bid documents of inadequate quality compared those required by the project plans, specifications, and/or permits?</li> </ul>				

## **Attachment 4: Sample Certifications**

US I&S Certification must document the location of the manufacturing process involved with the production of iron and steel materials. Each handler (supplier, fabricator, manufacturer, processor, etc.) of the iron and steel products and their step in the process must be recorded and certified as domestically performed.

The applicant may utilize either:

1. a Final Manufacturer Certification process, in which the final manufacturer that delivers the iron or steel product to the worksite, vendor, or contractor, may provide a certification identifying all handlers of the iron or steel product, and asserting that all manufacturing processes occurred in the US; or
2. a Step Certification process in which each handler of the iron or steel product provides a separate certification letter certifying that their step in the process was domestically performed.

## Final Manufacturer Certification

The following information is provided as a sample letter of certification for US I&S compliance. Documentation must be provided on company letterhead. The Final Manufacturer's Certification should list everyone who has handled the product, starting with the processor of the raw iron or steel through the contractor who installs the final product.

*Date*

*Company Name*

*Company Address*

*City, State Zip*

*Subject: United States Iron and Steel Certification for Project (XXXXXX)*

*I, (company representative), certify that the following products and/or materials shipped/provided to the subject project are in full compliance with the United States Iron and Steel requirement as required in Texas Water Code § 17.183 and/or Texas Government Code, Chapter 2252, Subchapter F, as amended by SB 1289, 85<sup>TH</sup> Legislative Session, as applicable.*

*Item, Products and/or Materials:*

*1. XXXX*

*2. XXXX*

*3. XXXX*

*Such process took place at the following location:*

<i>Contractor:</i>	_____	_____	_____
	<i>(Name)</i>	<i>(Item)</i>	<i>(Process)</i>

<i>Supplier:</i>	_____	_____	_____
	<i>(Name)</i>	<i>(Item)</i>	<i>(Process)</i>

<i>Manufacturer:</i>	_____	_____	_____
	<i>(Name)</i>	<i>(Item)</i>	<i>(Process)</i>

<i>Processor:</i>	_____	_____	_____
	<i>(Name)</i>	<i>(Item)</i>	<i>(Process)</i>

*If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.*

*Signed by company representative*

## Step Certification

A step certification is a process under which each handler (supplier, fabricator, manufacturer, processor, etc.) of the iron and steel products certifies that their step in the process was domestically performed. The step certification process requires receipt of a separate letter from everyone who handles the product, starting with the processor of the raw iron or steel through the contractor that installs the final product.

### Step Certification Letter

The following information is provided as a sample letter of step certification for US I&S compliance. Documentation must be provided on company letterhead of each handler responsible for that process of the iron or steel product.

*Date*

*Company Name*

*Company Address*

*City, State Zip*

*Subject: United States Iron and Steel Step Certification for Project (XXXXXXXXXX)*

*I, (company representative), certify that the (melting, bending, coating, galvanizing, cutting, etc.) process for (manufacturing or fabricating) the following products and/or materials shipped or provided for the subject project is in full compliance with the United States Iron and Steel requirement required in Texas Water Code § 17.183 and/or Texas Government Code, Chapter 2252, Subchapter F, as amended by SB 1289, 85<sup>TH</sup> Legislative Session, as applicable.*

*Item, Products and/or Materials:*

*1. Xxxx*

*2. Xxxx*

*3. Xxxx*

*Such process took place at the following location:*

*Handler:* \_\_\_\_\_  
*(Name) (Item) (Process)*

*If any of the above compliance statements change while providing material to this project we will immediately notify the prime contractor and the engineer.*

*Signed by company representative*



## Step Certification Log

The following information is provided as a sample log to keep track of step certification for US I&S compliance. The TWDB makes no claims regarding the legality of the step certification log with respect to US I&S compliance.

### United States Iron and Steel Step Certification Log for

---

(Iron or Steel Product)

**CONTRACTOR:****(NAME)****(ITEM)****(PROCESS)****SUPPLIER:****(NAME)****(ITEM)****(PROCESS)****MANUFACTURER:****(NAME)****(ITEM)****(PROCESS)****PROCESSOR:****(NAME)****(ITEM)****(PROCESS)**

**Attachment “A-1”**  
**Harris County Road & Bridge Construction**  
**Prevailing Wage Rates for the 2<sup>nd</sup> Quarter 2020**

<b>Worker Classifications</b>	<b>Rate</b>
Asphalt Distributor Operator	\$14.06
Asphalt Paving Machine Operator	\$14.32
Asphalt Raker	\$12.36
Asphalt Shoveler	\$11.68
Broom or Sweeper Operator	\$12.68
Bulldozer Operator	\$11.81
Carpenter (Rough)	\$12.49
Concrete Finisher (Paving)	\$12.98
Concrete Finisher (Structures)	\$12.98
Concrete Paving Curbing, Machine Operator	\$11.71
Concrete Paving Finishing, Machine Operator	\$13.07
Concrete Paving Joint Sealer, Operator	\$11.00
Concrete Paving Saw Operator	\$13.99
Concrete Paving Spreader, Operator	\$10.44
Concrete Rubber	\$9.00
Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel Operator	\$12.71
Crusher and Screed Plant Operator	\$11.29
Electrician	\$27.11
Flagger	\$10.33
Form Builder/Setter (Structures)	\$12.23
Form Liner (Paving & Curb)	\$12.34
Form Setter (Paving & Curb)	\$12.34
Foundation Drill Operator, (Crawler Mounted)	\$17.43
Foundation Drill Operator, (Truck Mounted)	\$15.89
Front End Loader Operator	\$13.17
Laborer, Common	\$11.02
Laborer, Utility	\$11.73
Manhole Builder	\$9.00
Mechanic	\$16.96
Milling Machine Operator, (Fine Grade)	\$13.53

<b>Worker Classifications</b>	<b>Rate</b>
Mixer Operator	\$10.33
Motor Grader Operator (Rough)	\$14.23
Motor Grader Operator	\$15.69
Oiler	\$12.12
Painter (Structures)	\$18.62
Pavement Marking Machine, Operator	\$11.18
Piledriverman	\$14.95
Pipelayer	\$12.12
Reinforcing Steel Setter, (Paving)	\$15.15
Reinforcing Steel Setter, (Structure)	\$14.39
Roller Operator, Pneumatic, (Self-Propelled)	\$11.57
Roller Operator, Steel Wheel, Flat Wheel/Tamping	\$11.57
Roller Operator, Steel Wheel, Plant Mix Pavement	\$11.92
Scraper Operator	\$13.47
Servicer	\$13.97
Sign Installer (PGM)	\$8.54
Slip Form Machine Operator	\$11.07
Spreader Box Operator	\$13.58
Structural Steel Worker	\$14.39
Tractor operator (Crawler Type)	\$13.68
Tractor operator, Pneumatic	\$10.07
Traveling Mixer Operator	\$11.00
Truck driver, Lowboy-Float	\$16.03
Truck driver, Single Axle, (Heavy)	\$11.46
Truck driver, Single Axle, (Light)	\$11.48
Truck Driver (Tandem Axel Semi-Trailer)	\$12.27
Work Zone Barricade Servicer	\$11.67

**Welders - Receive rate prescribed for craft performing operation to which welding is incidental.**

DOL Ref #TX20030048

**Harris County Engineering Construction Classifications  
Revised – 2<sup>nd</sup> Quarter 2020**

**State: Texas**

Construction Types: Highway

Counties: Brazoria, Chambers, Fort Bend, Galveston, Hardin, Harris, Jefferson, Liberty, Montgomery, Orange and Waller Counties in Texas.

**HIGHWAY CONSTRUCTION PROJECTS** (excluding tunnels, building structures in rest area projects, and railroad construction; bascule, suspension & spandrel arch bridges; bridges designed for commercial navigation; bridges involving marine construction; other major bridges).

**Asphalt Distributor Operator**

Drives distributor truck, sets spray bars and operates valves and levers to control distribution of bituminous material for highway surfacing. May oil, grease or otherwise service and make adjustments to equipment as needed. Performs other related duties.

**Asphalt Paving Machine Operator**

Operates paving machine that spreads and levels asphaltic concrete on highway subgrade. Controls movement of machine, raises and lowers screed, regulates width of screed. May, oil, grease, service and make adjustments to equipment as needed. Performs other related duties.

**Asphalt Raker**

Distributes asphaltic materials evenly over road surface by raking and brushing material to correct thickness; directs Laborers when to add or take away material to fill low spots or to reduce high spots. Performs other related duties.

**Asphalt Shoveler**

A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

**Broom or Sweeper Operator**

Operates a self-propelled machine to sweep and clean roadway surfaces. May oil grease, service and make adjustments to equipment as needed. Performs other related duties.

**Bulldozer Operator**

Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard material.

May use a push block on front of tractor to push load scrapers. May oil grease, or otherwise service and make minor repairs to equipment as needed. Performs other related duties.

### **Carpenter, Rough**

Works from plans to build, assemble, fit together, align, plum, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks form while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties.

### **Concrete Finisher, Paving**

Finishes the exposed surfaces of fresh concrete paving, median barrier and every element of concrete structures to the final grade and contour structures to the final grade and contour with the use of straight edges and steel trowels. Operates bridge deck finishing machine. Finishes concrete curbs and gutters. Finishes exposed surface of concrete after forms have been removed by patching imperfections with fresh concrete, rubbing surface with abrasive stone, and directing others in removing excess or defective concrete with power tools. Performs other related duties.

### **Concrete Finisher, Structures**

A worker semi-skilled in concrete finishing who assists Concrete finisher by performing specific or general duties of lesser skill and keeping Concrete Finisher supplied with materials, tools, and supplies; cleaning working area an equipment; and holding materials and tools. Performs other related duties.

### **Concrete Paving Curbing Machine Operator**

Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

### **Concrete Paving Finishing Machine Operator**

Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

### **Concrete Paving Joint Sealer Operator**

Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

**Concrete Paving Saw Operator**

Operates a water – cooled power saw with either or an abrasive blade to saw expansion and contraction joints in concrete paving. May also be used to saw asphaltic pavements. May oil grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Concrete Paving Spreader Operator**

Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

**Concrete Rubber**

Finishes the exposed surface of concrete masonry after the forms have been removed by patching holes and broken corners with fresh concrete, rubbing surface with abrasive stone to remove rough spots, and removing g high spots and defective concrete with hand chisel and hammer or pneumatic chisel and powered abrasive stone. Performs other related duties.

**Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel Operator**

A worker who operates a lattice boom type crane can hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber tired. May include placement of rock riprap, clamshell, dragline, pipe and pile driving operations. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Crusher and Screed Plant Operator**

Operates a crusher or screening plant through which rock is run to break it into crushed stone for construction or to control flow of materials not needed. May include minor repairs and may service and make necessary adjustments to equipment as needed. Performs other related duties.

**Electrician**

Plans and directs the layout of metal electrical conduit, installs wiring systems, switch-panels, buss bars, works on overhead distribution systems and underground distribution systems. Performs other related duties.

**Flagger**

A worker who directs traffic in or around a construction site. May use signs or devices to direct traffic. May help assemble, position and clean devices or equipment used to direct traffic. Must be able to effectively communicate with the public. May require certain level of training by TXDOT specifications. Performs other related duties.

**Form Builder/Setter, Structures**

Works from plans to build, assemble, fit together, align, plum, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks forms while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties.

**Form Liner, Paving & Curb**

Fits together, aligns and sets to grade metal and wooden forms for placement of concrete paving and curbs. Works with survey crew to set stringline for paving, curb, and gutter curb. Performs other related duties.

**Form Setter, Paving & Curb**

Fits together, aligns and sets to grade metal and wooden forms for placement of concrete paving and curbs. Works with survey crew to set stringline for paving, curb, and gutter curb. Performs other related duties.

**Foundation Drill Operator, Crawler Mounted**

Operates a hole-drilling machine that is crawler mounted. May include geotechnical operations such as soils nails, rock nails, tiebacks, anchors and jet grouting. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Foundation Drill Operator, Truck Mounted**

Operates a hole drilling machine that is mounted on the rear of a rubber-tired vehicle or truck. May include soils nails, rock nails, tiebacks, anchors and jet grouting. Drive truck from location to location or may have laborer who drives truck. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Front End Loader Operator**

Operates a rubber tired, skid steer or crawler type tractor with an attached scoop type bucket on front end. Machine is used to load materials from stockpiles, excavation, charging batch plants, loading and unloading trucks. May be used with attachments in lieu of the bucket. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Laborer, Common**

A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and

transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

### **Laborer, Utility**

Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill and may later become a helper in a specific classification. Performs other related duties.

### **Manhole Builder**

Constructs a means of permanent access to water and sewer lines for maintenance purposes. This work consists of laying brick or concrete slab at bottom of ditch up to an approximate grade line near the surface of the ground. Brick or block is normally laid to form a nearly circular manhole. Brick or block is laid in by eyesight and is normally to a plumb line. Chipped or culled brick can be used quite often is. No effort may be made to keep mortar off the face of the brick and joints are not pointed. May apply coating of concrete to interior and exterior surface. Performs other related duties.

### **Mechanic**

Assembles, set up, adjusts and maintains and repairs all types of construction equipment and trucks. He may perform the duties of a welder in repair of equipment. Performs other related duties.

### **Milling Machine Operator, Fine Grade**

Operates a power-driven milling machine that planes material of the to roadbed and discharges the material into a hauling unit or a windrow. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

### **Mixer Operator**

Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power

tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

**Motor Grader Operator, Rough**

Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Motor Grader Operator**

Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Oiler**

A learner or semi-skilled worker who under the direction of the watch engineer may oil and grease or otherwise service all engines and necessary equipment as needed. He may clean and paint engine room as needed. Performs other related duties.

**Painter, Structures**

Paints and stains structural steel and concrete surfaces of bridges, retaining walls, or other structures. Directs cleaning and abrasive blasting of surfaces prior to painting or staining. Performs other related duties.

**Pavement Marking Machine Operator**

Operates machine used in laying paint stripes or markers on all types of paving. Loads machine with appropriate materials and may walk or ride on machine. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Piledriverman**

Sets in place, aligns, plumbs directs driving of timber, concrete, steel, pipe and any other type of piling. Sets, drives and pulls steel, concrete and other types of sheet piling. Rigs pile and leads and bracing. Signals operator. Splices piles before and after driving. Directs pile cutoff. May direct jetting or drilling equipment in connection with installing piles to grade. Performs other related duties.



**Pipelayer**

Installs concrete, clay, steel, ductile iron, plastic, corrugated pipe and any other type of pipe for storm drainage, water lines, gas lines and sanitary sewer lines. Lays underground communication and electrical ducts. May install and set electrical ground boxes, hand holes, manholes, inlets and other structures. Caulks joints, make threaded and flanged connections. Installs valves and other accessories. Performs other related duties.

**Reinforcing Steel Setter, Paving**

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

**Reinforcing Steel Setter, Structure**

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

**Roller Operator, Pneumatic, Self-Propelled**

Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Roller Operator, Steel Wheel, Flat Wheel/Tamping**

Operates a self-propelled machine with either steel wheels or pneumatic tires which is used to compact earth fills, subgrade, flexible base and all other types of materials except bituminous. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Roller Operator, Steel Wheel, Plant Mix Pavement**

Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Scraper Operator**

Operates a self-contained wheeled tractor scraper both self loading or assisted by crawler tractors or other scrapers. Used to excavate and transport earth or other materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Servicer**

Drives a truck, which carries various fuels, oils, greases and filters. Must have knowledge of and is responsible for the correct oiling and greasing and changing of filters on equipment according to the manufacturers' specifications. Uses compressed air grease guns, wrenches and other tools. May make adjustments to clutches, brakes and other mechanical items. Keeps record of service preventive maintenance records. May have laborer assisting him. May require CDL if driving truck on public highways. Performs other related duties.

**Sign Installer (PGM)**

Sets forms, reinforcing steel, anchor bolts and pours concrete for Sign foundations. Fabricates and erects pipe and angle Frameworks by bolting, welding or other means prior to installation of signs that are normally prefabricated. Works from plans in location and drilling holes for proper location and alignment of signs. May direct hoisting of signs into place. Fastens signs to framework by bolting and other means. Locates and sets lighting brackets. May perform other work associated with signing projects. Supervises sign erector helper. Performs other related duties.

**Slip Form Machine Operator**

Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

**Spreader Box Operator**

Operates spreader box by adjusting hopper and strike off blade so that the gravel, stone or other material may be spread to a specific depth on road surface during seal coat and surface treatment operations. May oil, grease or other wise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Structural Steel Worker**

Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

**Tractor operator, Crawler Type**

Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard material. May use a push block on front of tractor to push load scrapers. May oil grease, or otherwise service and make minor repairs to equipment as needed. Performs other related duties.

**Tractor Operator, Pneumatic**

Operates a gasoline or diesel powered agricultural tractor that tows compaction rollers, plow, disc, water tanks, scrapers and other similar operations. May use other miscellaneous attachments. May oil. Grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

**Traveling Mixer Operator**

Drives a gasoline or diesel truck upon which is mounted a concrete mixer. Operates concrete mixer and dumps concrete on the grade, into forms or into concrete pumps or buckets. Cleans mixer drum. May require CDL license for on highway use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

**Truck driver, Lowboy-Float**

Drives a heavy-duty diesel powered truck to which is attached a trailer upon which heavy equipment is hauled. Driver is often required to operate heavy equipment to load or unload the lowboy. May require CDL license for on highway use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

**Truck driver, Single Axle, Heavy**

Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May services and make necessary adjustments for proper operation equipment. Performs other related duties

**Truck driver, Single Axle, Light**

Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May services and make necessary adjustments for proper operation equipment. Performs other related duties

**Truck Driver, Tandem Axle, Semi-Trailer**

Drives a diesel-powered tractor pulling a semi trailer hauling materials. Hauls dirt, rock, aggregates or other material. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

**Work Zone Barricade Servicer**

Fabricates, erects and maintains temporary traffic control devices, including arrow boards, signs, barricades, channelizing devices, barrels and all message boards. May operates a truck during traffic control operations.

**WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.**

**Attachment “A-2”  
Harris County Building Construction  
Prevailing Wage Rates for the 2<sup>nd</sup> Quarter 2020**

Worker Classifications		Base Rate	Fringe Benefit	Wage Total
Asbestos Worker/Insulator	1 Journeyman / 1 Apprentice	\$24.28	\$14.16	\$38.44
Boilermaker	5 Journeyman / 1 Apprentice	\$28.00	\$22.35	\$50.35
Carpenter-(Including Acoustical Ceiling Work)	2 Journeyman / 1 Apprentice	\$23.05	\$8.78	\$31.83
Floor Layer/Carpet Layer	1 Journeyman / 3 Helpers \$ 8.80	\$20.00	\$0.00	\$20.00
Electrician (Excludes Low Voltage Wiring and Installation of Alarms)	3 Journeyman / 2 Apprentice	\$32.25	\$9.24	\$41.49
Elevator Mechanic	1 Journeyman / 1 Apprentice	\$44.00	\$34.76	\$78.76
Plasterer	1 Journeyman / 3 Plaster Tenders	\$19.92	\$1.00	\$20.92
Plumbers-(Excluding HVAC Pipe)	3 Journeyman / 2 Apprentice	\$36.15	\$11.04	\$47.19
Pipefitters-(HVAC Pipe Only)	1 Journeyman/ 1 Apprentice	\$33.30	\$12.26	\$45.56
Sprinkler Fitter, Fire	1 Journeyman/ 1 Apprentice	\$29.53	\$21.27	\$50.80
Sheet Metal Worker-(Including HVAC Duct and System Installation)	2 Journeyman/ 1 Apprentice	\$27.72	\$13.70	\$41.42
Asbestos Abatement Worker-(Ceilings, Floors, & Walls only)	1 Journeyman/ 3 Helpers \$9.10	\$15.00	\$0.00	\$15.00
Bricklayer-(See Mason Tender Brick)	1 Journeyman / 3 Mason Tenders Brick	\$18.87	\$0.00	\$18.87
Cement Mason/Concrete Finisher	1 Journeyman/ 3 Mason Tenders Cement	\$15.00	\$0.00	\$15.00
Drywall Finisher/Taper	1 Journeyman/ 3 Helpers \$8.54	\$16.27	\$3.66	\$19.93
Drywall Hanger-(Includes Installing Metal Studs)	1 Journeyman/ 3 Helpers \$9.46	\$17.44	\$3.93	\$21.37
Form Builder/Formsetter	1 Journeyman/ 3 Helpers \$7.67	\$15.00	\$0.00	\$15.00
Glazier	1 Journeyman/ 3 Helpers \$11.51	\$23.27	\$7.12	\$30.39
Insulator-(Batt and Foam)	1 Journeyman/ 3 Helpers \$6.50	\$15.00	\$0.73	\$15.73
Ironworker - Reinforcing	1 Journeyman/ 3 Helpers \$7.83	\$15.00	\$0.00	\$15.00
Ironworker - Structural	1 Journeyman/ 3 Helpers \$10.19	\$24.42	\$7.12	\$31.54
Common Laborer - Laborer		\$15.00	\$0.00	\$15.00
Mason Tender Brick - Laborer-(Bricklayer's Helper)		\$15.00	\$0.00	\$15.00
Mason Tender Cement - Laborer-(Concrete Mason's / Concrete Finisher's Helper)		\$15.00	\$0.00	\$15.00
Pipelayer - Laborer		\$15.00	\$0.00	\$15.00
Plaster Tender - Laborer-(Plaster's Helper)		\$15.00	\$2.51	\$17.51
Lather	1 Journeyman/ 3 Helpers \$13.38	\$19.73	\$0.00	\$19.73
Painter-(Brush, Roller, and Spray)	1 Journeyman/ 3 Helpers \$7.42	\$17.24	\$4.41	\$21.65
Pipefitter-(Excluding HVAC Pipe)	1 Journeyman/ 3 Helpers \$12.40	\$33.30	\$12.26	\$45.56
Asphalt Paver - Power Equipment Operator		\$16.03	\$0.00	\$16.03
Back Hoe - Power Equipment Operator		\$15.00	\$0.00	\$15.00
Crane - Power Equipment Operator		\$34.85	\$9.85	\$44.70
Forklift - Power Equipment Operator		\$16.00	\$0.00	\$16.00
Slab & Wall Saw - Power Equipment Operator		\$15.54	\$3.83	\$19.37
Roofer	1 Journeyman/ 3 Helpers \$7.85	\$15.40	\$0.00	\$15.40
Tile Finisher	1 Journeyman/ 3 Helpers \$8.08	\$15.00	\$0.00	\$15.00
Tile Setter	1 Journeyman/ 3 Helpers \$10.91	\$16.17	\$0.00	\$16.17
Truck Driver		\$15.00	\$0.00	\$15.00
Electrician (Alarm Installation Only)-APPRENTICES (see definitions)	1 Journeyman/1 Apprentice	\$17.97	\$3.37	\$21.34
Electrician (Low Voltage Wiring Only)-HELPER (see definitions)	1 Journeyman/3 Helper \$11.70	\$18.00	\$1.68	\$19.68
<b>Welders-Receive rate prescribed for craft performing operation in which welding is incidental</b>				
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## Harris County Building Construction Classifications Revised – 2<sup>nd</sup> Quarter 2020

State: Texas

Construction Type: Building

Counties: Harris County in Texas.

**BUILDING CONSTRUCTION PROJECTS** (Use current highway general wage determination for Paving & Utilities incidental to Building Construction for Harris County)

**Asbestos Worker/Insulator - 1 Journeyman/1 Apprentice** (Including application of all insulating materials, protective coverings, coatings and finishing to all type of mechanical systems)

Applies insulating material to exposed surfaces of structures, such as air ducts, hot and cold pipes, storage tanks, and cold storage rooms: Reads blueprints and selects required insulation material (in sheet, tubular, or roll form), such as fiberglass, foam rubber, styrofoam, cork, or urethane, based on material's heat retaining or excluding characteristics. Brushes adhesives on or attaches metal adhesive-backed pins to flat surfaces as necessary to facilitate application of insulation material. Measures and cuts insulation material to specified size and shape for covering flat or round surfaces, using tape measure, knife, or scissors. Fits, wraps, or attaches required insulation material around or to structure, following blueprint specifications. Covers or seals insulation with preformed plastic covers, canvas strips, sealant, or tape to secure insulation to structure, according to type of insulation used and structure covered, using staple gun, trowel, paintbrush, or caulking gun.

**Boilermaker - 5 Journeyman/1 Apprentice**

Assembles, analyzes defects in, and repairs boilers, pressure vessels, tanks, and vats in field, following blueprints and using handtools and portable power tools and equipment: Locates and marks reference points for columns or plates on foundation, using master straightedge, squares, transit, and measuring tape, and applying knowledge of geometry. Attaches rigging or signals crane operator to lift parts to specified position. Aligns structures or plate sections to assemble boiler frame, tanks, or vats, using plumb bobs, levels, wedges, dogs, or turnbuckles. Hammers, flame-cuts, files, or grinds irregular edges of sections or structural parts to facilitate fitting edges together. Bolts or arc-welds structures and sections together. Positions drums and headers into supports and bolts or welds supports to frame. Aligns water tubes and connects and expands ends to drums and headers, using tube expander. Bells, beads with power hammer, or welds tube ends to ensure leak proof joints. Bolts or welds casing sections, uptakes, stacks, baffles, and such fabricated parts as chutes, air heaters, fan stands, feeding tube, catwalks, ladders, coal hoppers, and safety hatch to frame, using wrench. Installs manholes, handholes, valves, gauges, and feed water connection in drums to complete assembly of water tube boilers. Assists in testing assembled vessels by pumping water or gas under specified pressure into vessel and observing instruments for evidence of leakage. Repairs boilers or tanks in field by unbolting or flame cutting defective sections or tubes, straightening plates, using torch or jacks, installing new tubes, fitting and welding new sections and replacing worn lugs on bolts. May rivet and caulk sections of vessels, using pneumatic riveting and caulking hammers.

**Carpenter - 2 Journeyman/1 Apprentice** (Including Acoustical Ceiling Work)

Constructs, erects, installs, and repairs structures and fixtures of wood, plywood, and wallboard, using carpenter's handtools and power tools, and conforming to local building codes: Studies blueprints,

sketches, or building plans for information pertaining to type of material required, such as lumber or fiberboard, and dimensions of structure or fixture to be fabricated. Selects specified type of lumber or other materials. Prepares layout, using rule, framing square, and calipers. Marks cutting and assembly lines on materials, using pencil, chalk, and marking gauge. Shapes materials to prescribed measurements, using saws, chisels, and planes. Assembles cut and shaped materials and fastens them together with nails, dowel pins, or glue. Verifies trueness of structure with plumb bob and carpenter's level. Erects framework for structures and lays subflooring. Builds stairs and lays out and installs partitions and cabinetwork. Covers sub floor with building paper to keep out moisture and lays hardwood, parquet, and wood-strip-block floors by nailing floors to sub floor or cementing them to mastic or asphalt base. Applies shock-absorbing, sound-deadening, and decorative paneling to ceilings and walls. Fits and installs prefabricated window frames, doors, doorframes, weather stripping, interior and exterior trim, and finish hardware, such as locks, letter drops, and kick plates. Constructs forms and chutes for pouring concrete. Erects scaffolding and ladders for assembling structures above ground level. May weld metal parts to steel structural members.

**Floor Layer/Carpet Layer** - 1 Journeyman/3 Helpers \$8.80

**Electrician (Excludes Low Voltage Wiring and Installation of Alarms)** - 3 Journeyman/2 Apprentice (Including Pulling Wire and Low Voltage Wiring and Installation of Fire Alarms, Security Systems, Telephones, and Computers.)

Plans layout, installs, and repairs wiring, electrical fixtures, apparatus, and control equipment: Plans new or modified installations to minimize waste of materials, provide access for future maintenance, and avoid unsightly, hazardous, and unreliable wiring, consistent with specifications and local electrical codes. Prepares sketches showing location of wiring and equipment, or follows diagrams or blueprints, ensuring that concealed wiring is installed before completion of future walls, ceilings, and flooring. Measures, cuts, bends, threads, assembles, and installs electrical conduit, using tools, such as hacksaw, pipe threader, and conduit bender. Pulls wiring through conduit. Splices wires by stripping insulation from terminal leads, using knife or pliers, twisting or soldering wires together, and applying tape or terminal caps. Connects wiring to lighting fixtures and power equipment, using hand tools. Installs control and distribution apparatus, such as switches, relays, and circuit-breaker panels, fastening in place with screws or bolts, using hand tools and power tools. Connects power cables to equipment, such as electric range or motor, and installs grounding leads. Tests continuity of circuit to ensure electrical compatibility and safety of components, using testing instruments, such as ohmmeter, battery and buzzer, and oscilloscope. Observes functioning of installed equipment or system to detect hazards and need for adjustments, relocation, or replacement.

**Elevator Mechanic** - 1 Journeyman/1 Apprentice

*FOOTNOTES: a. - Employer contributes 8% of basic hourly rate for over 5 years' service and 6% of basic hourly rate for 6 months to 5 years' service as Vacation Pay Credit. Paid Holidays: New Year's Day; Memorial Day; Independence Day Labor Day; Thanksgiving Day; Friday after Thanksgiving Day; Christmas Day*

erector; elevator installer; elevator mechanic Assembles and installs electric and hydraulic freight and passenger elevators, escalators, and dumbwaiters, determining layout and electrical connections from blueprints: Studies blueprints and lays out location of framework, counterbalance rails, motor pump, cylinder, and plunger foundations. Drills holes in concrete or structural steel members with portable



electric drill. Secures anchor bolts or welds brackets to support rails and framework, and verifies alignment with plumb bob and level. Cuts prefabricated sections of framework, rails, and other elevator components to specified dimensions, using acetylene torch, power saw, and disk grinder. Installs cables, counterweights, pumps, motor foundations, escalator drives, guide rails, elevator cars, and control panels, using hand tools. Connects electrical wiring to control panels and electric motors. Installs safety and control devices. Positions electric motor and equipment on top of elevator shaft, using hoists and cable slings.

**Plasterer - 1 Journeyman/3 Plaster Tenders**

Applies coats of plaster to interior walls, ceilings, and partitions of buildings, to produce finished surface, according to blueprints, architect's drawings, or oral instructions, using hand tools and portable power tools: Directs workers to mix plaster to desired consistency and to erect scaffolds. Spreads plaster over lath or masonry base, using trowel, and smooths plaster with darby and float to attain uniform thickness. Applies scratch, brown, or finish coats of plaster to wood, metal, or board lath successively. Roughens undercoat with scratcher (wire or metal scraper) to provide bond for succeeding coats of plaster.

**Plumbers - 3 Journeyman/2 Apprentice (Excluding HVAC Pipe)**

Assembles, installs, and repairs pipes, fittings, and fixtures of heating, water, and drainage systems, according to specifications and plumbing codes: Studies building plans and working drawings to determine work aids required and sequence of installations. Inspects structure to ascertain obstructions to be avoided to prevent weakening of structure resulting from installation of pipe. Locates and marks position of pipe and pipe connections and passage holes for pipes in walls and floors, using ruler, spirit level, and plumb bob. Cuts openings in walls and floors to accommodate pipe and pipe fittings, using hand tools and power tools. Cuts and threads pipe, using pipe cutters, cutting torch, and pipe-threading machine. Bends pipe to required angle by use of pipe-bending machine or by placing pipe over block and bending it by hand. Assembles and installs valves, pipe fittings, and pipes composed of metals, such as iron, steel, brass, and lead, and nonmetals, such as glass, vitrified clay, and plastic, using hand tools and power tools. Joins pipes by use of screws, bolts, fittings, solder, plastic solvent, and caulks joints. Fills pipe system with water or air and reads pressure gauges to determine whether system is leaking. Installs and repairs plumbing fixtures, such as sinks, commodes, bathtubs, water heaters, hot water tanks, garbage disposal units, dishwashers, and water softeners. Repairs and maintains plumbing by replacing washers in leaky faucets, mending burst pipes, and opening clogged drains.

**Pipefitters - 1 Journeyman/1 Apprentice (HVAC Pipe Only) (For ratios see Journeyman/Apprentice schedule)**

Lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints: Selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications. Inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness. Plans installation or repair to avoid obstructions and to avoid interfering with activities of other workers. Cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch, and pipe cutting

machine. Threads pipe, using pipe-threading machine. Bends pipe, using pipe bending tools and pipe bending machine. Assembles and installs variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic. Connects pipes, using threaded, caulked, soldered, brazed, fused, or cemented joints, and hand tools. Secures pipes to structure with brackets, clamps, and hangers, using hand tools and power tools. Installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools. Installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints. Increases pressure in pipe system and observes connected pressure gauge to test system for leaks.

**Sprinkler Fitter, Fire - 1 Journeyman/1 Apprentice**

Lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints: Selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications. Inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness. Plans installation or repair to avoid obstructions and to avoid interfering with activities of other workers. Cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch, and pipe cutting machine. Threads pipe, using pipe-threading machine. Bends pipe, using pipe bending tools and pipe bending machine. Assembles and installs variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic. Connects pipes, using threaded, caulked, soldered, brazed, fused, or cemented joints, and hand tools. Secures pipes to structure with brackets, clamps, and hangers, using hand tools and power tools. Installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools. Installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints. Increases pressure in pipe system and observes connected pressure gauge to test system for leaks. May weld pipe supports to structural steel members. May observe production machines in assigned area of manufacturing facility to detect machinery malfunctions. May operate machinery to verify repair. May modify programs of automated machinery, such as robots and conveyors, to change motion and speed of machine, using teach pendant, control panel, or keyboard and display screen of robot controller and programmable controller.

**Sheet Metal Worker - 2 Journeyman/1 Apprentice (Including HVAC Duct and System Installation)**

Fabricates, assembles, installs and repairs sheet metal products, including sheetmetal roof (also see Roofer). Operates soldering and welding equipment to join together sheet metal parts. Seals seams and joints with sealant. Installs roof sheets, trims, flashing, gutters down spouts and other related items. Performs other related duties.

**Asbestos Abatement Worker - 1 Journeyman/3 Helpers \$9.10 (Ceilings, Floors, & Walls only)**

Removes asbestos from ceilings, walls, beams, boilers, and other structures, following hazardous waste handling guidelines: Assembles scaffolding and seals off work area, using plastic sheeting and duct tape. Positions mobile decontamination unit or portable showers at entrance of work area.



Builds connecting walkway between mobile unit or portable showers and work area, using hand tools, lumber, nails, plastic sheeting, and duct tape. Positions portable air evacuation and filtration system inside work area. Sprays chemical solution over asbestos covered surfaces, using tank with attached hose and nozzle, to soften asbestos. Cuts and scrapes asbestos from surfaces, using knife and scraper. Shovels asbestos into plastic disposal bags and seals bags, using duct tape. Cleans work area of loose asbestos, using vacuum, broom, and dustpan. Places asbestos in disposal bags and seals bags, using duct tape. Dismantles scaffolding and temporary walkway, using hand tools, and places plastic sheeting and disposal bags into transport bags. Seals bags, using duct tape, and loads bags into truck.

**Bricklayer - 1 Journeyman/3 Mason Tenders Brick (See Mason Tender Brick)**

Lays building materials, such as brick, structural tile, and concrete cinder, glass, gypsum, and terra cotta block (except stone) to construct or repair walls, partitions, arches, sewers, and other structures: Measures distance from reference points and marks guidelines on working surface to lay out work. Spreads soft bed (layer) of mortar that serves as base and binder for block, using trowel. Applies mortar to end of block and positions block in mortar bed. Taps block with trowel to level, align, and embed in mortar, allowing specified thickness of joint. Removes excess mortar from face of block, using trowel. Finishes mortar between brick with pointing tool or trowel. Breaks bricks to fit spaces too small for whole brick, using edge of trowel or brick hammer. Determines vertical and horizontal alignment of courses, using plumb bob, gaugeline (tightly stretched cord), and level. Fastens brick or terra cotta veneer to face of structures, with tie wires embedded in mortar between bricks, or in anchor holes in veneer brick. May weld metal parts to steel structural members. May apply plaster to walls and ceiling, using trowel, to complete repair work.

**Cement Mason/Concrete Finisher - 1 Journeyman/3 Mason Tenders Cement (See Concrete Mason/Concrete Finisher)**

finisher; concrete floater Smoothes and finishes surfaces of poured concrete floors, walls, sidewalks, or curbs to specified textures, using hand tools or power tools, including floats, trowels, and screeds: Signals concrete deliverer to position truck to facilitate pouring concrete. Moves discharge chute of truck to direct concrete into forms. Spreads concrete into inaccessible sections of forms, using rake or shovel. Levels concrete to specified depth and workable consistency, using hand held screed and floats to bring water to surface and produce soft topping. Smoothes, and shapes surfaces of freshly poured concrete, using straightedge and float or power screed. Finishes concrete surfaces, using power trowel, or wets and rubs concrete with abrasive stone to impart finish. Removes rough or defective spots from concrete surfaces, using power grinder or chisel and hammer, and patches holes with fresh concrete or epoxy compound. Molds expansion joints and edges, using edging tools, jointers, and straightedge. May sprinkle colored stone chips, powdered steel, or coloring powder on concrete to produce prescribed finish. May produce rough concrete surface, using broom. May mix cement, using hoe or concrete-mixing machine. May direct sub grade work, mixing of concrete, and setting of forms.

**Drywall Finisher/Taper - 1 Journeyman/3 Helpers \$8.54**

wallboard and plasterboard; sheetrock taper; taper and bedder; taper and floater Seals joints between plasterboard or other wallboards to prepare wall surface for painting or papering: Mixes sealing compound by hand or with portable electric mixer, and spreads compound over joints between boards, using trowel, broad knife, or spatula. Presses paper tape over joint to embed tape into compound and

seal joint, or tapes joint, using mechanical applicator that spreads compound and embeds tape in one operation. Spreads and smoothes cementing material over tape, using trowel or floating machine to blend joint with wall surface. Sands rough spots after cement has dried. Fills cracks and holes in walls and ceiling with sealing compound. Installs metal molding at corners in lieu of sealant and tape. Usually works as member of crew. May apply texturing compound and primer to walls and ceiling preparatory to final finishing, using brushes, roller, or spray gun. May countersink nails or screws below surface of wall prior to applying sealing compound, using hammer or screwdriver.

**Drywall Hanger** - 1 Journeyman/3 Helpers \$9.46 (Includes Installing Metal Studs)

dry-wall installer; gypsum dry-wall systems installer Plans gypsum drywall installations, erects metal framing and furring channels for fastening drywall, and installs drywall to cover walls, ceilings, soffits, shafts, and movable partitions in residential, commercial, and industrial buildings: Reads blueprints and other specifications to determine method of installation, work procedures, and material, tool, and work aid requirements. Lays out reference lines and points for use in computing location and position of metal framing and furring channels and marks position for erecting metalwork, using chalk line. Measures, marks, and cuts metal runners, studs, and furring channels to specified size, using tape measure, straightedge and hand and portable power cutting tools. Secures metal framing to walls and furring channels to ceilings, using hand and portable power tools. Measures and marks cutting lines on drywall, using square, tape measure, and marking devices. Scribes cutting lines on drywall, using straightedge and utility knife and breaks board along cut lines. Fits and fastens board into specified position on wall, using screws, hand tools, portable power tools, or adhesive. Cuts openings into board for electrical outlets, vents, or fixtures, using keyhole saw or other cutting tools. Measures, cuts, assembles, and installs metal framing and decorative trim for windows, doorways, and vents. Fits, aligns, and hangs doors and installs hardware, such as locks and kick plates

**Formbuilder/Formsetter** - 1 Journeyman/3 Helpers \$7.67

Constructs built-in-place or prefabricated wooden forms, according to specifications, for molding concrete structures: Studies blueprints and diagrams to determine type and dimension of forms to be constructed. Saws lumber to blueprint dimensions, using handsaw or power saw, and nails lumber together to make form panels. Erects built-in-place forms or assembles and installs prefabricated forms on construction site according to blueprint specifications, using hand tools, plumb rule, and level. Inserts spreaders and tie rods between opposite faces of form to maintain specified dimensions. Anchors and braces forms to fixed objects, using nails, bolts, anchor rods, steel cables, planks, and timbers.

**Glazier** - 1 Journeyman/3 Helpers \$11.51

Installs glass in windows, skylights, store fronts, and display cases, or on surfaces, such as building fronts, interior walls, ceilings, and tabletops: Marks outline or pattern on glass, and cuts glass, using glasscutter. Breaks off excess glass by hand or with notched tool. Fastens glass panes into wood sash with glazier's points, and spreads and smoothes putty around edge of panes with knife to seal joints. Installs mirrors or structural glass on building fronts, walls, ceilings, or tables, using mastic, screws, or decorative molding. Bolts metal hinges, handles, locks, and other hardware to prefabricated glass doors. Sets glass doors into frame and fits hinges. May install metal window and doorframes into which glass panels are to be fitted. May press plastic adhesive film to glass or spray glass with tinting solution to prevent light glare. May install stained glass windows.

**Insulator - 1 Journeyman/3 Helpers \$6.50 (Batt and Foam)**

Applies batt and form insulation to walls, ceilings and other surfaces according to manufacturers specifications and blue print instructions. May use sealants such as cement plaster or asphalt compound to seal insulation; may spread concrete over floor slabs to form wearing floor: brushes adhesives, cuts insulating materials to specified shape to cover surfaces; uses tape or other sealants to adhere insulation to surfaces. May use staple gun, towel, paintbrushes and caulking guns.

**Ironworker Reinforcing - 1 Journeyman/3 Helpers \$7.83**

Positions and secures steel bars in concrete forms to reinforce concrete; places rods in forms, spacing and fastening together with wire and pliers. Cuts bars using hacksaw, bar cutters or acetylene torch. Bends steel rods with hand tools or rod bending machine; reinforces concrete with wire mesh; welds reinforcing bars together.

**Ironworker Structural - 1 Journeyman/3 Helpers \$10.19**

erector; ironworker; steel erector; structural-iron erector; structural-iron worker; structural-steel erector Performs any combination of following duties to raise, place, and unite girders, columns, and other structural-steel members to form completed structures or structure frameworks, working as member of crew: Sets up hoisting equipment for raising and placing structural-steel members. Fastens steel members to cable of hoist, using chain, cable, or rope. Signals worker operating hoisting equipment to lift and place steel member. Guides member, using tab line (rope) or rides on member in order to guide it into position. Pulls, pushes, or pries steel members into approximate position while member is supported by hoisting device. Forces members into final position, using turnbuckles, crowbars, jacks, and hand tools. Aligns rivet holes in member with corresponding holes in previously placed member by driving drift pins or handle of wrench through holes. Verifies vertical and horizontal alignment of members, using plumb bob and level.

**Common Laborer**

Performs any combination of the following tasks in erecting, repairing and wrecking buildings; dig, spread and level dirt and gravel; lift carry and hold building materials, tools and supplies; clean tools, equipment, materials and work areas; mix, pour and spread concrete, asphalt, gravel and other materials; join, wrap and seal sections of pipe; routine non-machine tasks such as removing forms from set concrete, filling expansion joints with asphalt, and placing culverts in trench. May also signal construction equipment operators; measure distances from grade stakes, drive stakes and stretch lines; bolt, nail align and block up under forms; mix and finish poured concrete, erect scaffolding; spread paint or coating to seal surfaces; caulking compounds to seal surfaces; remove projections from concrete, and mount pipe hangers.

**Mason Tender Brick-Laborer (Bricklayer's Helper)**

**Mason Tender Cement-Laborer (Concrete Mason's/Concrete Finisher's Helper)**

**Pipelayer-Laborer**

Lay pipe for storm or sanitation sewers, drains, and water mains. Perform any combination of the following tasks: grade trenches or culverts, position pipe, or seal joints.

**Plaster Tender-Laborer** (Plaster's Helper)

Tends machine that pumps plaster or stucco through spray-gun for application to ceilings, walls, and partitions of buildings: Starts and stops machine on signals from PLASTERER (construction). Fills hopper of machine with plaster. Turns valves to regulate pump and compressor. Assists in erecting scaffolds.

**Lather**- 1 Journeyman/3 Helpers \$13.38

Fastens wooden, metal, or rockboard lath to walls, ceilings, and partitions of buildings to provide supporting base for plaster, fireproofing, or acoustical material, using hand tools and portable power tools: Erects horizontal metal framework to which laths are fastened, using nails, bolts, and studgun. Drills holes in floor and ceiling, using portable electric tool, and drives ends of wooden or metal studs into holes to provide anchor for furring or rockboard lath. Wires horizontal strips to furring to stiffen framework. Cuts lath to fit openings and projections, using hand tools or portable power tools. Wires, nails, clips, or staples lath to framework, ceiling joists, and flat concrete surfaces. Bends metal lath to fit corners, or attaches preformed corner reinforcements. Wires plasterer's channels to overhead structural framework to provide support for plaster or acoustical ceiling tile.

**Painter** - 1 Journeyman/3 Helpers \$7.42 (Brush, Roller, and Spray)

Applies coats of paint, varnish, stain, enamel, or lacquer to decorate and protect interior or exterior surfaces, trimmings, and fixtures of buildings and other structures: Reads work order or receives instructions from supervisor or homeowner regarding painting. Smooths surfaces, using sandpaper, brushes, or steel wool, and removes old paint from surfaces, using paint remover, scraper, wire brush, or blowtorch to prepare surfaces for painting. Fills nail holes, cracks, and joints with caulk, putty, plaster, or other filler, using caulking gun and putty knife. Selects premixed paints, or mixes required portions of pigment, oil, and thinning and drying substances to prepare paint that matches specified colors. Removes fixtures, such as pictures and electric switchcovers, from walls prior to painting, using screwdriver. Spreads dropcloths over floors and room furnishings, and covers surfaces, such as baseboards, doorframes, and windows with masking tape and paper to protect surfaces during painting. Paints surfaces, using brushes, spray gun, or paint rollers. Simulates wood grain, marble, brick, or tile effects. Applies paint with cloth, brush, sponge, or fingers to create special effects. Erects scaffolding or sets up ladders to perform tasks above ground level.

**Pipefitter** - 1 Journeyman/3 Helpers \$12.40 (Excluding HVAC Pipe)

Lays out, assembles, installs, and maintains pipe systems, pipe supports, and related hydraulic and pneumatic equipment for steam, hot water, heating, cooling, lubricating, sprinkling, and industrial production and processing systems, applying knowledge of system operation, and following blueprints: Selects type and size of pipe, and related materials and equipment, such as supports, hangers, and hydraulic cylinders, according to specifications. Inspects work site to determine presence of obstructions and to ascertain that holes cut for pipe will not cause structural weakness. Plans installation or repair to avoid obstructions and to avoid interfering with activities of other workers. Cuts pipe, using saws, pipe cutter, hammer and chisel, cutting torch, and pipe cutting machine. Threads pipe, using pipe threading machine. Bends pipe, using pipe bending tools and pipe bending machine. Assembles and installs variety of metal and nonmetal pipes, tubes, and fittings, including iron, steel, copper, and plastic. Connects pipes, using threaded, caulked, soldered, brazed,

fused, or cemented joints, and hand tools. Secures pipes to structure with brackets, clamps, and hangers, using hand tools and power tools. Installs and maintains hydraulic and pneumatic components of machines and equipment, such as pumps and cylinders, using hand tools. Installs and maintains refrigeration and air-conditioning systems, including compressors, pumps, meters, pneumatic and hydraulic controls, and piping, using hand tools and power tools, and following specifications and blueprints. Increases pressure in pipe system and observes connected pressure gauge to test system for leaks. May weld pipe supports to structural steel members. May observe production machines in assigned area of manufacturing facility to detect machinery malfunctions. May operate machinery to verify repair. May modify programs of automated machinery, such as robots and conveyors, to change motion and speed of machine, using teach pendant, control panel, or keyboard and display screen of robot controller and programmable controller. May be designated Steam Fitter (construction) when installing piping systems that must withstand high pressure.

**Asphalt Paver - Power Equipment Operator (PEO)**

operator; bituminous-paving-machine operator; blacktop-paver operator; blacktop spreader; mechanical-spreader operator; paving-machine operator, asphalt or bituminous Operates machine that spreads and levels hot-mix bituminous paving material on sub grade of highways and streets: Bolts extensions to screed to adjust width, using wrenches. Lights burners to heat screed. Starts engine and controls paving machine to push dump truck and maintain constant flow of asphalt into hopper. Observes distribution of paving material along screed and controls direction of screed to eliminate voids at curbs and joints. Turns valves to regulate temperature of asphalt flowing from hopper when asphalt begins to harden on screed.

**Backhoe - PEO**

Operates power-driven machine, equipped with movable shovel, to excavate or move coal, dirt, rock, sand, and other materials: Receives written or oral instructions from supervisor regarding material to move or excavate. Pushes levers and depresses pedals to move machine, to lower and push shovel into stockpiled material, to lower and dig shovel into surface of ground, and to lift, swing, and dump contents of shovel into truck, car, or onto conveyor, hopper, or stockpile. Observes markings on ground, hand signals, or grade stakes to remove material, when operating machine at excavation site.

**Crane - PEO**

Operates electric-, diesel-, gasoline-, or steam-powered guy-derrick or stiff-leg derrick (mast supported by fixed legs or tripod), to move products, equipment, or materials to and from quarries, storage areas, and processes, or to load and unload trucks or railroad cars: Pushes and pulls levers and depresses pedals to raise, lower, and rotate boom and to raise and lower load line in response to signals.

**Forklift - PEO**

Drives gasoline-, liquefied gas-, or electric-powered industrial truck equipped with lifting devices, such as forklift, boom, scoop, lift beam and swivel-hook, fork-grapple, clamps, elevating platform, or trailer hitch, to push, pull, lift, stack, tier, or move products, equipment, or materials in warehouse, storage yard, or factory: Moves levers and presses pedals to drive truck and control movement of lifting apparatus. Positions forks, lifting platform, or other lifting device under, over, or around



loaded pallets, skids, boxes, products, or materials or hooks tow trucks to trailer hitch, and transports load to designated area. Unloads and stacks material by raising and lowering lifting device.

**Slab & Wall Saw - PEO**

**Roofer - 1 Journeyman/3 Helpers \$7.85**

Covers roofs with roofing materials other than sheet metal, such as composition shingles or sheets, wood shingles, or asphalt and gravel, to waterproof roofs: Cuts roofing paper to size, using knife, and nails or staples it to roof in overlapping strips to form base for roofing materials. Installs gutters and downs spouts. Aligns roofing material with edge of roof, and overlaps successive layers, gauging distance of overlap with chalkline, gauge on shingling hatchet, or by lines on shingles. Fastens composition shingles or sheets to roof with asphalt, cement, or nails. Punches holes in slate, tile, terra cotta, or wooden shingles, using punch and hammer. Cuts strips of flashing and fits them into angles formed by walls, vents, and intersecting roof surfaces. When applying asphalt or tar and gravel to roof, mops or pours hot asphalt or tar onto roof base. Applies alternate layers of hot asphalt or tar and roofing paper until roof covering is as specified. Applies gravel or pebbles over top layer, using rake or stiff-bristled broom.

**Tile Finisher - 1 Journeyman/3 Helpers \$8.08**

Supplies and mixes construction materials for TILE SETTER (construction) 861.381-054, applies grout, and cleans installed tile: Moves tiles, tilesetting tools, and work devices from storage area to installation site manually or using wheelbarrow. Mixes mortar and grout according to standard formulas and request from TILE SETTER (construction), using bucket, water hose, spatula, and portable mixer. Supplies TILE SETTER (construction) with mortar, using wheelbarrow and shovel. Applies grout between joints of installed tile, using grouting trowel. Removes excess grout from tile joints with wet sponge and scrapes corners and crevices with trowel. Wipes surface of tile after grout has set to remove grout residue and polish tile, using nonabrasive materials. Cleans installation site, mixing and storage areas, and installation machines, tools, and equipment, using water and various cleaning tools. Stores tile setting materials, machines, tools, and equipment. May apply caulk, sealers, acid, steam, or related agents to caulk, seal, or clean installed tile, using various application devices and equipment. May modify mixing, grouting, grinding, and cleaning procedures according to type of installation or material used. May assist TILE SETTER (construction) to position and secure metal lath, wire mesh, or felt paper prior to installation of tile. May cut marked tiles to size, using power saw or tile cutter.

**Tile Setter – 1 Journeyman/3 Helpers \$10.91**

Applies tile to walls, floors, ceilings, and promenade roof decks, following design specifications: Examines blueprints, measures and marks surfaces to be covered, and lays out work. Measures and cuts metal lath to size for walls and ceilings with tin snips. Tacks lath to wall and ceiling surfaces with staple gun or hammer. Spreads plaster base over lath with trowel and levels plaster to specified thickness, using screed. Spreads concrete on subfloor with trowel and levels it with screed. Spreads mastic or other adhesive base on roof deck, using serrated spreader to form base for promenade tile. Cuts and shapes tile with tile cutters and biters. Positions tile and taps it with trowel handle to affix tile to plaster or adhesive base.

**Truck Driver**

Drives truck with capacity of more than 3 tons, to transport materials to and from specified destinations: Drives truck to destination, applying knowledge of commercial driving regulations and area roads. Prepares receipts for load picked up. Collects payment for goods delivered and for delivery charges. May maintain truck log, according to state and federal regulations. May maintain telephone or radio contact with supervisor to receive delivery instructions. May load and unload truck. May inspect truck equipment and supplies, such as tires, lights, brakes, gas, oil, and water. May perform emergency roadside repairs, such as changing tires, installing light bulbs, tire chains, and spark plugs. May position blocks and tie rope around items to secure cargo during transit.

**Electrician (Alarm Installation Only) - 1 Journeyman/1 Apprentice**  
APPRENTICES (see definitions)

Registered Apprenticeship Ratios  
For All Apprentices

Apprentice duties consist but are not limited to reading blue prints, lay out, fabrication, installation, and assembly. Other duties are the setting up and operation of fabrication machines, using hand tools, power tools, lifting/handling devices, sealing if necessary, according to their particular craft. Apprentices also are trained in the preparation process of a job that include but not limited to staging, planning, distribution, and sectioning of materials.

Apprentices may be used in any of the crafts listed where noted on the Prevailing Wage Rate Schedule, if they are currently certified in a program recognized by the Bureau of Apprenticeship and Training, U.S. Department of Labor, providing the proper ratio between journeyman and apprentice is observed. Apprentice certification certificates must be supplied with the first weekly payroll upon which the apprentice's name appears. Helpers or Laborers can not be utilized when Apprentices are shown

**Asbestos Worker / Insulator**

Harris County allows the use of 1 Journeyman and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 2th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman

1 Journeyman w/ 1 Apprentice  
2 Journeymen w/ 2 Apprentices

**Boilermakers**

Harris County allows the use of 5 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 6th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman

1-5 Journeymen w/ 1 Apprentice  
6-10 Journeymen w/ 2 Apprentices

**Carpenter**

Harris County allows the use of 2 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 4th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman

- 1-2 Journeymen w/ 1 Apprentice
- 3-4 Journeymen w/ 2 Apprentices
- 5-6 Journeymen w/ 3 Apprentices

**Electrician**

Harris County allows the use of 3 Journeymen and 2 Apprentices, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 3rd Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman. All Journeymen and Apprentices must hold a current license from the State of Texas.

- 1 Journeyman w/ 1 Apprentice
- 2 Journeymen w/ 1 Apprentice
- 3 Journeymen w/ 2 Apprentices
- 4 Journeymen w/ 3 Apprentices
- 5 Journeymen w/ 3 Apprentices
- 6 Journeymen w/ 4 Apprentices
- 7 Journeymen w/ 4 Apprentices
- 8 Journeymen w/ 4 Apprentices
- 9 Journeymen w/ 4 Apprentices
- 10 Journeymen w/ 5 Apprentices

**Plumbers**

Harris County allows the use of 3 Journeymen and 2 Apprentices, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 3rd Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman. All Journeymen and Apprentices must hold a current license from the State of Texas.

- 1 Journeyman w/ 1 Apprentice
- 2 Journeymen w/ 1 Apprentice
- 3 Journeymen w/ 2 Apprentices
- 4 Journeymen w/ 3 Apprentices
- 5 Journeymen w/ 3 Apprentices
- 6 Journeymen w/ 4 Apprentices
- 7 Journeymen w/ 4 Apprentices
- 8 Journeymen w/ 4 Apprentices
- 9 Journeymen w/ 4 Apprentices
- 10 Journeymen w/ 5 Apprentices



**Sprinkler Fitter**

Harris County allows the use of 1 Journeyman and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 2th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman

1 Journeyman w/ 1 Apprentice  
2 Journeymen w/ 2 Apprentices

**Sheetmetal Worker**

Harris County allows the use of 2 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 4th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman

1-2 Journeymen w/ 1 Apprentice  
3-4 Journeymen w/ 2 Apprentices  
5-6 Journeymen w/ 3 Apprentices

**Pipefitter**

Harris County allows the use of 1 Journeymen and 1 Apprentice, the Apprentice can be used with the first Journeyman. No other Apprentices can be added until the 4th Journeyman is added. All Apprentices are to be under the direct supervision of a Journeyman

1 Journeyman w/ 1 Apprentice  
2 Journeymen w/ 1 Apprentice  
3 Journeymen w/ 2 Apprentices  
4 Journeymen w/ 3 Apprentices  
5 Journeymen w/ 3 Apprentices  
6 Journeymen w/ 4 Apprentices  
7 Journeymen w/ 4 Apprentices  
8 Journeymen w/ 4 Apprentices  
9 Journeymen w/ 4 Apprentices  
10 Journeymen w/ 5 Apprentices

**Electrician (Low Voltage Wiring Only) - 1 Journeyman/3 Helper \$11.70 HELPER (see definitions)**

(Must not exceed 3 helpers to 1 journeyman)

A Helper is a semi-skilled laborer (rather than a skilled journeyman) who works under the direction of and assists a journeyman. Under the journeyman's direction and supervision, the helper performs a variety of duties to assist the journeyman such as preparing, carrying, and furnishing equipment, supplies and maintaining them in order; cleaning and preparing work areas; lifting, positioning, and holding materials or tools; and other related semi-skilled tasks as directed by the journeyman. A helper may use the tools of the trade at and under the direction of the journeyman. The particular duties performed by a helper vary according to area practice. The journeyman must work in close proximity to the location of the helpers work area. The helpers wage rate shall be calculated at no less than 65% of the prevailing wage for that journeyman's classification.

Helper who assists more than one journeyman craft should be listed with the notation indicating each journeyman craft classification they assist.

**WELDERS** - Receive rate prescribed for craft performing operation to which welding is incidental.

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**When Apprentices are shown, Helpers cannot be utilized**

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**If there are questions as to the classification of a worker, contact the Contract Compliance Officer in writing with a description of the work the worker will be performing. After review the Contract Compliance Officer will respond in writing with the classification and wage rate to be paid the worker in question.**

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**Fringe Benefits**

If the worker is not receiving fringe benefits, they must be paid in cash if noted on the prevailing wage schedule along with the base rate.

The term wages means the basic hourly rate of pay; any contribution irrevocably made by a contractor or subcontractor to a trustee or to a third person pursuant to a bona fide fringe benefit fund, plan, or program; and the rate of costs to the contractor or subcontractor which may be reasonably anticipated in providing bona fide fringe benefits to laborers and mechanics pursuant to an enforceable commitment to carry out a financially responsible plan of program, which was communicated in writing to the laborers and mechanics affected. The fringe benefits enumerated in the Davis-Bacon Act include medical or hospital care, pensions on retirement or death, compensation for injuries or illness resulting from occupational activity, or insurance to provide any of the foregoing; unemployment benefits; life insurance, disability insurance, sickness insurance, or accident insurance; vacation or holiday pay; defraying costs of apprenticeship or other similar programs; or other bona fide fringe benefits. Fringe benefits do not include benefits required by other Federal, State, or local law. The prevailing wages (including fringe benefits) as adopted for this contract are based upon a survey performed under the Davis-Bacon Act. Thus determinations in regard to fringe benefits, to the extent practicable, will be based upon the standards set forth in the following federal regulations.

**Title 29, Code of Federal Regulations, Part 4  
Labor Standards for Federal Service Contracts  
(29 CFR 4.169-4.171)**

**29 CFR 4.170 - Furnishing fringe benefits or equivalents.**

(a) General. Fringe benefits required under the Act shall be furnished, separate from and in addition to the specified monetary wages, by the contractor or subcontractor to the employees engaged in performance of the contract, as specified in the determination of the Secretary or his authorized representative and prescribed in the contract documents. Section 2(a)(2) of the Act provides that the obligation to furnish the specified benefits ``may be discharged by furnishing any equivalent combinations of fringe benefits or by making equivalent or differential payments in cash under rules and regulations established by the Secretary.'' The governing rules and regulations for furnishing such equivalents are set forth in Sec. 4.177 of this subpart. An employer cannot offset an amount of monetary wages paid in excess of the wages required under the determination in order to satisfy his fringe benefit obligations under the Act, and must keep appropriate records separately showing amounts paid for wages and amounts paid for fringe benefits.

(b) Meeting the requirement, in general. The various fringe benefits listed in the Act and in Sec. 4.162(a) are illustrative of those which may be found to be prevailing for service employees in a particular locality. The benefits which an employer will be required to furnish employees performing on a particular contract will be specified in the contract documents. A contractor may dispose of certain of the fringe benefit obligations which may be required by an applicable fringe benefit determination, such as pension, retirement, or health insurance, by irrevocably paying the specified contributions for fringe benefits to an independent trustee or other third person pursuant to an existing ``bona fide" fund, plan, or program on behalf of employees engaged in work subject to the Act's provisions. Where such a plan or fund does not exist, a contractor must discharge his obligation relating to fringe benefits by furnishing either an equivalent combination of ``bona fide" fringe benefits or by making equivalent payments in cash to the employee, in accordance with the regulations in Sec. 4.177.

**29 CFR 4.171 - ``Bona fide" fringe benefits.**

(a) To be considered a ``bona fide" fringe benefit for purposes of the Act, a fringe benefit plan, fund, or program must constitute a legally enforceable obligation, which meets the following criteria:

(1) The provisions of a plan, fund, or program adopted by the contractor, or by contract as a result of collective bargaining, must be specified in writing, and must be communicated in writing to the affected employees. Contributions must be made pursuant to the terms of such plan, fund, or program. The plan may be either contractor-financed or a joint contractor-employee contributory plan. For example, employer contributions to Individual Retirement Accounts (IRAs) approved by IRS are permissible.

However, any contributions made by employees must be voluntary, and if such contributions are made through payroll deductions, such deductions must be made in accordance with Sec. 4.168. No contribution toward fringe benefits made by the employees themselves, or fringe benefits provided from monies deducted from the employee's wages may be included or used by an employer in satisfying any part of any fringe benefit obligation under the Act.

- (2) The primary purpose of the plan must be to provide systematically for the payment of benefits to employees on account of death, disability, advanced age, retirement, illness, medical expenses, hospitalization, supplemental unemployment benefits, and the like.
- (3) The plan must contain a definite formula for determining the amount to be contributed by the contractor and a definite formula for determining the benefits for each of the employees participating in the plan.
- (4) Except as provided in paragraph (b), the contractor's contributions must be paid irrevocably to a trustee or third person pursuant to an insurance agreement, trust or other funded arrangement. The trustee must assume the usual fiduciary responsibilities imposed upon trustees by applicable law. The trust or fund must be set up in such a way that the contractor will not be able to recapture any of the contributions paid in nor in any way divert the funds to its own use or benefit.
- (5) Benefit plans or trusts of the types listed in 26 U.S.C. 401(a) which are disapproved by the Internal Revenue Service as not satisfying the requirements of section 401(a) of the Internal Revenue Code or which do not meet the requirements of the Employee Retirement Income Security Act of 1974, 29 U.S.C. 1001, et seq. and regulations thereunder, are not deemed to be "bona fide" plans for purposes of the Service Contract Act.
- (6) It should also be noted that such plans must meet certain other criteria as set forth in Sec. 778.215 of 29 CFR part 778 in order for any contributions to be excluded from computation of the regular rate of pay for overtime purposes under the Fair Labor Standards Act (Secs. 4.180-4.182).
- (b)(1) Unfunded self-insured fringe benefit plans (other than fringe benefits such as vacations and holidays which by their nature are normally unfunded) under which contractors allegedly make "out of pocket" payments to provide benefits as expenses may arise, rather than making irrevocable contributions to a trust or other funded arrangement as required under Sec. 4.171(a)(4), are not normally considered "bona fide" plans or equivalent benefits for purposes of the Act.
- (2) A contractor may request approval by the Administrator of an unfunded self-insured plan in order to allow credit for payments under the plan to meet the fringe benefit requirements of the Act. In considering whether such a plan is bona fide, the Administrator will consider such factors as whether it could be reasonably anticipated to provide the prescribed benefits, whether it represents a legally enforceable commitment to provide such benefits, whether it is carried out under a financially responsible program, and whether the plan has been communicated to the employees in writing. The Administrator in his/her discretion may direct that assets be set aside and preserved in an escrow account or that other protections be afforded to meet the plan's future obligation.
- (c) No benefit required by any other Federal law or by any State or local law, such as unemployment compensation, workers' compensation, or social security, is a fringe benefit for purposes of the Act.
- (d) The furnishing to an employee of board, lodging, or other facilities under the circumstances described in Sec. 4.167, the cost or value of which is creditable toward the monetary wages specified under the Act, may not be used to offset any fringe benefit obligations, as such items and facilities are not fringe benefits or equivalent benefits for purposes of the Act.
- (e) The furnishing of facilities which are primarily for the benefit or convenience of the contractor or the cost of which is properly a business expense of the contractor is not the furnishing of a "bona

fide" fringe benefit or equivalent benefit or the payment of wages. This would be true of such items, for example, as relocation expenses, travel and transportation expenses incident to employment, incentive or suggestion awards, and recruitment bonuses, as well as tools and other materials and services incidental to the employer's performance of the contract and the carrying on of his business, and the cost of furnishing, laundering, and maintaining uniforms and/or related apparel or equipment where employees are required by the contractor, by the contractor's Government contract, by law, or by the nature of the work to wear such items. See also Sec. 4.168.

(f) Contributions by contractors for such items as social functions or parties for employees, flowers, cards, or gifts on employee birthdays, anniversaries, etc. (sunshine funds), employee rest or recreation rooms, paid coffee breaks, magazine subscriptions, and professional association or club dues, may not be used to offset any wages or fringe benefits specified in the contract, as such items are not "bona fide" wages or fringe benefits or equivalent benefits for purposes of the Act.

**ATTACHMENT “B-1”**

**WORKER’S COMPENSATION INSURANCE COVERAGE**

Article 5.3.1, Workers’ Compensation Insurance Coverage, is to be amended to add the following:

(A) Definitions.

Certificate of coverage (“certificate”) - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Workers’ Compensation Commission (the “TWCC”) or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84) showing statutory workers’ compensation insurance coverage for the person’s or entity’s employees providing services on a project, for the duration of the project.

Duration of the project - includes the time from the beginning of the work on the project until the CONTRACTOR’s/person’s work on the project has been completed and accepted by the governmental entity.

Persons providing services on the project (“Subcontractor” in Section 406.096 of the Texas Labor Code) - includes all persons or entities performing all or part of the services the CONTRACTOR has undertaken to perform on the project, regardless of whether that person contracted directly with the CONTRACTOR and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity or employees of any entity which furnishes persons to provide services on the project. “Services” include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. “Services” do not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

- (B) The CONTRACTOR shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreement, which meets the statutory requirements of Texas Labor Code, ‘401.011(44) for all employees of the CONTRACTOR providing services on the project, for the duration of the project.
- (C) The CONTRACTOR must provide a certificate of coverage to the OWNER prior to being awarded the contract.
- (D) If the coverage period shown on the CONTRACTOR’s current certificate of coverage ends during the duration of the project, the CONTRACTOR must, prior to the end of the coverage period, file a new certificate of coverage with the OWNER, showing that the coverage has been extended.

- (E) The CONTRACTOR shall obtain from each person providing services on the project and provide to the OWNER:
  - (1) a certificate of coverage, prior to that person beginning work on the project, so the OWNER will have on file certificates of coverage showing coverage for all persons providing services on the project; and
  - (2) no later than seven days after receipt by the CONTRACTOR, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
- (F) The CONTRACTOR shall retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
- (G) The CONTRACTOR shall notify the OWNER in writing by certified mail or personal delivery, within 10 days after the CONTRACTOR knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project;
- (H) The CONTRACTOR shall post on each project site a notice, in the text, form and manner prescribed by the TWCC, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify current coverage and report failure to provide coverage.
- (I) The CONTRACTOR shall contractually require each person with whom it contracts to provide services on a project to:
  - (1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code '401.011(44) for all its employees providing services on the project, for the duration of the project;
  - (2) provide to the CONTRACTOR, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.
  - (3) provide the CONTRACTOR, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - (4) obtain from each other person with whom it contracts, and provide to the CONTRACTOR:
    - (a) a certificate of coverage, prior to the other person beginning work on the project; and

- (b) a new certificate of coverage showing extension of the coverage period, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
  - (5) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
  - (6) notify the OWNER in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
  - (7) contractually require each other person with whom it contracts to perform as required by paragraphs (1) through (7) inclusive, with the certificate of coverage to be provided to the person for whom they are providing services.
- (J) By signing this contract or providing or causing to be provided a certificate of coverage, the CONTRACTOR is representing to the OWNER that all employees of the CONTRACTOR who will provide services on the project will be covered by workers' compensation coverage for the duration of the project; that the coverage will be based on proper reporting of classification codes and payroll amounts; and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the TWCC's Division of Self-Insurance Regulation. Providing false or misleading information may subject the CONTRACTOR to administrative penalties, criminal penalties, civil penalties, or other civil actions.
- (K) The CONTRACTOR's failure to comply with any of these provisions is a breach of contract by the CONTRACTOR which entitles the OWNER to declare the contract void if the CONTRACTOR does not remedy the breach within ten days after receipt of notice of breach from the OWNER.

The following is the form of notice of workers' compensation coverage prescribed by the TWCC. Pursuant to Section 110.110(d)(7), this notice must be printed with a title in at least 30-point bold type, and text in at least 19-point normal type, and shall be in both English and Spanish and any other language common to the worker population.



**REQUIRED WORKERS' COMPENSATION COVERAGE**

“The law requires that each person working on this site or providing services related to this construction project must be covered by workers’ compensation insurance. This includes persons providing, hauling, or delivering equipment or materials, or providing labor or transportation or other service related to the project, regardless of the identity of their employer or status as an employee.”

“Call the Texas Workers’ Compensation Commission at (512) 440-3789 to receive further information on the legal requirement for coverage, to verify whether your employer has provided the required coverage, or to report an employer’s failure to provide coverage.”

This required notice should not be attached to the contract. Instead, upon request, the CONTRACTOR should be provided with a copy of Section 110.110 and Figure 2 thereto.

Please note that Section 110.110 of Chapter 28 of the Texas Administrative Code requires that the governmental entity retain the certificates of coverage provided by the CONTRACTOR for the duration of the project and for three years thereafter.

**ATTACHMENT “C-1”**

**HB 914 CONFLICT DISCLOSURES**



JOHNSON RADCLIFFE  
PETROV & BOBBITT PLLC

## MEMORANDUM

**TO:** All Prospective Bidders or Contractors

**FROM:** Johnson Radcliffe Petrov & Bobbitt PLLC ("JRPB")

**DATE:** November 8, 2006

**RE:** North Harris County Regional Water Authority (the "Authority") –  
HB 914 Conflict Disclosures

---

### Introduction

Texas Local Government Code Section 176.001, et seq. requires that all persons seeking to contract with a local governmental entity such as the Authority must complete and file with JRPB a Conflicts of Interest Questionnaire (the "Questionnaire"). The new statutory disclosure requirements apply to any individual or company that seeks to provide the Authority with any property, goods, or services, including construction contracts and professional services contract. A copy of the Questionnaire is attached to this memorandum.

### Procedures to Comply with the Law

We have determined that the best way to monitor compliance with the new statutory disclosure requirements is to require as part of a bid submission or request for proposals that the Questionnaire be completed and submitted to the Authority. The completion and submission of the Questionnaire with the bid or proposal ensures that the Authority has the information available prior to awarding a contract or accepting a proposal.

Effective immediately, for all new or amended contracts with the Authority, a completed Questionnaire must be submitted **prior** to award of the contract by the Authority. **FAILURE TO COMPLETE THE QUESTIONNAIRE WILL BE VIEWED AS AN INCOMPLETE SUBMISSION THAT IN THE DISCRETION OF THE AUTHORITY, MAY BE WAIVED PROVIDED THAT THE QUESTIONNAIRE IS COMPLETED AND SUBMITTED PRIOR TO THE AWARD OF THE CONTRACT.**

### Notifying Potential Contractors of Requirements

We understand that many prospective bidders/contractors may not be aware of the new statutory disclosure requirements or how the requirements apply to their business with the Authority. Therefore, in order to notify prospective bidders/contractors of the new requirements, a

brief summary of the Section 176 requirements and the Authority's procedures to comply with the law, is included with all bid packets or requests for proposals. This language is prominently included in the bid packets and/or requests for proposals under the heading "HB 914 Conflict Disclosures."

### **Conclusion**

We know that these new statutory disclosure requirements are difficult to understand, implement and comply with; however, we feel that the procedures outlined above will streamline compliance with and application of these new requirements. If you have any questions regarding these matters, please do not hesitate to contact us.

/jtm  
Attachments

cc: Board of Directors of the Authority

**North Harris County Regional Water Authority**

Alan J. Rendl – President

Kelly P. Fessler – Vice President

Lenox A. Sigler – Secretary

James D. (Jim) Pulliam – Treasurer

Ron Graham – Assistant Secretary

Jimmie Schindewolf, P.E. – General Manager

<b>CONFLICT OF INTEREST QUESTIONNAIRE</b> For vendor or other person doing business with local governmental entity		<b>FORM CIQ</b>
<p>This questionnaire is being filed in accordance with chapter 176 of the Local Government Code by a person doing business with the governmental entity.</p> <p>By law this questionnaire must be filed with the records administrator of the local government not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. See Section 176.006, Local Government Code.</p> <p>A person commits an offense if the person violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.</p>	<div style="border: 1px solid black; text-align: center; padding: 2px; font-weight: bold;">OFFICE USE ONLY</div> <div style="border: 1px solid black; padding: 2px;">                         Date Received                     </div>	
<div style="border: 1px solid black; padding: 2px;"> <b>1</b> Name of person doing business with local governmental entity.                         </div>		
<div style="border: 1px solid black; padding: 2px;"> <b>2</b> <div style="margin-top: 10px;"> <input type="checkbox"/> Check this box if you are filing an update to a previously filed questionnaire.                                 </div> <div style="margin-top: 10px; font-size: small;">                                     (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than September 1 of the year for which an activity described in Section 176.006(a), Local Government Code, is pending and not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)                                 </div> </div>		
<div style="border: 1px solid black; padding: 2px;"> <b>3</b> Describe each affiliation or business relationship with an employee or contractor of the local governmental entity who makes recommendations to a local government officer of the local governmental entity with respect to expenditure of money.                         </div>		
<div style="border: 1px solid black; padding: 2px;"> <b>4</b> Describe each affiliation or business relationship with a person who is a local government officer and who appoints or employs a local government officer of the local governmental entity that is the subject of this questionnaire.                         </div>		

Adopted 01/13/2008

**CONFLICT OF INTEREST QUESTIONNAIRE**

For vendor or other person doing business with local governmental entity

**FORM CIQ**

**Page 2**

**5** Name of local government officer with whom filer has affiliation or business relationship. (Complete this section only if the answer to A, B, or C is YES.)

This section, item 5 including subparts A, B, C & D, must be completed for each officer with whom the filer has affiliation or business relationship. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income from the filer of the questionnaire?

☐

Yes

☐

No

B. Is the filer of the questionnaire receiving or likely to receive taxable income from or at the direction of the local government officer named in this section AND the taxable income is not from the local governmental entity?

☐

Yes

☐

No

C. Is the filer of this questionnaire affiliated with a corporation or other business entity that the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?

☐

Yes

☐

No

D. Describe each affiliation or business relationship.

**6** Describe any other affiliation or business relationship that might cause a conflict of interest.

**7**

\_\_\_\_\_  
Signature of person doing business with the governmental entity

\_\_\_\_\_  
Date

Adopted 01/13/2006

**ATTACHMENT “D-1”**

**HARRIS COUNTY BOND/PERMIT DOCUMENTS**

**SAMPLE PERMIT DOCUMENTS**

**ORIGINALS TO BE OBTAINED BY CONTRACTOR  
FROM ISSUING AGENCY**



**HARRIS COUNTY**

**PUBLIC INFRASTRUCTURE DEPARTMENT  
ENGINEERING DIVISION**

9900 Northwest Frwy.  
Suite 103  
Houston, Texas 77092  
(713) 956-3000

**NOTICE TO CONSTRUCT FACILITIES  
WITHIN HARRIS COUNTY RIGHT-OF-WAY**

**PLEASE SUBMIT THE FOLLOWING:**

1. One (1) copy of the completed application in the name of the owner of the proposed pipeline, utility line or other construction activity. Please be sure all forms are signed.
2. Three (3) sets of the engineering drawings that include proposed construction plans, profiles, cross-section details, and elevations. Traffic control plans shall be submitted for turn lanes and other construction activity requiring a lane closure.
3. For all unauthorized users a Surety Bond (use the attached form) should be filled out in accordance with the State Insurance Board's guidelines in the applicable amount of: \$5,000.00 per road crossing and \$5,000.00 per parallel installation (\$8.00 per lineal foot if over 625 feet in length). Bond Amounts for other construction activity (median cuts, turn lanes, work in the esplanade) are 75% of construction cost or as established by the Precinct Engineer. Please include the following: a bond number, the officer's name, address and phone number. If the officer is from out of state a countersignature by an agent in the State of Texas is necessary. Please include name, company name, address and phone number of the agent for verification. Please be sure all required signature are on the bond
4. Entities who do not have the statutory right to use County roads and are referred to as "unauthorized users". In this instance any main or pipeline crossing a County road is charged a fee of \$150.00 per crossing while each parallel installation in the right-of-way is assessed a fee of \$1.00 per linear foot. Median cuts, turn lanes and manholes are assessed a fee of \$150.00 each.
5. Approval from the Harris County Flood Control District must be shown on the drawings if proposed construction involves an encroachment or crossing of a Harris County Flood Control ditch. Obtain approval before submittal to the Engineering Division.
6. Approval from the Harris County Engineer must be shown on all drawings for the proposed construction of public utility lines (water, sewer, storm sewer and force mains) and other construction activity (turn lanes, median cuts) including Traffic Control plans. Permits and plans must be onsite at all times.

**SHOULD YOU HAVE ANY QUESTIONS, PLEASE CALL (713) 956-3000**

BOND COVERING CONSTRUCTION OF FACILITIES WITHIN HARRIS COUNTY  
AND HARRIS COUNTY FLOOD CONTROL DISTRICT RIGHTS-OF-WAY

STATE OF TEXAS §  
§  
§  
§  
COUNTY OF HARRIS §

BOND NO. \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS:

That \_\_\_\_\_, as principal,  
and, \_\_\_\_\_

\_\_\_\_\_, as surety, a corporation existing under  
and by virtue of the laws of the State of \_\_\_\_\_, and authorized to  
do an indemnifying business in the State of Texas, and whose principal office is located in the  
City of \_\_\_\_\_, State of \_\_\_\_\_, whose  
officer, residing in the State of Texas, authorized to accept service in all suits and action  
brought within said State, is

(Officer's Name): \_\_\_\_\_

(ADDRESS): \_\_\_\_\_

\_\_\_\_\_, hereinafter  
called "Surety", are held and firmly bound unto HARRIS COUNTY, a body corporate and  
politic under the laws of the State of Texas, hereinafter called "County", in the full sum of

\_\_\_\_\_ Dollars (\$ \_\_\_\_\_), lawful currency of the  
United States of America, for the payment of which the said Principal and Surety bind  
themselves, their successors and assigns, jointly, and severally, firmly by these presents:

WHEREAS, the principal plans to lay, construct, maintain and/or repair facilities in,  
under, across, along one or more roads, streets, highways, drainage or flood control features in  
the County of Harris, and the State of Texas, under the jurisdiction of the Commissioners'  
Court of Harris County, Texas pursuant to the Commissioners' Court order adopted on the  
26th day of October, 2004, recorded in Volume No. 228, at Page 118. of the Commissioners'  
Court Minutes of Harris County, Texas, regulating same, which Commissioners' Court order  
is hereby referred to and made a part hereof for all purposes as though fully set out herein;  
and

WHEREAS, the principal has prepared, or caused to be prepared, the attached Request  
for Construction in The Harris County and/or Harris County Flood Control District Right-of-  
Way and accompanying plans, specifications and other documents.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the principal shall faithfully perform the activity described in the above mentioned Request for Construction in The Harris County and/or Harris County Flood Control District Right-of-Way and accompanying plans, specifications and other documents, pursuant, to the minimum requirements and conditions of the above mentioned Commissioners' Court order regulating same, and do and perform each and every, all and singular, the matters and things in said Commissioners' Court order set forth and specified to be by said principal and done and performed, at the time and in the manner therein specified, and shall pay over and make good and reimburse the County, all loss and damages which the County may sustain by reason of any failure or default on the part of said principal, then this obligation shall be null and void; otherwise to remain in full force and effect..

This bond is payable at the County Courthouse in Harris County.

The term of this bond is for a period of two (2) years commencing on the date hereof, and may be continued from year to year by continuation certificate executed by the principal and the surety

EXECUTED this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
Surety

\_\_\_\_\_  
Principal

By \_\_\_\_\_  
Attorney-in-Fact

By \_\_\_\_\_  
Officer Authorized to Execute

\_\_\_\_\_  
Title

Surety's Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Principal's Address: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone: (\_\_\_\_\_) - \_\_\_\_\_

Telephone: (\_\_\_\_\_) \_\_\_\_\_



LETTER OF NO OBJECTION

Expires: September 29, 2020

**REVISED**

April 29, 2020

Keelen Greenwade  
Dannenbaum Engineering Corp.  
3100 W. Alabama  
Houston, TX 77098

**RE: REQUEST FOR ENCROACHMENT ACROSS THE JENKINS JUNCTION TO WRIGHT ROAD  
JUNCTION PIPELINE**  
(TEPPCO SOUTH TEXAS CRUDE LINES; LID #C59; TRACT #COPELAND RD; DB #9972)  
**LETTER OF NO OBJECTION – HARRIS COUNTY, TEXAS**

Dear Mr. Greenwade:

This letter is to memorialize our understanding regarding your request on behalf of North Harris County Regional Water Authority ("NHCWA") regarding NHCWA'S proposed construction of one (1) sixty inch (60") water line as per plans and/or specifications from Dannenbaum Engineering Corporation received on August 22, 2018, a copy of which are attached hereto as Exhibit A (collectively referred to as the "ENCROACHMENT") crossing the Jenkins Junction to Wright Road Junction pipeline (the "PIPELINE") of Enterprise Crude Pipeline LLC ("COMPANY") located within the right-of-way/easement as depicted on the GIS map attached hereto as Exhibit B, (the "EASEMENT"). **Please be advised this letter supersedes and amends the Letter of No Objection dated April 30, 2019.**

COMPANY is committed to protecting the environment and the health and safety of our employees, contractors, customers and the public by conducting its business in a safe and environmentally responsible manner. Activity that may disturb the PIPELINE, its appurtenant assets or its support structure can pose a threat to the environment, persons and public safety. Consequently, we request that NHCWA adhere to this same commitment to the environment and safety when undertaking construction of the ENCROACHMENT in and around the EASEMENT. At this time, COMPANY will not make an objection to the proposed ENCROACHMENT, conditioned upon NHCWA'S understanding of the following:

1. The following language must be conspicuously displayed on all drawings depicting the pipeline:

**WARNING! PIPELINE**  
Use Caution When Excavation

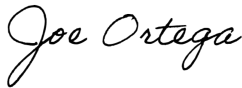
2. COMPANY recommends physical verification of pipeline location prior to commencement of any work by coordinating with Tommy Lindsey at 281-533-9036.
3. NHCWA may place excavated material inside COMPANY'S rights-of-way. COMPANY requires hand excavation to be performed within eighteen-inches (18") plus half the diameter of COMPANY'S pipeline; however, at no point should mechanical excavation be performed less than two feet (2') from COMPANY'S pipeline. All mechanical digging equipment must have the teeth removed or barred with a plate welded across the teeth.
4. NHCWA will not place large landscaping, including, but not limited to, trees and large shrubs with a mature untrimmed height greater than eighteen inches (18") on COMPANY'S rights-of-way. No

light or utility poles, fences, buildings, houses, barns, garages, patios, swimming pools, reinforced concrete slabs or other permanent structures unless herein approved will be permitted on COMPANY'S rights-of-way.

5. NHCWA agrees to clean up and repair all damages to COMPANY'S rights-of-way resulting from the work on or across COMPANY'S rights-of-way. Any and all damage repairs and cleanup of COMPANY'S rights-of-way will be subject to COMPANY'S acceptance.
6. The existence of the Encroachment does not constitute a waiver of COMPANY'S express rights under the COMPANY'S grant of easement or any other rights which may be implied by law or equity.

If you believe anything set forth in this letter misstates our understanding or if you require more information or clarification of any matters set forth herein, please contact the undersigned at your soonest convenience. The undersigned can be reached at (281) 887-3373 or contacted via e-mail at [jaortega@eprod.com](mailto:jaortega@eprod.com).

Regards,

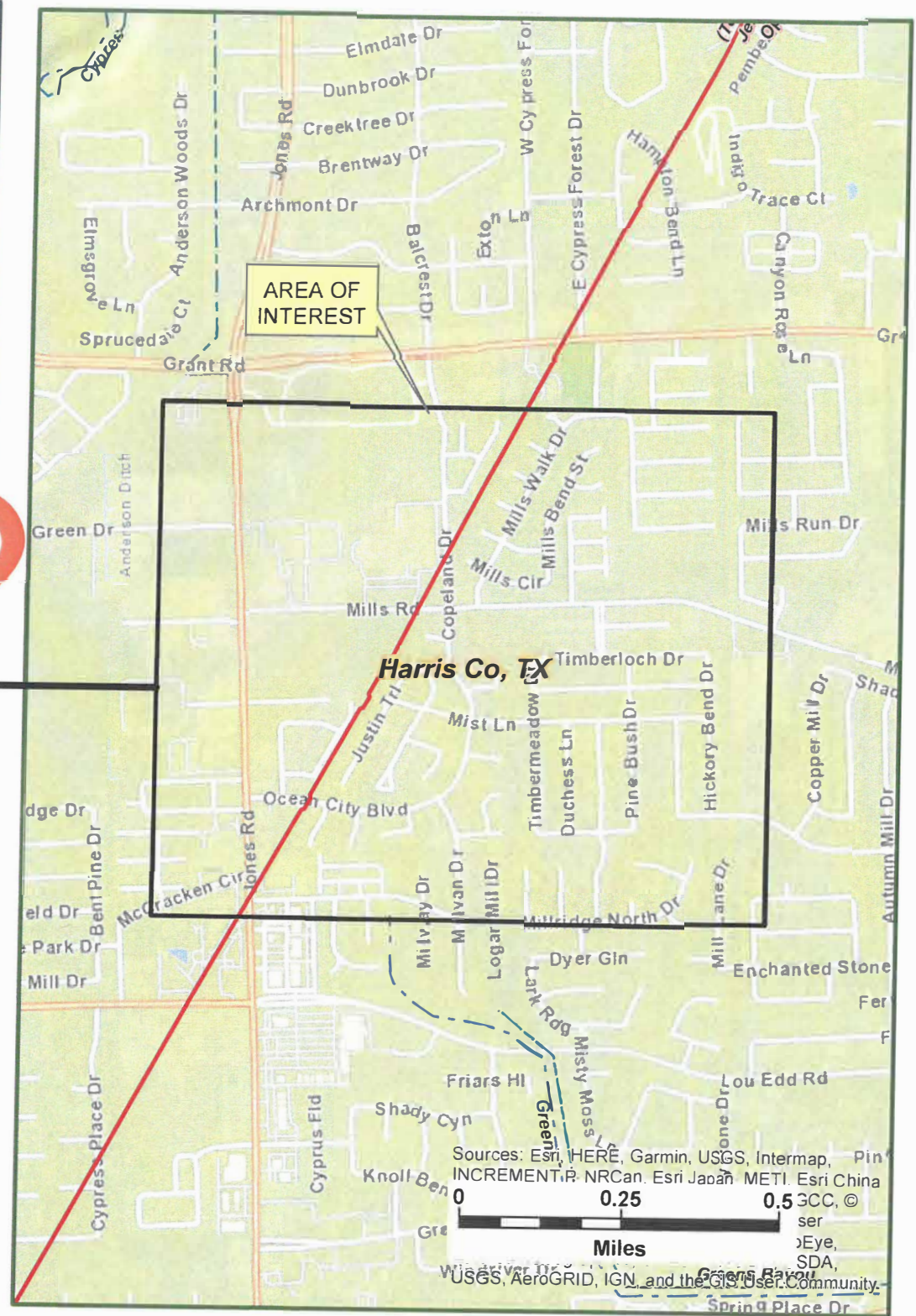
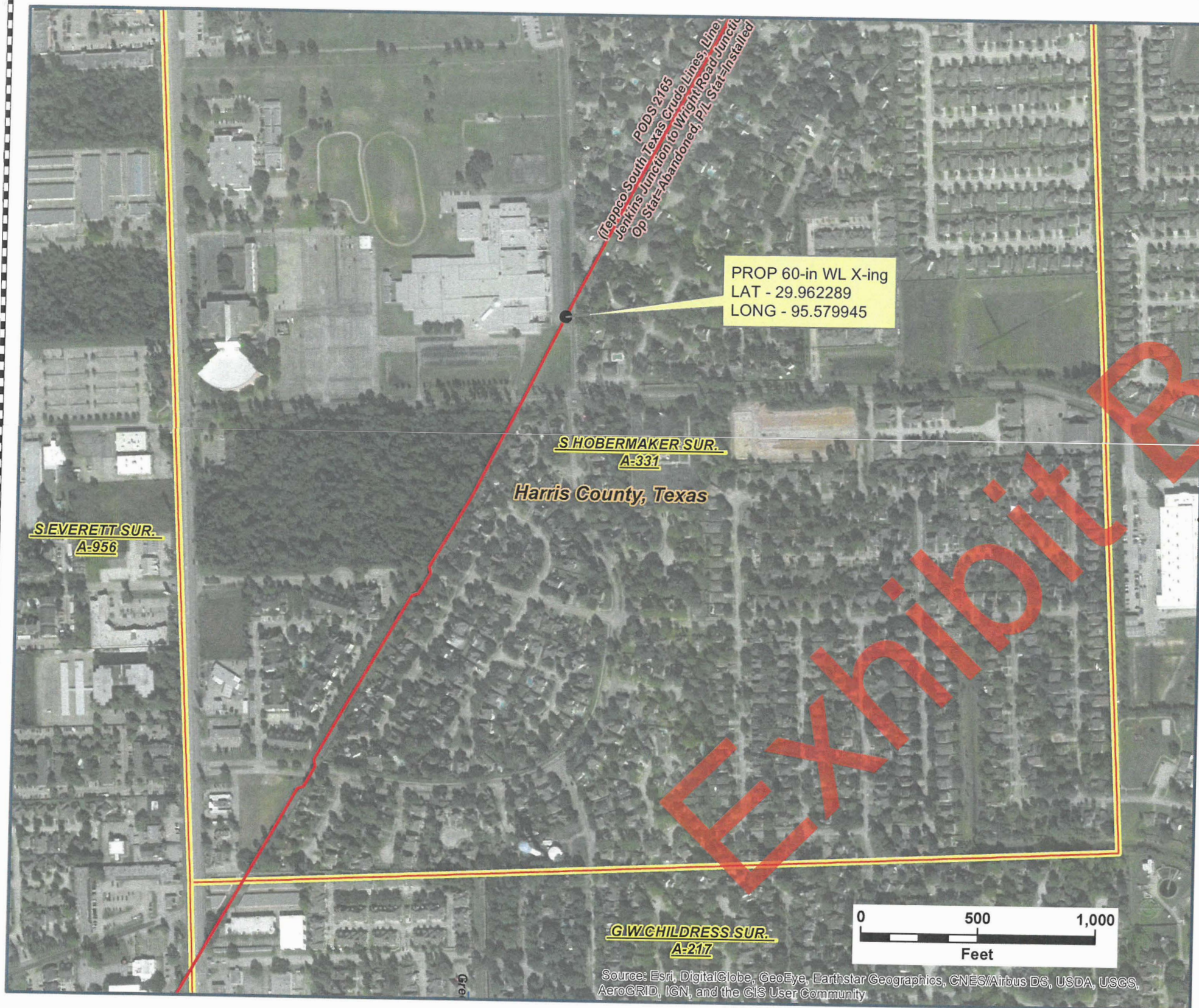


Joseph Ortega  
Land Representative - Encroachments

cc: Mike Brown  
Jonathan Rodriguez  
Ed Sangel  
Tommy Lindsey







This GIS Map has been created from Enterprise Products Operating LLC's proprietary GIS data. Neither Enterprise Products Operating LLC, nor any entity associated therewith, guarantees the accuracy of the data, or assumes any responsibility or liability for any reliance thereon. Revised 09/07/18 (mw).

Coordinates shown hereon may not represent precise locations. They should be used for general locational purposes only.



Attachment E-1  
00800 - E-1

**Encroachment(s) DB-9972 (NHCRWA-60-in  
WL X-ing-Copeland Dr.)**



**ExxonMobil Pipeline Company**  
22777 Springwoods Village Pkwy  
EMHC/E3.5A.418  
Spring, Texas 77389  
(832) 625-3147 Telephone

**Christopher Hinson**  
Manager, ROW & Claims



December 10, 2019

**LETTER OF NO OBJECTION**

**RE: Plans to construct a 60 inch Water line under and across EMPCo's TX-167 (4" and 6") pipelines**

**Harris County, TX  
EMPCo ROW XCS-0106**

**Dannenbaum Engineering Corporation  
3100 West Alabama  
Houston, Texas 77098  
Attn: Carl McConnell**

Dear Mr. McConnell:

H-2019.092

As you are aware, ExxonMobil Pipeline Company ("EMPCo") owns and/or operates petroleum, petroleum products and chemicals pipelines that must be protected from external damage and maintained in accordance with EMPCo, State and Federal standards to protect the safety of the public and the environment. In order to do this, EMPCo has developed certain Right-of-Way Restrictions (see attached) that must be complied with by anyone intending to construct facilities on or within our rights-of-way.

EMPCo has reviewed Dannenbaum Engineering Corporation's proposed plans to construct a 60 inch Water line under and across EMPCo's TX-167 (4" and 6") pipelines at the West side of Copeland Dr., approximately 300 feet North of Mills Rd and Copeland intersection; Houston, TX; 29°57'44.00"N, 95°34'47.60"W (the "Project"). EMPCo has determined that the Project as proposed in the plans provided by Dannenbaum Engineering Corporation does not conflict with EMPCo's Right-of-Way Restrictions. Accordingly, EMPCo does not object to the Project as shown on the drawing (Project 28-8, sheet no. 44 of 99). Changes to the Project will require additional review and could result in the withdrawal of EMPCo's consent.

This no objection is subject to the following conditions:

1. Dannenbaum Engineering Corporation's or constructor must make the appropriate One Call notification(s) by calling 811.
2. Dannenbaum Engineering Corporation's or constructor must contact EMPCo's Javier Robles at 281-705-6106 a minimum of 72 hours prior to performing any activity within the easement.

Failure to obtain EMPCo's consent to any proposed change to the Project at least 72 hours prior to implementation of the change shall void this consent.

If there are any questions or if I may provide additional information in this regard, please feel free to contact me at 832-625-7093.

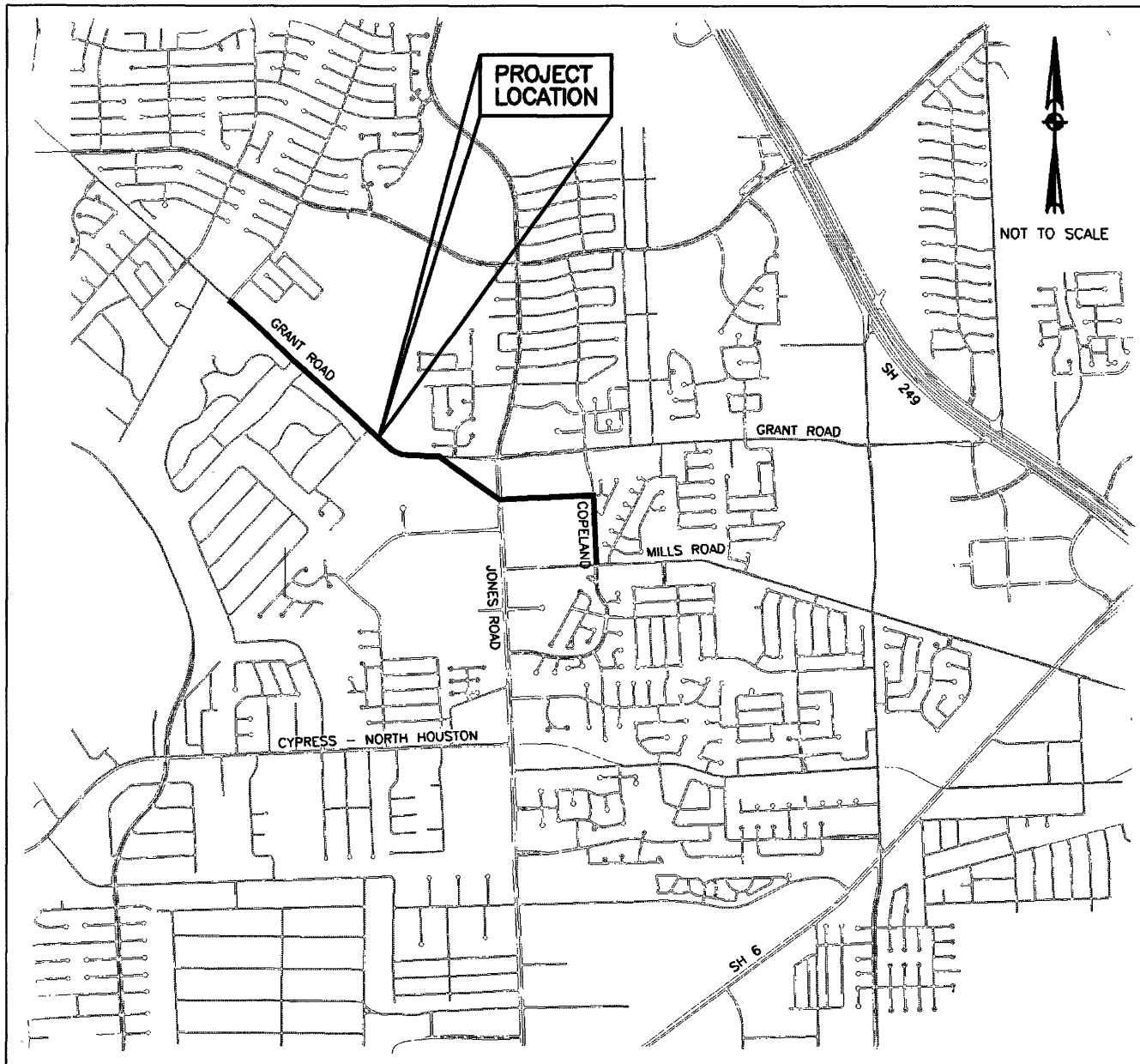
Very truly yours,

A handwritten signature in blue ink, appearing to read "CH", followed by a larger, stylized signature in blue ink that appears to be "Christopher Hinson".

Christopher Hinson

Enclosure



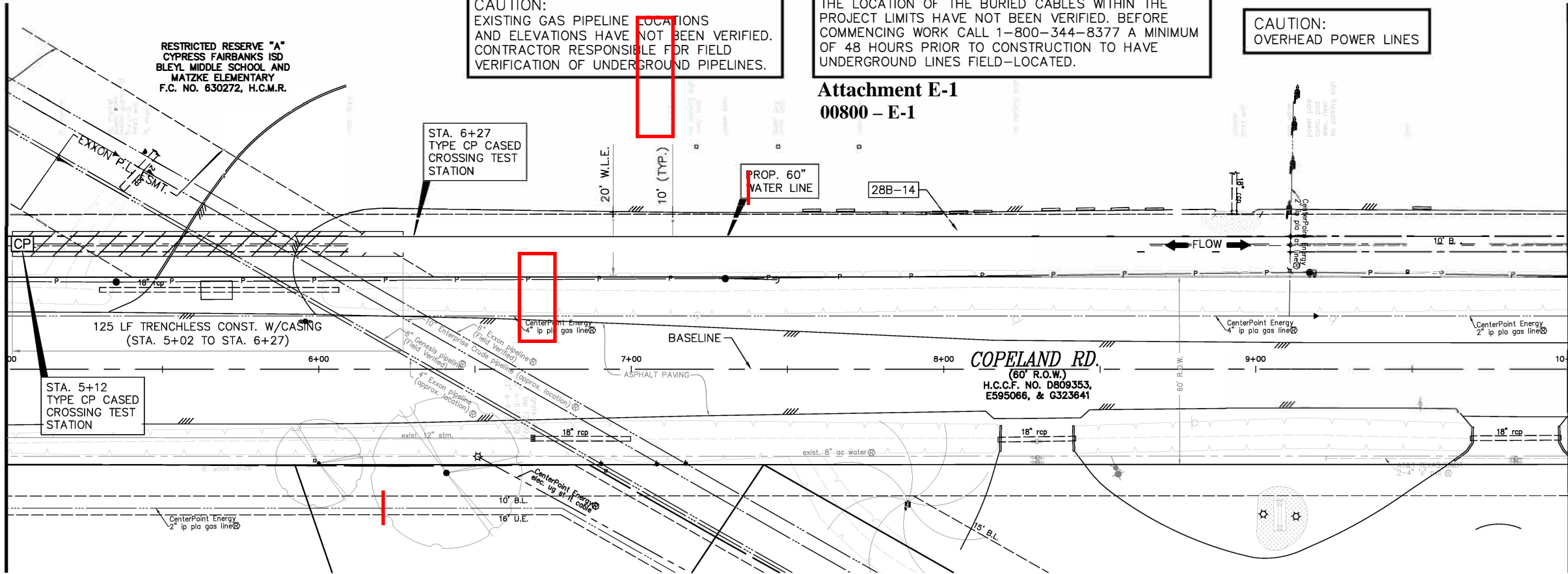


## VICINITY MAP

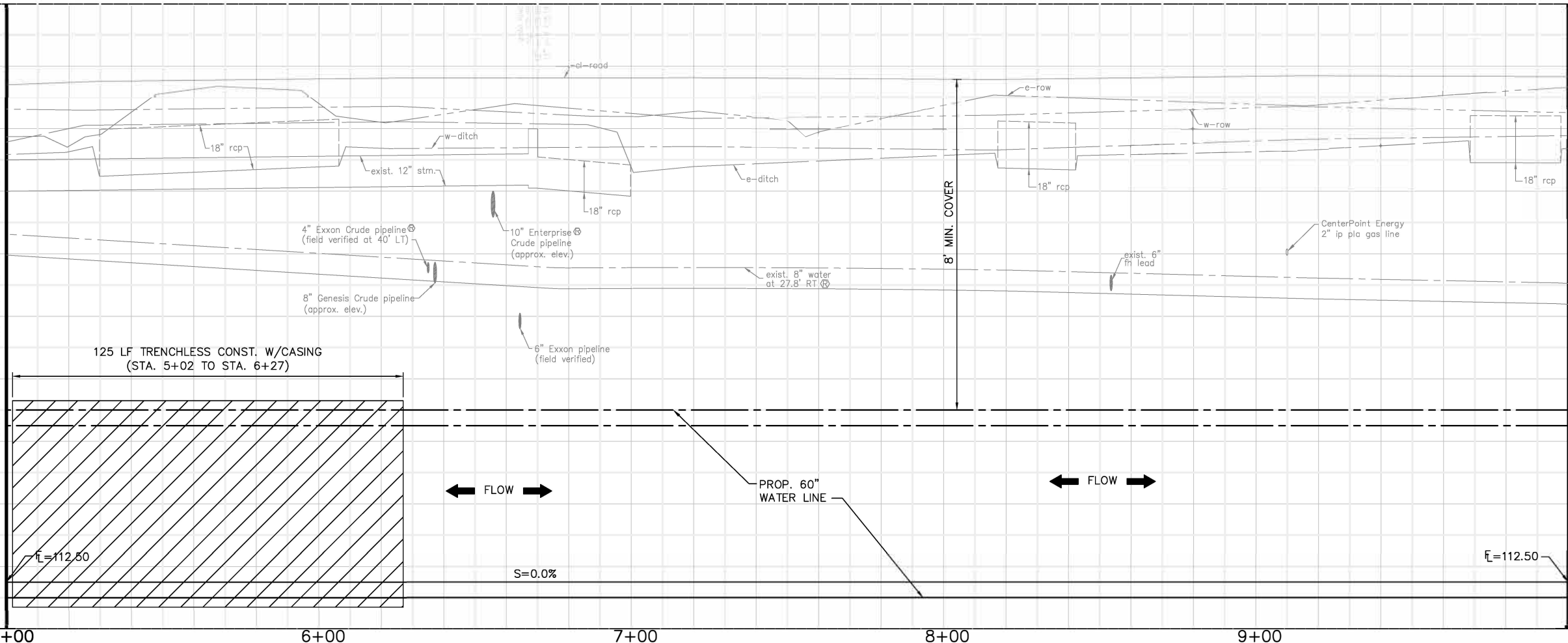
KEY MAP NO 000  
GIMS MAP NO 00000

LAST MODIFIED: Oct 02, 2019 -- 2:20pm BY USER: yimwy  
DWG LOCATION: G:\1110\4876-01 NHCRWA PROJECT 28-B\ACAD\Drawings\Civil\  
DWG NAME: 4876-01\_44.dwg

MATCH LINE STA. 5+00 - SEE SHEET 43



MATCH LINE STA. 5+00



MATCH LINE STA. 10+00 - SEE SHEET 45

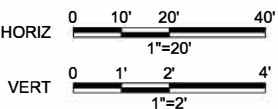
No.	Date	Revisions	App.

**BENCHMARK:**

FLOODPLAIN REFERENCE MARK NUMBER 110125 IS A HCFCD BRASS DISK STAMPED K100 BM10 ON EAST SIDEWALK OF GRANT ROAD BRIDGE OVER CYPRESS CREEK APPROXIMATELY 0.90 MILE WEST OF JONES ROAD IN KEYMAP 369A IN THE CYPRESS WATERSHED NEAR STREAM K100-00-00 ELEV. 127.25 FEET NAVD 1988 2001 ADJUSTMENT

**HORIZONTAL DATUM:**

ALL HORIZONTAL COORDINATES ARE BASED ON TEXAS STATE PLANE COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NAD83. THE COORDINATES & DISTANCES SHOWN ARE SURFACE AND MAY BE CONVERTED TO GRID BY MULTIPLYING BY A SCALE FACTOR OF 0.999870017 (TxDot factor). 100 YR FL=125.00'



NO ARRANGING FOR LINES TO BE TURNED OFF OR MOVED CALL CENTERPOINT ENERGY AT 713-327-2223.

NOTICE: FOR YOUR SAFETY, YOU ARE REQUIRED BY TEXAS LAW TO CALL 811 AT 48 HOURS BEFORE YOU DO SO THAT UNDERGROUND LINES CAN BE MARKED. THIS VERIFICATION DOES NOT FULFILL YOUR OBLIGATION TO CALL 811.

**PRIVATE UTILITY LINES SHOWN**

DATE: CENTERPOINT ENERGY/UNDERGROUND ELECTRICAL FACILITIES VERIFICATION ONLY.

THE SIGNATURE VERIFIES EXISTING UNDERGROUND FACILITIES - NOT TO BE USED FOR CONFLICT WITH DATUM. SIGNATURE VALID FOR SIX MONTHS.

DATE: CENTERPOINT ENERGY/NATURAL GAS FACILITIES VERIFICATION ONLY. THE SIGNATURE VERIFIES THAT YOU HAVE SHOWN OFF NATURAL GAS LINES CORRECTLY - NOT TO BE USED FOR CONFLICT VERIFICATION. (GAS SERVICE LINES ARE NOT SHOWN.) SIGNATURE VALID FOR SIX MONTHS.

DATE: Approved for AT&T Texas/SWBT underground conduit facilities only. SIGNATURE VALID FOR ONE YEAR



AECOM TECHNICAL SERVICES, INC.  
19219 KATY FREEWAY, SUITE 100  
HOUSTON, TEXAS 77094-1009  
281.848.2400  
WWW.AECOM.COM  
TBP REG. NO. F-3580

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
PROJECT 28-B  
PROPOSED 60" AND 54" WATER LINE ALONG GRANT ROAD AND COPELAND ROAD

COPELAND ROAD BASELINE  
PLAN AND PROFILE  
STA. 5+00 TO 10+00



DRAWN BY: CHECKED BY:

**DANNENBAUM**

ENGINEERING CORPORATION  
T.B.P.E. FIRM REGISTRATION #392  
3100 WEST ALABAMA HOUSTON, TEXAS 77098 (713) 520-9570

SHEET  
No. 44 OF 99

10+00

## RIGHT-OF-WAY RESTRICTIONS & REQUIREMENTS

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In a continuing effort to provide a safe environment for persons working on or near pipelines operated by ExxonMobil Pipeline Company (EMPCo), the following restrictions will apply to all work. Deviations from these restrictions will not be allowed without the express written consent of EMPCo. EMPCo operates its pipelines in accordance with the regulations of the U.S. Department of Transportation and other state and local agencies and will enforce any restrictions necessary to protect the pipelines, properties, and safety of the public.

Detailed plans (plan and profile) for proposed construction must be submitted to ExxonMobil Pipeline Company (EMPCo) for review and approval to determine to what extent, if any, the pipeline right-of-way will be affected by the proposed construction or development. See submission addresses below.

These restrictions apply only to EMPCo operated pipelines. Other ExxonMobil affiliates should be contacted to determine requirements for their rights-of-way.

### GENERAL RESTRICTIONS & REQUIREMENTS

1. In accordance with law, constructors must contact the appropriate ONE CALL system(s) prior to work and comply with all applicable laws and regulations.
2. No work may commence in or around EMPCo's right of way until an EMPCo representative has authorized it to begin. Notice of desired work start date should be given to EMPCo a minimum of 72 hours in advance.
3. A Third Party Excavation Safe Work Checklist should be signed each day prior to beginning work on EMPCo's right of way.
4. If it is determined that your project impacts EMPCo's facilities a non-refundable advance fee may be required to conduct preliminary engineering design work. Any work performed by EMPCo to remedy such impacts will be entirely at the requestor's expense, which will first require the full execution of EMPCo's standard Reimbursement Agreement. Any necessary inspection, protection, lowering, adjustment, casing, re-coating, and/or relocation of the pipelines will not be scheduled until: (A) all prerequisite data is compiled; (B) the appropriate agreements are executed; and (C) sufficient funds are received. It is EMPCo's minimum practice to inspect and recondition the pipeline(s) at proposed driveway, roadway or railroad crossings, the costs for which will be borne by the developer or owner.
5. EMPCo's right of way should not be used as temporary workspace (which includes its use for the staging, storage or laydown of equipment, materials or spoil) without proper approval from EMPCo.
6. No encroachments of any kind, including but in no way limited to signs, monuments, buildings, parking lots, structures, patios, decks, slabs, trees, shrubs, manholes, swimming pools, wells, leach beds, septic systems, cesspools, impoundments or large debris (such as cars, boats, trailers, tanks, scrap metal or boulders) shall be located within the pipeline right of way. The intention of this restriction is to maintain an unobstructed right of way.
7. A driveway, roadway, or railroad may be allowed to cross the right-of-way perpendicular, and will require an agreement to be signed by the party responsible for the crossing.
8. Any change in the surface grade or elevation over or along the pipeline(s) and right-of-way must be approved in advance.

9. Blasting activities within 500 feet of an EMPCo pipeline will require an approved blasting plan in advance.
10. Any crossings of EMPCo's pipelines with vehicles or heavy equipment shall be approved by EMPCo and may require ramping, matting or air bridging at requestor's expense. An EMPCo inspector should be present when temporary materials are installed and removed on EMPCo right of way.
11. The constructor shall assume full liability for any damages to EMPCo facilities due to construction /excavation activities. Be advised that our pipelines are cathodically protected and may have an effect on utility lines that are made of electrically conductive material

#### **EXCAVATION/CONSTRUCTION RESTRICTIONS & REQUIREMENTS**

12. No holes are to be bored or excavated within the boundaries of the right of way without prior approval of EMPCo.
13. All heavy equipment will have a spotter with it at all times while working within 10 feet of EMPCo's pipeline or on EMPCo's right of way.
14. The excavator shall install a bar across the teeth of the bucket to be used during excavation.
15. Excavation to initially expose the pipeline shall be parallel with the pipeline.
16. Mechanical excavation will cease once the earth has been removed to within (24") twenty-four inches of EMPCo pipeline, appurtenances and at all valve/stopple sites until exposed.
17. Shovels or other soft digging techniques will be used to manually clean the area above and below the line. After the line has been initially located, the line shall be kept visible to the equipment operator during the excavation process.
18. No excavations shall be made on land adjacent to the pipeline that will in anyway impair or withdraw the lateral support and cause any subsidence or damage to the pipeline.
19. Driving of sheet piling or any other vibration inducing activities in the vicinity of EMPCo Right of Way must be reviewed and approved by EMPCo.
20. All backfill on EMPCo's right of way shall be approved by EMPCo's on-site inspector.
21. If EMPCo's line is exposed during the excavation, the excavation will be made safe for entry and left open until EMPCo installs test leads or performs other visual inspection that may be required.
22. Constructor shall abide by all State & Federal Safety Rules and Regulations and shall operate equipment that is in good working condition and in a manner that is conducive to a safe working environment while working in or around EMPCo's facilities. An ExxonMobil representative has the authority to suspend all excavation/construction activities in and around EMPCo facilities if the equipment operator appears to be unqualified or equipment maintenance is not in accordance with applicable regulations.

## PIPELINE & UTILITY CROSSINGS

23. All pipelines, utility lines and other underground facilities constructed across EMPCo facilities shall cross the pipeline easement at an angle as close to 90 degrees as is possible but not less than 45 degrees, must be installed under the pipelines with a minimum vertical separation of 24 inches between structures, and installed in a manner acceptable to EMPCo's on-site representative. If the installer elects to install its pipelines/utilities across EMPCo's easement by any method of boring, then the installer at the request of EMPCo's representative, shall verify the vertical separation between EMPCo's facilities and the installer's pipelines/utilities. (See Bore Crossings)
24. An approved crossing ABOVE an EMPCo pipeline will need to clear EMPCo's pipeline by 24 inches and require a crossing agreement to be signed by the company responsible for that crossing.
25. When approved by EMPCo, all electrical, fiber optic, and communications cables crossing above an EMPCo pipeline should be cased across the width of EMPCo's right of way and covered with concrete 6" to 8" thick and a minimum width of 6 inches on each side and above the conduit.
26. Permanent aboveground markers identifying the crossing pipeline or utility shall be installed and maintained at the limits of EMPCo's right of way and/or at the crossing.
27. If it is impractical to install and maintain aboveground markers due to the crossing location, plastic marker tape shall be installed below cultivation level and over EMPCo's pipeline, extending the width of the right of way.

## BORE CROSSINGS

28. Bored crossings without a wire guide or with a clearance of 10' or less will require the installation of peepholes on the incoming sides of EMPCo's pipeline, at the point of intersection as to view the drill stem clearance prior to crossing.

## HYDRO-VAC EXCAVATION

29. Hydro-Excavation (Hydro-Vac) may be required in some situations to reduce the risk of damage to a pipeline if so deemed by EMPCo.
30. Grounding of the vacuum truck and wand is required and should be tested; downwind venting of the vacuum truck is required.
31. The water wand tip is to be an oscillation type (circular pattern) to prevent a concentrated water stream; stream nozzles are not allowed. The vacuum wand tip must have a neoprene or equivalent tip to prevent damage to the pipeline coating and surrounding structures.
32. If the excavation site is suspected to contain hydrocarbon-impacted soil, a plan must be developed for testing and disposal of soil/water slurry (e.g., lined roll-off bin.) at requestor's expense.

## FENCE POST/UTILITY POLES

33. Fences may be allowed to cross EMPCo's easement, but will not be allowed along and within EMPCo's easement. Fence posts shall not be placed within 4 feet horizontally of the pipeline(s). Fences should not be installed in manner that would obstruct EMPCo's line of sight or access to EMPCo's facilities. Flag poles, Utility poles and guy wires shall not be placed within EMPCo's right of way or within 8 feet horizontally of EMPCo's pipeline(s).



34. Overhead electrical or telephone lines shall be installed so that a minimum of 20 feet vertical clearance is maintained between the lowest point of the overhead crossing and the natural ground level above EMPCo's pipeline.

**OFFSHORE/OPEN WATER CROSSINGS**

35. EMPCo should be notified of any crossings of EMPCo pipelines located offshore or in open water. Upon notification of a proposed offshore or open water crossing an EMPCo representative will inform you of the crossing requirements.

**NOTIFICATIONS**

All improvement, construction, or encroachment notifications and/or requests for information pertaining to assets operated by ExxonMobil Pipeline Company must be directed, in writing, to the appropriate address noted below:

Requests should include:

1. A brief description of the project or work to be performed
2. Appropriate vicinity map page(s) and coordinates
3. Three (3) copies of pertinent plan and profile drawings
4. Estimated timing of your project or special timing requirements
5. A contact name, company name, mailing address, and telephone number

Once received, your request will be logged, researched and responded to as soon as possible (minimum 45 days). Large requests for information may require substantially more time. Inclusion of all of the above information will help to expedite your request.

**Submission Address by Area**

State	Company	Area	Address
MT	ExxonMobil Pipeline Company	All	ROW & Claims: ENCROACHMENTS 22777 Springwoods Village Parkway E3.5A.552 Spring, TX 77389 Phone (406) 670-3979
AR, IL, MA, MO, RI, TN, IN, MI, MN, OK, CA, TX	Mobil Pipe Line Company ExxonMobil Pipe Line Company	All All	ROW & Claims: ENCROACHMENTS 22777 Springwoods Village Parkway E3.5A.552 Spring, TX 77389 Phone (281) 922-2024
LA	ExxonMobil Pipeline Company	All	ROW& Claims: ENCROACHMENTS 18440 Highland Rd Baton Rouge, LA 70809 Phone (225) 715-9381

FORM, ROWC, XINGRSTRCT 2018-0002



# Genesis Pipeline Texas, L.P.

agenesisenergycompany

January 17, 2020

North Harris County Regional Water Authority  
C/O Mark Breeding (Hunton Andrews Kurth LLP)  
600 Travis St., Houston, TX 77002  
Via electronic mail (markbreeding@akllp.com)

**Re: Project 28B** - Proposed 72 Inch Casing and 60 Inch Waterline installation at Copeland and Mills Road, Houston, TX; Harris County (Crossing of the Conroe to Satsuma Line)

Dear Mr. Jimmie Schindewolf:

We understand from your Encroachment Application attached as Exhibit B ("Application") and previous correspondence that North Harris County Regional Water Authority ("NHCRWA") will be constructing a water line ("NHCRWA Waterline") near the public road crossing at Copeland Road and Mills Road in Harris County (such project referred to by you as Project 28B, herein referenced as the "Project"). The NHCRWA Waterline will cross a 8-inch pipeline owned by Genesis Pipeline Texas, L.P. ("Genesis") as indicated in the Application. NHCRWA has asked for a letter of no objection for the crossing of the Genesis 8-inch pipeline by the NHCRWA Waterline. This letter is to provide "no objection" to the proposed crossing, contingent upon NHCRWA meeting certain requirements.

NHCRWA will be required to do the following:

- Give notice to Genesis of all work at least 48 hours in advance by contacting Jermaine Conyers at (409) 984-1226.
- Follow the attached Genesis General Guidelines for Crossing Genesis Pipelines attached as Exhibit A (the "Guidelines for Crossing Genesis Pipelines").
- The NHCRWA Waterline will only cross the Genesis 8-inch Pipeline such that the total cover from the Genesis Pipeline(s) to the top of the NHCRWA Waterline is at least two feet (2').
- NHCRWA has provided a peep hole for Genesis to confirm separation and will continue to work with Genesis if future peep holes are required.
- NHCRWA shall maintain all insurance required as described in the Application and shall name Genesis as additional insureds and waive subrogation against Genesis.

Genesis has reviewed the NHCRWA Application and proposed plans to construct the NHCRWA Waterline under the Genesis pipeline, and has determined that the Project as proposed in the plans does not conflict with the Guidelines for Crossing Genesis Pipelines. Accordingly, Genesis does not object to the Project as shown in the Application. Changes to the Project will

require additional review and could result in the withdrawal of Genesis' consent. Failure to obtain Genesis' consent to any proposed change to the Project at least 48 hours prior to implementation of the change shall void this consent.

We likewise look forward to our continued mutually beneficial relationship.

Sincerely,

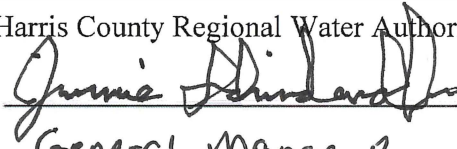


Robert Findley  
Specialist – ROW, Pipelines & Engineering  
281-386-3210

ACCEPTED AND AGREED TO THIS  
27<sup>th</sup> DAY OF JANUARY, 2020.

North Harris County Regional Water Authority

By:



Title:

General Manager

CC: Stan Sarman via electronic mail (stan.sarman@aecom.com)



October 8, 2018

**Dannenbaum Engineering Corporation**

3100 West Alabama Street | Houston, TX 77098  
DIR (713) 527-6356

**Attn: Keelan Greenwade**

**Re: LONO – NHCRWA Project 28-B-Water Line along Copeland and Grant Road (OZ1607010)**

Keelan Greenwade,

Thank You for your submittal, I have reviewed your preliminary project drawing/s (attached), and have no opposition to them. Kinder Morgan has two high pressure natural gas lines (KM NGPL GC#1 & 2, both 30inch lines) crossing your projects' route at Grant Rd., we will not allow any above grade structure to be placed in the ROW (that includes but is not limited to: building, signs, light poles, electrical poles, bollards, etc) unless agreed to in writing. Please see the below summary and attached guidelines for further details about the process.

For projects that include plans for **utility crossings**, road and driveway crossings, parking lots, sidewalks or jogging trails, and other construction activities within 25' of Kinder Morgan high pressure pipelines, you will need to complete an Encroachment Agreement with Kinder Morgan for the construction.

- Kinder Morgan requires that you contact the local operations damage prevention supervisor for scheduling of line depth probing at points of interest. If applicable your drawings shall be revised to reflect pipeline/s depth of cover and/or off-set and submitted for Letter of No Objection (LONO) or Encroachment Agreement.
- Kinder Morgan requires prior notification of the construction by the contractor submitting a state "1-call" and a phone call to area operations personnel to schedule inspectors.
- Utilities crossing the pipeline shall maintain a minimum 2' separation below the Kinder Morgan pipelines, and pavement crossings will generally require a minimum of 4' of ground cover at the crossing.
- Unpaved area with heavy equipment crossing will generally require additional cover or protective mats placed over the pipeline for crossing over the pipeline prior to crossing. Please contact our local area contact for scheduling of pipeline depth validation at points of interest.
- For Parking Lots, there is a \$5,000 fee for the granting of the encroachment to cover the cost of a Kinder Morgan Damage Prevention Inspector during construction of the proposed parking lot. The payment is due when the signed agreement is returned to Kinder Morgan prior to start of construction.

The construction contractor must follow the attached guidelines and notify the appropriate Kinder Morgan operations office and issue a "Texas One Call" phone No. 811 prior to construction to schedule a Kinder Morgan Damage Prevention inspector to be on location when work is being conducted within 25' of the high pressure pipelines. Kinder Morgan inspectors will confirm clearances and we reserve the right to revoke approval and require adjustment at your expense of any construction that does not meet the requirements as outlined above or as set forth in the attached guidelines or OZ1607010

interferes in any way with Kinder Morgan's rights under its easement or as pipeline owner / operator, or compromises the safety of the pipelines operation.

For this area, the Kinder Morgan operations contact is:

Leonard Kluth / 281-886-1803 / [Leonard\\_Kluth@kindermorgan.com](mailto:Leonard_Kluth@kindermorgan.com)

Sincerely,

*Oscar Zapata*

Project Manager

1001 Louisiana Street

Houston, Texas 77002

(713) 420-4654 office

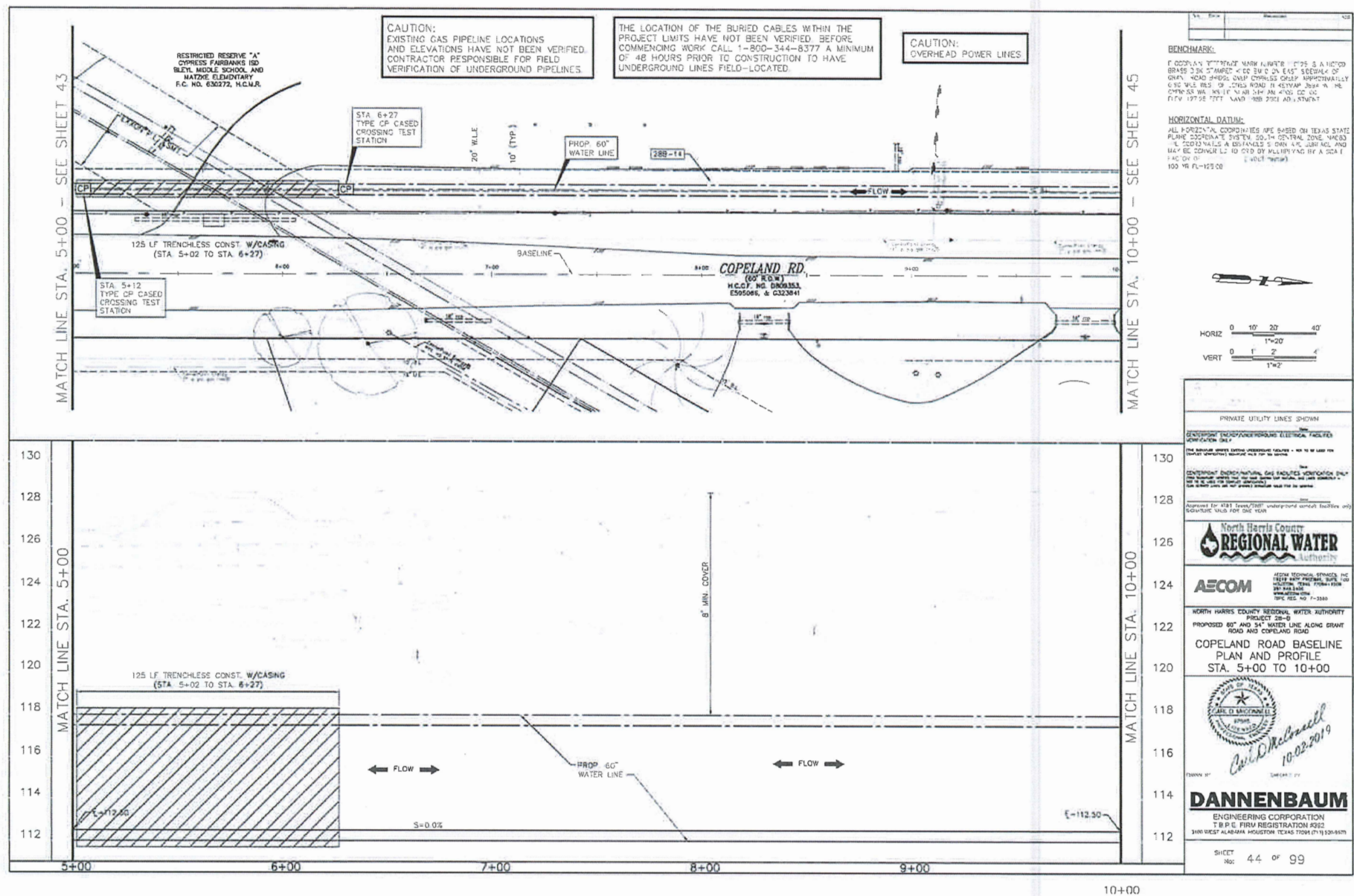
(713) 594-7547 cell

[oscar\\_zapata@kindermorgan.com](mailto:oscar_zapata@kindermorgan.com)

cc.

[Leonard\\_Kluth@kindermorgan.com](mailto:Leonard_Kluth@kindermorgan.com)

[Jim\\_Ephraim@kindermorgan.com](mailto:Jim_Ephraim@kindermorgan.com)



## **GENERAL REQUIREMENTS FOR CROSSING GENESIS PIPELINES (Installation and Modification of Pipelines, Road and Utility Lines)**

A party (herein called "INSTALLER") who proposes to install or modify pipelines, utility lines, phone lines, fiber optic lines, water lines, sewer lines or other underground facilities, roads, streets, driveways, railroads or other above ground facilities, ditches or drainage canals crossing existing pipelines owned or operated by GENESIS Pipeline USA, L.P. or GENESIS Pipeline Texas, L.P. or their affiliates (herein called "GENESIS") shall adhere and abide by the following:

1. INSTALLER shall not commence work in the crossing area without first having obtained GENESIS's written approval of INSTALLER's plan and profile regarding the proposed crossing. Such plans shall include, but not be limited to, any boring or excavation, any proposed addition of fill or removal of ground on the GENESIS right-of-way, and the horizontal placement of, or routing along side of or parallel to, GENESIS pipelines by any apparatus, drains, sewers or any other construction. INSTALLER will adhere to and comply with GENESIS damage prevention, public awareness, excavation and trenching safety and related policies/procedures.
  - a. In all cases, the situation will be evaluated to ensure that adequate provisions are made for corrosion control. If the INSTALLER elects to install its pipelines/utilities within GENESIS' easement by any method of boring, then the INSTALLER shall physically verify the separation between GENESIS' facilities and the INSTALLER'S pipeline/utilities. Where physical verification is not practical, minimum clearance will be four (4) feet horizontally and ten (10) feet vertically.
  - b. Blasting will only be allowed at GENESIS sole discretion. If considered, plans contemplating blasting operations within 500 feet of the GENESIS pipelines shall be submitted to GENESIS for approval at least ten (10) working days prior to commencement of blasting operations. This plan must include hole depth, diameter, spacing, burden, delay times and sequence, explosive type, maximum charge weight per delay, and blast zone location relative to the pipelines. If GENESIS determines the integrity of the pipelines will be jeopardized, then blasting will not be permitted. After blasting is completed pipeline must be leak tested if blasting is allowed. INSTALLER will reimburse GENESIS for leak testing.
  - c. No signs, monuments, building structures, and/or manholes shall be located within the pipeline right-of-way or within 15 feet of the pipeline.
  - d. GENESIS may deem it necessary to back weld any collars located under and in close proximity to any road, street, driveway, drainage canal or ditches, etc. If deemed necessary then Genesis will require reimbursement for the cost of back welding of collars.
  - e. Paved streets, roads, driveways or parking areas crossing over or on GENESIS right-of-way shall be surfaced using asphalt or breakaway concrete.



- f. No trucks or heavy equipment are to cross the GENESIS pipeline right-of-way without approval from GENESIS. If GENESIS determines that the integrity of the GENESIS pipelines may be jeopardized if they are crossed with heavy equipment, a temporary road crossing to protect the pipelines and the equipment will be required. All temporary road crossings will be built to the specifications of GENESIS. Depending upon the soil conditions, depth and character of the pipelines, and the projected stresses induced upon the pipelines from the vehicles which are to cross, GENESIS may require fill or matting material of its choice to be placed over the pipelines. The designs of all temporary road crossings require GENESIS' prior written approval. Should conditions change after construction of the temporary road crossing (e.g. heavier equipment than previously planned for or inclement weather conditions), then the INSTALLER shall not cross the GENESIS pipelines with equipment until the integrity of the GENESIS pipelines can be protected from the change in condition. In the case of collared pipelines, the collars are to be roped/welded prior to the start of any construction activities. Roping/welding of collars will be completed by GENESIS and reimbursed by INSTALLER.
2. At least forty-eight (48) hours prior to commencing any excavating or other construction activity in the vicinity of the pipelines the INSTALLER must telephone the LOCAL ONE CALL SERVICE provider.
3. All construction activity shall conform to all applicable federal, state, county and/or local regulations. However, the regulations will not constitute the maximum requirements for the INSTALLER. The maximum requirements will be determined at the sole discretion on GENESIS.
4. **No excavating or other construction activity shall be conducted in the immediate vicinity of the pipelines in the absence of a GENESIS representative. The INSTALLER will assume full liability for any damages to GENESIS due to construction/excavation activities. GENESIS is not aware of any spills that have occurred at the location for which the INSTALLER is requesting approval or in the vicinity thereof, but accordingly, if in the event during INSTALLER'S construction any contaminated soil of any nature needs to be removed and disposed of it shall be removed and disposed of at the sole risk and expense of the INSTALLER and according to GENESIS' requirements and specifications.**
5. If GENESIS deems it necessary to lower, encase, rope/weld collars on, or otherwise adjust the pipelines because of the INSTALLER'S construction activity, the INSTALLER shall reimburse GENESIS for the cost of such lowering, encasement, roping collars, or other adjustment.
6. Minimum Clearance/Separation/Cover
  - a. All pipelines, utility lines and other underground facilities (except electrical power cables and telecommunications cables) constructed such that they cross GENESIS pipelines must be installed under the GENESIS pipelines with a vertical separation of twenty four (24) inches of clearance between the outside of the GENESIS pipe and the extremity of any other underground structure.

- b. All electrical power cables and telecommunications cables shall be installed with a minimum vertical separation of twenty four (24) inches between structures and in a manner acceptable to GENESIS' on-site representative. In addition, the electrical power cables must be enclosed in conduit (steel or PVC) and marked with the burial warning tape a minimum of six (6) inches on each side and above the conduit. The conduit and warning tape must extend a minimum of twenty-five (25) feet on either side of the centerline of the pipelines. Communications cables must be enclosed in conduit (steel or PVC) and marked with the burial warning tape a minimum of six (6) inches on each side and above the conduit. The conduit and warning tape must extend a minimum of twenty-five (25) feet either side of the centerline of the pipelines.
- c. Any overhead power or communication lines must maintain at least 15 foot of clearance between the lowest point on the conductor or cable and the top of the ground along the easement and right-of-way. Power or communication structures will not be allowed in the easement and right-of-way. No overhead power or communications lines will be allowed that interfere with the operations and maintenance of the Genesis pipeline or easement. Any overhead power or communications lines may be required to relocate if Genesis deems necessary for the location or placement of Genesis' above ground facilities.
- d. Any road, street, or driveway shall be constructed with a minimum cover, as measured from the top of the pipelines to the top of the surface of the road, street, or driveway as shown below:

LOCATION

MINIMUM COVER

- |  |  |
|--|--|
| (1) Under road or street                             | Forty-eight (48) inches measured from top of shallowest pipeline to top of crown in pavement but no less than twenty four (24) inches below bottom of sub-grade. |
| (2) Under driveway on residential lot                | Thirty-six (36) inches below crown but no less than twenty four (24) inches below bottom of sub-grade  |
| (3) Under all other surfaces within the right-of-way | Thirty-six (36) inches   |

- e. Any ditches, drainage canals, etc., shall be constructed with a minimum cover, as measured from the lowest point in ditch, canal, etc., to the top of the pipe, as shown below:

LOCATION

MINIMUM COVER

- |   |
|---|
| (1) Under lowest surface of road ditches: |
|---|

a)	Unlined	Thirty-six (36) inches
b)	Concrete/asphalt lined	Twelve (12) inches
(2)	Drainage canals and ditches	Sixty (60) inches

7. No excavations or fill activities shall be made on land adjacent to the pipelines which will in any way alter right-of-way drainage patterns, impair or withdraw the lateral support, or which will cause any subsidence or damage to the pipelines.
8. If GENESIS deems it necessary, the INSTALLER shall remove teeth from the bucket of excavation equipment and/or a bar shall be installed across the teeth of the bucket during excavation in the vicinity of the pipelines. GENESIS' designated representative shall have the authority to reject the use of equipment to excavate if, in their opinion, the equipment is unsuitable to perform the excavation in a safe and prudent manner.
9. All written correspondence is to be sent to:

**Genesis Energy, L.P.  
Attn: Robert Findley  
919 Milam, Suite 2100  
Houston, TX 77002**

GENESIS appreciates the opportunity to work with INSTALLERS in the early stages of development activity to minimize any conflict, which may arise, and to protect the integrity of our pipelines.



# Exhibit B

## Encroachment Application

Date: <u>7/23/2019</u>	Project Name: <u>NHCRWA Project 28B</u>
Contractor Name: <u>North Harris County Regional Water Authority</u>	Genesis System Location: <u>Copeland and Grant</u>
Contact Person: <u>Carl D. McConnell, PE, PMP</u>	Owner Name: <u>North Harris County Regional Water Authority</u>
Contact Phone No.: <u>713-527-6384</u>	Contact Person: <u>Carl D. McConnell, PE, PMP</u>
Address: <u>3100 West Alabama Houston, Texas 77098</u>	Contact Phone No.: <u>713-527-6384</u>
	Address: <u>3100 West Alabama Houston, Texas 77098</u>

Type of Encroachment: Proposed 60" and 54" Water Line

Location of Proposed Encroachment: Copeland Drive, Houston, Texas Harris County  
(must include street, city, state and county)

Final Project Plans Attached: See Attached Drawing. Requesting permission to cross easement.

Project Plans, including a plan and profile view of the Project with respect to the pipeline, are required. Project Plans should comply with the Genesis Crossing/Encroachment specifications in order to avoid delays in the review process.

Send Project Plans to:

Robert Findley  
919 Milam Street, Suite 2100  
Houston, TX 77002

Payment of non-refundable fee of \$3,500.00 must be made to the order and attention as provided below:

<p><b>For pipelines located in Texas:</b>  <b>Genesis Pipeline Texas, L.P.</b>  <b>Attn: Robert Sou</b>  <b>919 Milam, Suite 2100</b>  <b>Houston, TX 77002</b></p>	
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It is understood that this payment is non-refundable and that Genesis will provide documentation of expenses only to the extent that they exceed \$3,500.00. It is further understood that we will be liable to Genesis for reimbursement of actual costs related to their evaluation of the impacts of this project.


It is understood that review of this project does not mean the project will be approved. The final approval of the project will be the execution of Genesis' Encroachment Agreement, Reimbursement Agreement or other pertinent Agreement. Also, Genesis will require contractor and/or owner to carry for the benefit of Genesis insurance to cover encroachment activities on the easement as follows:


- ◆ Comprehensive General Liability in the amount of **\$1,000,000.00** combined single limit for bodily injury and Property Damage for occurrence/aggregates, and with excess liability in the amount of **\$4,000,000.00**: (1) Manufacturer's and Contractor's Liability; (2) Contractual Liability; (3) Products Liability/Completed Operations; (4) Owners and Contractors' Protective Liability—Independent Contractors; (4) Personal Injury Liability.
- ◆ Automobile Public Liability and Property Damage with limits of liability in the amount of **\$1,000,000.00** for each accident and bodily injury sustained by any person or persons and property damage.
- ◆ Workman's Compensation Insurance in compliance with statutory liability under the Workman's Compensation laws in those states wherein operations are conducted, including common law liability as a result of injuries to employees who are not embraced within the scope of the Workmen's compensation Act.

NOTE: Genesis, at Genesis' sole discretion, reserves the right to require higher rates of coverage depending on the location of the encroachment, such as, but not limited to, highly populated areas, environmentally sensitive areas.

**Contractor:**

**Owner:**

SIGNATURE:   
NAME: Carl D. McConnell, PE, PMP  
TITLE: Deputy Manager – Public Works Division  
DATE: 7/23/2019

SIGNATURE:   
NAME: Carl D. McConnell, PE, PMP  
TITLE: Deputy Manager – Public Works Division  
DATE: 7/23/2019

Printed copy may not be most current version.



## DANNENBAUM ENGINEERING CORPORATION

314359

OUR REF. NUMBER	YOUR INVOICE NUMBER	INVOICE DATE	INVOICE AMOUNT	INVOICE PAID		NET CHECK AMOUNT
130860	ENCROACHMENT	7/18/2019	3,500.00	3,500.00	0.00	3,500.00

## DANNENBAUM ENGINEERING CORPORATION

P.O. BOX 22292 HOUSTON, TEXAS 77227

COMPASS BANK  
HOUSTON, TEXAS35-1054  
1130

712 314359

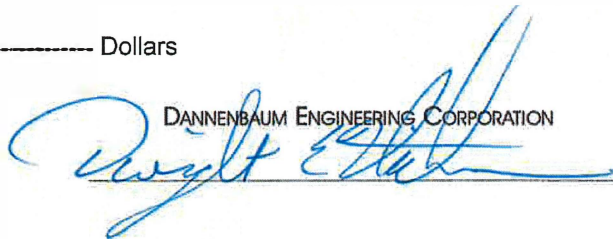
CHECK DATE	CONTROL NUMBER	CHECK AMOUNT
7/18/2019	314359	\$*****3.500.00

PAY Three Thousand Five Hundred and 00/100----- Dollars

TO THE  
ORDER  
OF

GENESIS PIPELINE TEXAS LP

DANNENBAUM ENGINEERING CORPORATION



AUTHORIZED SIGNATURE

⑈ 3 1 4 3 5 9 ⑈ ⑆ 1 1 3 0 1 0 5 4 7 ⑆ 0 0 0 5 0 9 7 3 3 2 ⑈

DANNENBAUM ENGINEERING CORP.

314359

GEN2590		GENESIS PIPELINE TEXAS LP		Check Date	7/18/2019	Check Number	314359
Ref Nbr	Inv Nbr	Inv Date	Invoice Amount	Amount Paid	Disc Taken	Net Check Amt	
130860	ENCROACHMENT	7/18/2019	3500.00	3500.00	0.00	3500.00	

Section 01110

**SUMMARY OF WORK**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes the summary of the Work including Work covered by Contract Documents, by the Owner, Owner-furnished products, Work sequence, future Work, Contractor use of Premises and any specific notifications to the Contractor unique to this Project.

**A. Work Covered by Contract Documents**

Work of the contract is for the construction of a 60-Inch and 54-Inch waterline along Grant Road and Copeland Road using open cut and trenchless construction. The work includes connection to project 28A at Grant Road and Lakewood Drive and passes along Grant Road crossing below Cypress Creek. Before reaching Jones Road the 54-Inch waterline diverges from Grant Road to cross perpendicularly below HCFCD Unit K143-00-00 and Kinder Morgan pipelines where it connects to project 28E and realigns itself behind a shopping center to then cross Jones Road perpendicularly and into the CFISD property. The proposed waterline continues through the CFISD property until it transitions from 54-Inch to 60-Inch pipe, connects with project 28F and turns southward along Copeland Road crossing below Enterprise, Exxon and Genesis gas lines. The waterline terminates by connecting to project 28C at the Northwest corner of Copeland and Mills Road.

**1. Special Instructions to the Contractor**

- a. Prior to construction within a 100-year floodplain, a floodplain permit, must be obtained from the local Floodplain Administrator (National Flood Insurance Program).
- b. As per agreement with the Texas Parks and Wildlife Department (TPWD Project No. 38280) and to ensure compliance with the Migratory Bird Treaty Act, clearing will be conducted outside the migratory bird nesting season where possible. If clearing must be performed during nesting season (March 15<sup>th</sup> – September 15<sup>th</sup>), nest surveys will be conducted prior to clearing, and a 25-foot buffer zone will be established around any observed active nests until the young have fledged.
- c. The OWNER will comply with the terms and conditions of the U.S. Army Corps of Engineers' Nationwide Permit 12, Utility Line Activities during construction of the proposed pipelines. The project is designed such that construction activities should not result in the loss of greater than 0.5 acre of jurisdictional waters of the United States, including

wetlands, for each single and complete project. Side-casted earthen material generated from trench excavation is not anticipated to disperse from the project site. Exposed areas resulting from construction activities will be stabilized as soon as practicable, and surface contours will be returned to pre-construction conditions as near as possible. Should one or more of the criteria described in the "Notification" section of Nationwide Permit 12 be anticipated, the OWNER will prepare and submit a pre-construction notification to the U.S. Army Corps of Engineers and await permit authorization prior to initiating project construction activities.

- d. The OWNER has previously coordinated with the appropriate agencies and impacts to known cultural or archeological deposits have been avoided or mitigated. However, the CONTRACTOR may encounter unanticipated cultural or archeological deposits during construction. If archeological sites or historic structures which may qualify for designation as a State Archeological Landmark according to the criteria in 13 TAC Chapter 26, or that may be eligible for listing on the National Register of Historic Places in accordance with 36 CFR Part 800, are discovered after construction operations are begun, the CONTRACTOR shall immediately cease operations in that particular area and notify the OWNER, the TWDB, and the Texas Historical Commission, 1511 N. Colorado St. , P. O. Box 12276, Capitol Station, Austin, Texas 78711-2276. The CONTRACTOR shall take reasonable steps to protect and preserve the discoveries until they have been inspected by the OWNER's representative and the TWDB. The OWNER will promptly coordinate with the State Historic Preservation Officer and any other appropriate agencies to obtain any necessary approvals or permits to enable the work to continue. The CONTRACTOR shall not resume work in the area of the discovery until authorized to do so by the OWNER.
- e. No activity is authorized that is likely to jeopardize the continued existence of a threatened or endangered species as listed or proposed for listing under the Federal Endangered Species Act (ESA), and/or the State of Texas Parks and Wildlife Code on Endangered Species, or to destroy or adversely modify the habitat of such species. If a threatened or endangered species is encountered during construction, the CONTRACTOR shall immediately cease work in the area of the encounter and notify the OWNER, who will immediately implement actions in accordance with the ESA and applicable State statutes. These actions shall include reporting the encounter to the TWDB, the U.S. Fish and Wildlife Service, and the Texas Parks and Wildlife Department, obtaining any necessary approvals or permits to enable the work to continue, or implement other mitigation actions. The

CONTRACTOR shall not resume construction in the area of the encounter until authorized to do so by the OWNER.

1.02 MEASUREMENT AND PAYMENT

A. Cash Allowances

Include the following specific Cash Allowances in the Contract Price:

Harris County Permits reimbursed on an actual cost basis.

Approved Construction Modifications, reimbursed in Accordance with Article 10 of Section 0700.

1.03 – 1.04 NOT USED

1.05 RELATED REQUIREMENTS

A. Document 00700 – “General Conditions”

B. Section 01145 – “Use of Premises”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

A. Owner Furnished Products

Items furnished by Owner for installation by Contractor: “North Harris County Regional Water Authority” logo for Project Sign(s), PVC pipeline markers and stickers.

B. Contractor’s Responsibilities

1. Arrange and pay for product delivery to site.
2. Receive and unload products at site; jointly with Project Manager, inspect for completeness or damage.
3. Handle, store, install, and finish products.
4. Repair or replace damaged items.
5. Complete connection to projects 28-A, 28-C, 28-E and 28-F.

6. Crossing existing utilities and pipelines.
7. Furnish and provided temporary field offices.

C. Contractor's Use of Premises

1. Comply with procedures for access to the site and Contractor's use of rights-of-way as specified in Section 01145 – "Use of Premises".
2. Construction Operations: Limited to the Owner's easements provided the Owner.
3. Acquisition of the following parcel(s) may be delayed and is/are expected to be acquired by the date shown. The Contractor must prepare his construction schedule accordingly:
4. Utility Outages and Shutdown: Provide notification to the Project Manager 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.

1.08 – 1.10 NOT USED

1.11 SEQUENCING (NOT USED)

1.12 SCHEDULING (NOT USED)

1.13 WARRANTY

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01145

USE OF PREMISES

PART 1 GENERAL

1.01 SUMMARY

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

1.02 MEASUREMENT AND PAYMENT

No payment will be made for this item. Include cost of work activities specified in this section in overhead cost of this project.

1.03 REFERENCES

Texas Department of Transportation – “Texas Manual on Uniform Traffic Control Devices (TMUTCD)”.

1.04 SUBMITTALS (NOT USED)

1.05 RELATED REQUIREMENTS

- A. Document 00700 – “General Conditions”
- B. Section 01110 – “Summary of Work”
- C. Section 01504 – “Temporary Facilities and Controls”
- D. Section 01555 – “Traffic Control and Regulation”
- E. Section 02317 – “Excavation and Backfill for Utilities”
- F. Section 02911 – “Topsoil”
- G. Section 02922 – “Sodding”
- H. Section 02951 – “Pavement Repair and Resurfacing”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

A. Properties Within Rights-of-Way

1. Confine access, operations, and storage areas to rights-of-way provided by the Owner as stipulated in Document 00700 – “General Conditions”; trespassing on abutting lands or other lands in the area is not allowed.
2. Make arrangements, at no cost to the Owner, for temporary use of private properties. Contractor and Contractor’s surety shall indemnify and hold harmless the Owner and Project Manager against claims or demands arising from use of properties outside rights-of-way. Submit notarized copy(s) of agreement(s) between private property owner and Contractor prior to use of area.
3. Restrict total length of distributed materials along route of construction to 1,000 linear feet unless approved in writing by Project Manager.
4. Do not store material(s) in City and County Rights-Of-Way.

B. Properties Outside of Rights-of-Way

1. Do not alter condition of properties adjacent to and along rights-of-way.
2. Do not use ways, means, methods, techniques, sequences, and procedures that result in damage to properties or improvements.
3. Restore Contractor damaged properties outside of rights-of-ways at no cost to the Owner.

C. Use of Site

1. Obtain approvals from governing authorities prior to impeding or closing public roads and streets. Do not close more than two consecutive intersections at one time.
2. Notify Project Manager at least 48 hours prior to closing street or street crossing. Obtain permits for street closures in advance.
3. Maintain 10-foot-wide minimum access lane for emergency vehicles including access to fire hydrants.
4. Avoid obstructing drainage ditches or inlets; when obstruction is unavoidable due to requirements of Work, provide grading and temporary drainage structures to maintain unimpeded flow.

5. Locate and protect private lawn sprinkler systems which may exist within site. Test existing irrigation systems prior to construction. Repair or replace damaged systems to condition existing at start of Work, or better.
6. Perform daily clean up in affected construction areas in order to restore site to existing or better conditions. Areas should be free of debris, scrap material, dirt, mud, and other items identified by Project Manager. Do not leave buildings, roads, streets, and other construction areas unclean.
7. Restore damaged landscaping to condition existing at start of Work, or better.
8. Beware of overhead power lines existing in area and in close proximity of project. When 10 feet of clearance between energized overhead power line and construction-related activity cannot be maintained, request CenterPoint Energy de-energize or move conflicting overhead power line. Contact CenterPoint Energy representatives at (713) 207-2222. Schedule, coordinate and pay costs associated with de-energizing or moving conflicting overhead power lines. There is no separate pay item for this effort. Include these costs in various items of bid that make such work necessary.

D. Notification to Adjacent Occupants

1. Notify in writing individual occupants in areas to be affected by Work of proposed construction and time schedule. Notify not less than 72 hours or more than 2 weeks prior to work performed within 200 feet of homes or businesses.
2. Include in written notification names and telephone numbers of two company representatives for resident contact available on 24-hour call. Include precautions taken to protect private property and identify potential access, utility inconvenience, and disruption.
3. Submit proposed notification document to Project Manager for approval. Consider ethnicity of neighborhood where English is not dominant language. Provide notice in understandable language.

E. Public, Temporary, and Construction Roads and Ramps

1. 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 Work.
2. Provide mats or other means to prevent overloading or damage to existing roadways from tracked equipment, large tandem axle trucks or equipment that will damage existing roadway surface.



3. Construct and maintain access roads and parking areas as specified in Section 01504 – “Temporary Facilities and Controls”.

F. Excavation in Streets and Driveways

1. Avoid hindering or inconveniencing of public travel on streets or intersecting alleys for more than two blocks at one time, except by permission of Project Manager.
2. Obtain necessary permits and Project Manager’s approval when nature of Work requires closing entire street. Permits required for street closure are Contractor’s responsibility. Avoid unnecessary inconvenience to abutting property owners.
3. Remove surplus materials and debris and open each block for public use when work in that block is complete.
4. Acceptance of any portion of Work is not based on return of street to public use.
5. Avoid obstructing driveways or entrances to private property.
6. Provide temporary crossing or complete excavation and backfill in one continuous operation to minimize duration of obstruction when excavation is required across drives or entrances.
7. Provide barricades and signs in accordance with Part 6 of the Texas Manual on Uniform Traffic Control Devices.

G. Traffic Control

Comply with traffic regulation as specified in Section 01555 – “Traffic Control and Regulation”.

H. Surface Restoration

1. Restore site to condition existing before construction.
2. Repair paved area per requirements of Section 02951 – “Pavement Repair and Resurfacing”.
3. Repair damaged turf areas according to Section 02317 – “Excavation and Backfill for Utilities”, level with topsoil conforming to Section 02911 – “Topsoil”, and re-sod in accordance with Section 02922 – “Sodding”. Water and level newly sodded areas with adjoining turf using appropriate steel wheel rollers for sodding. Do not use spot sodding or sprigging. Upon completion of planting, continue watering until turf is established.

I. Limits of Construction

1. Confine operations to lands within construction work limits shown on Plans. Unless otherwise noted on Plans adhere to the following:
  - a. Where utility alignment is within esplanade, and construction limits are shown on Plans to extend to edge of esplanade, keep equipment, materials, stockpiles, a minimum of 5 feet from back of curb.
  - b. Where construction limits are shown on Plans to extend to property line, keep equipment, materials, stockpiles, a minimum of 5 feet away from sidewalks.

J. Equipment and Material Salvage

Upon completion of Work, carefully remove salvageable equipment and material. Deliver them as directed by Project Manager. Dispose of equipment offsite at no additional cost to Owner when Project Manager deems equipment unfit for further use.

1.0 8 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01160

POTENTIALLY CONTAMINATED AREAS

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Handling, testing, stockpile, treatment, and disposal of *potentially contaminated* areas.
- B. Removal, testing, treatment, and disposal of *potentially contaminated* groundwater.
- C. Obtaining and paying for required permits.
- D. Hiring qualified professional environmental consultants.
- E. Hiring a testing laboratory to perform required testing.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

- 1. Preparatory Work related to *potentially contaminated* areas is on a lump sum basis. This item includes hiring environmental consultants, preparation of an Environmental Health and Safety Plan, preparation of an Environmental Work Plan, training personnel, and obtaining permits and environmental insurance. Contractor shall provide documents of all plans, training records, permits, and insurance prior to mobilization. The Contractor shall provide a schedule of values as specified in Section 01292 - Schedule of Values. Payment shall be made according to the schedule of values upon acceptance of each respective submittal or documentation confirming completion of the individual work items.
- 2. Environmental Health and Safety Monitoring and Field Screening includes, monitoring to assure safe working conditions, as defined in paragraph 3.03, Environmental Monitoring in Potentially Contaminated Areas and Field Screening, as defined in paragraph 3.04, Screening Potentially Contaminated Soil. No separate payment.
- 3. Mobilization, Handling, transportation, treatment, and disposal of *impacted* soil from open cut construction of water lines is on an unit price basis per cubic yard of bulked soil. This unit price is in addition to the unit price for installation of water line. Such price includes all additional costs associated with soil from open cut construction through *impacted* areas, as described in paragraph 3.01, Areas Potentially Contaminated, subparagraph 3.01B.2. Such

additional costs include sampling, testing, handling, transportation, temporary storage, treatment, and final disposal in accordance with paragraph 3.06. For this item, assume that all *contaminated* soil can be disposed in a landfill accepting Class I or Class II soil. Measurement for this item will be from the station where *impacted* soil is first identified by field screening to the station where there is no further indication of contamination as approved by the Project Manager. This item also includes preparation of temporary storage areas; providing and mobilizing water treatment equipment, plus any moving required within or between *potentially contaminated* areas; providing monitoring equipment to implement the Environmental Health and Safety Plan; providing screening equipment to implement the Environmental Work Plan; and required submittals. Payment for this item will be made upon receipt of documentation that material has been properly disposed.

4. Handling, transportation, treatment, and disposal of *impacted* soil from tunnel construction of water lines is on a unit price basis per cubic yard of bulked spoil. This unit price is in addition to the unit price for installation of water line. Such price includes all additional costs associated with soil from tunnel construction, including shafts, through *impacted* areas, as described in paragraph 3.01, Areas Potentially Contaminated, subparagraph 3.01B.2. Such additional costs include sampling, testing, handling, transportation, temporary storage, treatment, and final disposal in accordance with paragraph 3.06. For this item, assume that all *contaminated* soil can be disposed in a landfill accepting Class I or Class II soil. Payment for this item will be made upon receipt of documentation that material has been properly disposed.
5. Handling, transportation, treatment, and disposal of water pumped from the excavation or from dewatering activities in *potentially contaminated* areas is on an unit price basis per 1,000 gallons of contaminated water. This unit price is in addition to the unit price for installation of water line. Such price includes all additional costs associated with water from construction of water lines through *potentially contaminated* areas. Such additional costs include sampling, testing, handling, transportation, required treatment, temporary storage, and final disposal. For this item, assume that all treated water can be properly disposed in a sanitary sewer and that all material removed from the water by the treatment process can be properly disposed at a petroleum liquid recycling facility. Petroleum contamination levels, as presented in Phase II Environmental Site Assessment (ESA) Report, are expressed in terms of mg/L Total Petroleum Hydrocarbon (TPH). For purposes of interpreting data provided from the design phase, 1 mg/L of TPH can be assumed to be equivalent to 1 mg/L of oil and grease.
6. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

1.03 REFERENCES

- A. ASTM D 5092 – Standard Practice for Design and Installation of Ground Water Monitoring Wells.
- B. Code of Federal Regulation (CFR), Title 29, Section 1926 – “Safety and Health Regulations for Construction”
- C. CFR, Title 40, Section 261.24 – “Toxicity characteristic”
- D. CFR, Title 40, Section 261, Appendix II.
- E. Texas Administrative Code (TAC), Title 30, Section 116, Standard Exemptions 68 and 118.
- F. TAC, Title 30, Section 321, Subchapter H – “Control of Certain Activities by Rule; Subchapter H: Discharge to Surface Waters from Treatment of petroleum Substance Contaminated Waters.
- G. U.S. Environmental Protection Agency (EPA), (SW-846) Test Methods for Evaluating Solid Waste, Office of Solid Waste and Emergency Response, Washington, D.C. (P1388-239223, November 1986)

1.04 SUBMITTALS

- A. Submit an Environmental Work Plan to the Project Manager prior to the Date of Commencement.
  - 1. Have the Work Plan prepared by a Corrective Action Project Manager licensed in Texas.
  - 2. Do not commence work in potentially contaminated areas until the Environmental Work Plan for dealing with these materials has been reviewed and accepted by the Project Manager.
  - 3. Include in the Environmental Work Plan:
    - a. Sequence of construction through potentially contaminated areas;
    - b. Procedures for screening soil in potentially contaminated areas, identifying impacted material, and identifying contaminated material;
    - c. Procedures for handling impacted and contaminated material;
    - d. Proposed location of stockpile areas;

- e. Proposed treatment of contaminated material to meet disposal requirements, if required;
  - f. Proposed methods for disposal of treated or contaminated material;
  - g. Proposed carriers of contaminated material with verification each is properly licensed;
  - h. Proposed recycle/disposal sites for contaminated material with verification each is properly licensed;
  - i. List of any permits that may be required for handling or recycle/disposal of contaminated material;
  - j. Name and qualifications of professional environmental consultants to be used by Contractor on health, environmental, and safety issues regarding operations within potentially contaminated areas; and,
  - k. Proposed analytical laboratory with verification it is properly certified.
- B. Submit an Environmental Health and Safety Plan to the Project Manager prior to Date of Commencement.
- 1. Have the plan prepared by either a Corrective Action Project Manager licensed in Texas, with 40 hours of Health and Safety Training, or a Certified Industrial Hygienist.
  - 2. Include in the Plan, methods and procedures for assuring operations under conditions encountered are safe for citizens and workers.
- C. Submit a Groundwater Monitoring Plan to the Project Manager prior to Date of Commencement
- 1. Have the Monitoring Plan prepared by a professional engineer licensed in Texas.
  - 2. Include in the Monitoring Plan number and location of wells to be installed in potentially contaminated areas, size and depth of wells, anticipated screen intervals, type of casing, well development procedures, sampling procedures, plan for disposal of cuttings, number and location of existing wells to be abandoned, and abandonment procedures for wells.
- D. Submit to the Project Manager soil and groundwater field screening, monitoring and analytical laboratory test results on a weekly basis as work proceeds. Summarize test results in tables together with applicable regulatory criteria.

- E. Submit to the Project Manager copies of correspondence, reports, permits and other documents provided to, or received from, regulatory agencies.
- F. Submit to the Project Manager original, signed manifests for off-site disposal of contaminated material.

#### 1.05 RELATED REQUIREMENTS

- A. Document 00300 – “Bid”
- B. Section 01270 – “Measurement and Payment”
- C. Section 01576 – “Waste Material Disposal”
- D. Section 01578 – “Control of Ground Water and Surface Water”

#### 1.06 – 1.09 NOT USED

#### 1.10 DEFINITIONS

- A. *Potentially contaminated:* Soil and groundwater within station-to-station locations identified in a report where petroleum contamination has been detected during a Phase II ESA.
- B. *Impacted:* Soil or groundwater that contains visual or physical evidence of contamination, as described in paragraph 3.01, Areas Potentially Contaminated, subparagraph 3.01B.2.
- C. *Contaminated:* Soil that contains petroleum contamination in excess of levels identified in paragraph 3.06, Handling Impacted and Contaminated Soil, subparagraph 3.06A, or groundwater that contains petroleum contamination requiring permitted discharge to storm or sanitary sewer.

#### 1.11 – 1.13 NOT USED

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION

#### 3.01 GENERAL / MANUFACTURER(S)

- A. Areas Potentially Contaminated
  - 1. Conduct operations in potentially contaminated areas and in impacted areas in accordance with the Environmental Work Plan and the Environmental Health and Safety Plan.

2. Immediately notify the Project Manager and implement the Environmental Health and Safety Plan and the Environmental Work Plan whenever impacted soil or groundwater is encountered.
  - a. Provide location, depth, type (soil or groundwater), source (if known), and evidence contamination is suspected.
  - b. Impacted material is determined by visual or physical evidence of soil or groundwater contamination. Visual or physical evidence includes a petroleum or chemical odor, an indication of levels of contamination by air monitoring devices included as a part of the Environmental Health and Safety Plan that may be of concern, soil or groundwater discoloration, material oozing/dripping into the excavation, liquid floating on the groundwater, buried containers or refuse, unusual physical symptoms experienced by workers, and field screening results in excess of 50 ppm reading on the photoionization detector (PID). Refer to paragraph 3.04, Screening Potentially Contaminated Soil.

B. Environmental Monitoring in Potentially Contaminated Areas

1. Monitor conditions in *potentially contaminated* areas, as specified in the Environmental Health and Safety Plan, to maintain safe working conditions in accordance with Occupational Health and Safety Administration (OSHA) requirements (29 CFR 1926).

C. Additional Insurance Coverage

1. Contractor has provided unit prices for performing work associated with petroleum contaminated soil, if encountered (See Section 00300 – “BID”).
2. Contractor is obligated to perform this work notwithstanding paragraph 4.5 of the General Conditions.
3. If any of this work is encountered on this project, Owner may require, at Owner’s expense that the Contractor provide additional insurance coverage related to this work.

3.02 PREPARATION (NOT USED)

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Screening Potentially Contaminated Soil

1. Retain services of an environmental consultant or analytical testing laboratory for continuous field screening of soil removed from the excavation in potentially contaminated areas.



- a. Place samples in a sealed plastic bag for 15 minutes prior to screening.
  - b. Use a properly calibrated PID to screen the level of contamination in the head space of the plastic bag.
  - c. Use 100 ppm isobutylene as the calibration gas.
  - d. For the purposes of field screening, continuous is defined as at least twice per hour while soils are being removed in open cut areas or shafts, or once for each construction cycle in tunnels (i.e., each pipe length in pipe jacked tunnels or each advance of the tunnel shield in primary-lined tunnels).
2. Soil with field screening results in excess of a 50 ppm reading on the PID, or as otherwise defined in paragraph 3.01, Areas Potentially Contaminated, subparagraph 3.01B.2, is considered impacted.

**B. Handling Impacted and Contaminated Soils**

1. If soil is contaminated with petroleum only, the concentration of contaminants must exceed one or more of the levels listed in Table 01160B, Soil Contamination Criteria - Petroleum Only to be considered contaminated. Table 01160B is located at the end of this Section.
2. Remove, handle, transport, stockpile, and dispose of contaminated soil under the direction of an individual licensed by the State of Texas as a Corrective Action Project Manager with 40 hours of Health and Safety Training.
3. With concurrence of the Project Manager, place impacted soil, as described in paragraph 3.01, Areas Potentially Contaminated, subparagraph 3.01B.2, in suitable covered containers; in a stockpile at a temporary storage area, pending receipt of analytical results and receipt of authorization from TCEQ and the disposal site for final disposal; or, in trucks for transport directly to the disposal facility.
  - a. To avoid having to obtain a TCEQ permit for a storage facility, do not commingle impacted soil from different locations or with different sources.
  - b. Locate the temporary storage area to meet all of the following criteria:
    - 1) Selected by the Contractor.
    - 2) Acceptable to the Owner.
    - 3) Within a reasonable distance to allow access by personnel.

- 4) Outside the 100-year floodplain.
    - 5) Outside of, and not adjacent to, an area known or suspected to be a wetland.
    - 6) Secured using temporary fencing or other means of controlling access.
  - c. Place stockpiled soils on an impervious membrane and surround it with a berm to prevent migration of soils or moisture, other than evaporation.
  - d. Cover the stockpile and protect it from rain using a waterproof membrane covering.
  - e. Do not place soil over monitoring wells or piezometers, utility line manholes, or any other potential route for water to migrate to the subsurface.
  - f. Contact TCEQ-Air Permitting Division for assistance with completion of a PI 7 form in accordance with 30 TAC 116 Standard Exemptions 68 and 118. Additional testing may be required to evaluate emission rates from stockpiled soil.
  - g. Handle runoff from the temporary storage area in accordance with paragraph 3.07, Handling Water.
  - h. Remove any material, including excavated soil from the construction site, from the temporary storage area prior to completion of the project.
  - i. Comply with requirements as otherwise required by law.
4. If acceptable emission rates are not exceeded, and with required TCEQ permits and concurrence of the Project Manager, contaminated soil may be mixed and aerated so volatile petroleum hydrocarbons can evaporate, reducing the level of contamination to below concentrations prescribed in paragraph 3.06, Handling Impacted and Contaminated Soils, subparagraph 3.06A or 3.06I. Work the soil as follows:
- a. Spread stockpiled material to a maximum depth of 18 inches and make at least 3 passes with a disc harrow and at least 3 passes with a road grader to turn material completely over.
  - b. Make the specified passes to turn material over at least twice per day for 5 consecutive days or until the material contains less than permissible levels of contaminants.

5. If acceptable emission rates are exceeded and level of contamination is below levels prescribed in paragraph 3.06I, Contractor may choose to dispose of contaminated soil or develop and implement an appropriate emissions control plan, both subject to approval by the Project Manager. Such a plan should include provisions to work the soil as described in paragraph 3.06D, limit emissions to below allowable levels, and obtain required TCEQ permits.
6. If acceptable emission rates are exceeded and level of contamination exceeds levels prescribed in paragraph 3.06I, Contractor may choose to treat contaminated soil by another method or develop and implement an appropriate emissions control plan, both subject to approval by the Project Manager. Again, such a plan should include provisions to work the soil as described in paragraph 3.06D, limit emissions to below allowable levels, and obtain required TCEQ permits.
7. Transport contaminated soil in accordance with Department of Transportation and TCEQ rules and regulations. Use a licensed carrier acceptable to the Project Manager for such transport.
8. Dispose of contaminated soil at a properly licensed facility with prior approval of the Project Manager.
9. Assure that limits of contamination for disposal at the facility are not exceeded. General limits for proper disposal of Class II petroleum contaminated soil at landfills are listed at the end of this Section in Table 01160C, Contamination Limits for Disposal of Class II Soil.
  - a. Contact the landfill operator for exact disposal limits and for requirements regarding disposal of other types of contaminated soil.
  - b. Obtain signed manifests from the receiving facility and provide originals to the Project Manager.

**C. Handling Water**

1. Install and operate groundwater control systems, as described in Section 01578 – “Control of Ground Water and Surface Water”, and conduct construction activities in potentially contaminated areas to minimize the spread of contamination. Design and operate the groundwater control systems such that water from potentially contaminated areas is handled in systems separated and isolated from groundwater control systems outside of the potentially contaminated area.
2. Handle, test, treat, and discharge contaminated water to the storm or sanitary sewer in accordance with TCEQ, and EPA requirements.

- a. Subchapter H of Section 321, 30 TAC describes the requirements of TCEQ for handling, testing and discharging water contaminated with petroleum to the storm sewer.
  - b. On-site water handling, treatment, and disposal systems, if not already permitted, are subject to the air permitting provisions of paragraph 3.06C.
  - c. All such activities shall be under the direction of an individual licensed by the State of Texas as a Corrective Action Project Manager with 40 hours of Health and Safety Training.
3. Treat potentially contaminated, impacted, and contaminated water to be discharged to storm or sanitary sewers in accordance with Table 01160D, or as required to meet other disposal requirements.
- a. Provide equipment sized according to standard engineering practices to handle flows anticipated by dewatering operations.
  - b. Include a standard sized, commercially available oil/water separator as part of the treatment system suitable for intended use for dewatering operation discharges to a storm or sanitary sewer.
  - c. Where groundwater contamination levels exceed those noted in the Table 01160D, provide additional treatment systems as needed prior to discharge to the sanitary or storm sewers.
  - d. Do not discharge treated water into a sewer if the flow is less than one foot below the top of the manhole or would cause an overflow situation.
  - e. Recover free product collected in the treatment equipment.
  - f. Recycle (i.e., for beneficial reuse) or dispose of recovered contaminants in a manner acceptable to the Project Manager and the TCEQ.
  - g. Transport contaminated water and recovered contaminants in accordance with Department of Transportation and TCEQ rules and regulations. Use a licensed carrier acceptable to the Project Manager for such transport.
  - h. Obtain signed manifests from the receiving facility and provide originals to the Project Manager.
  - i. Furnish laboratory reports to the Project Manager within one week of sample date.

4. Obtain written approval from the Owner for discharge directly to a sanitary sewer which discharges to a wastewater treatment plant prior to commencing such discharge.
5. Obtain a permit from the TCEQ for discharge directly to a storm sewer prior to commencing such discharge.
6. Limits for discharge of water contaminated with only petroleum to sewers are given at the end of this Section in Table 01160D, Petroleum Contaminated Groundwater Discharge Limits

D. Disposal of Material Not Contaminated

1. Dispose of excess or unsuitable excavated materials that are not *contaminated*, off the job site in accordance with Section 01576 – “Waste Material Disposal”.

**TABLE  
ANALYTICAL TESTS**

**01160A**

Suspected Contamination	Analytical Tests to be Performed
Acids or caustics	pH
Gasoline	BTEX (if no free product is visible) TPH MTBE (water only) Ignitability/flashpoint (if free product is visible) Lead Oil and Grease
Diesel fuel Jet Fuel Fuel Oils: Nos. 1, 2 and 4	BTEX (if no free product is visible) TPH PAH Ignitability/flashpoint (if free product is visible) Oil and Grease
Lubricating oils Hydraulic fluids No. 6 fuel oil	TPH PAH Oil and Grease
Unknown petroleum contamination Waste oils	BTEX TPH PAH VOC Total metals (soil only) Oil and Grease

Suspected Contamination	Analytical Tests to be Performed
Solvents	VOC SVOC TOX Ignitability/flashpoint (if free product is visible)

Notes: BTEX - Benzene, Toluene, Ethyl Benzene, and Xylene  
SVOC - Semi-Volatile Organic Compounds  
TPH - total petroleum hydrocarbons TOX - total organic halides  
MTBE - methyl tertiary butyl ether PAH - Polycyclic aromatic hydrocarbons  
VOC - volatile organic compounds

**TABLE 01160B  
SOIL CONTAMINATION CRITERIA – PETROLEUM ONLY**

Contaminant	Maximum concentration (mg/kg)
TPH	10.0
Benzene	0.5
Toluene	0.5
Ethyl Benzene	0.5
Xylene	0.5

**TABLE**  
**CONTAMINATION LIMITS FOR DISPOSAL OF CLASS II SOIL\***

**01160C**

Soil Contaminated With	Contaminant	Limit for Disposal
		Class II Soil
Gasoline or Diesel	TPH	< 1500 mg/kg
	BTEX	and < 150 mg/kg
Waste Oil	TPH	< 600 mg/kg
	BTEX	and <150 mg/kg
	- or -	
	TPH	< 600 mg/kg
	BTEX	and >150 mg/kg
	Benzene	and <5 mg/kg
	- or -	
	TPH	< 600 mg/kg
	BTEX	and >150 mg/kg
	Benzene TCLP	and <0.25 mg/L

Note: TCLP - toxicity characteristic leachate procedure (40 CFR 261, Appendix II)

\* Class I soils exceed the listed values, but are not hazardous waste as defined by the 40 CFR Part 261.

**TABLE  
PETROLEUM CONTAMINATED GROUNDWATER DISCHARGE LIMITS**

**01160D**

Parameter	Discharge to Storm Sewer		Discharge to Sanitary Sewer	
	Limit	Method	Limit	Method
TPH (mg/L)	15	EPA 418.1	N/A	N/A
BTEX (mg/L)	0.5	SW846	N/A	N/A
Benzene (mg/L)	0.05	SW846	N/A	N/A
Lead (mg/L)	0.25	EPA 3020/7421	1.5	EPA 200.7
Lower Explosive Limit (%)	10		10	
pH	6.0 - 9.0	EPA 150.1	5.0 - 11.0	EPA 150.1
Oil and Grease, Total (mg/L)	N/A	N/A	400	EPA 413.1

3.04 – 3.07 NOT USED

**3.08 DEMONSTRATION / TESTING AND INSPECTION**

**A. Sampling and Testing**

1. Sample impacted soils at a rate of not less than one composite sample for every 20 cubic yards of excavation or the volume corresponding to every 50 linear feet of installed water line, whichever is more frequent. Make a composite sample by combining 4 samples collected from different locations within the excavated volume.
2. Sample treated water from potentially contaminated areas to be discharged to a sanitary sewer at a rate of one grab sample once per week or as otherwise specified in the discharge permit.
3. Sample treated water from potentially contaminated areas to be discharged to a storm sewer at a rate of one composite sample and one grab sample every 24-hours, or as otherwise specified in the discharge permit. Make a composite sample by combining at least 24 samples of equal volume collected at 1-hour intervals.
4. Analyze soil samples.
  - a. Analyze samples for the type of contamination suspected, as listed at the end of this section in Table 01160A, Analytical Tests, in accordance with SW-846. Use grab samples for analysis of TPH and VOCs



(including BTEX) and composite samples for analysis of other parameters.

- b. Have analyses conducted by a testing laboratory certified by the Environmental Protection Agency.

5. Analyze Groundwater Samples.

- a. For discharge to storm sewers, analyze samples for the type of contamination suspected, as listed at the end of this section in Table 01160A, Analytical Tests, in accordance with SW-846. Use grab samples for analysis of TPH and VOCs (including BTEX) and composite samples for analysis of other parameters.
- b. For discharge to sanitary sewers, analyze samples for oil and grease.
- c. Have analyses conducted by a testing laboratory certified by the Environmental Protection Agency.

3.09 – 3.10 NOT USED

END OF SECTION

Section 01255

**CHANGE ORDER PROCEDURES**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes procedures for processing Change Orders, including:

1. Assignment of responsible individual for approval and communication of changes in 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, and Time and Materials Change Order.
4. Execution of Change Orders.
5. Correlation of Contractor submittals.

**1.02 MEASUREMENT AND PAYMENT (NOT USED)**

**1.03 REFERENCES**

- A. Rental Rate Blue Book for Construction Equipment (a.k.a. Data Quest Blue Book)

**1.04 SUBMITTALS (NOT USED)**

**1.05 RELATED REQUIREMENTS**

- A. Document 00700 – “General Conditions”
- B. Section 01785 – “Project Record Documents”

**1.06 QUALITY ASSURANCE (NOT USED)**

**1.07 SYSTEM DESCRIPTION**

- A. Responsible Individual

Provide letter indicating name and address of individual authorized to execute change documents and responsible for informing others in Contractor’s employ and Subcontractors of changes to Work. Information shall be provided at a Preconstruction Conference.

**B. Documentation of Change in Contract Price and Contract Time**

1. Maintain detailed records of changes in Work. Provide full information required for identification and evaluation of proposed changes, and substantiate costs of changes in Work.
2. Document each proposal for change in Contract Price or Contract Time with sufficient data to allow evaluation of proposal.
3. Proposals shall include the following minimum information:
  - a. Quantities of items in original Bid with additions, reductions, deletions, and substitutions.
  - b. Quantities and cost of items in original Schedule of Values with additions, reductions, deletions and substitutions.
  - c. Provide Unit Prices for items not included in Schedule of Unit Prices with supporting information.
  - d. Justification for changes in Contract Time.
  - e. Additional data upon request.
4. For changes in Work performed on a time-and-materials basis, provide the following additional information:
  - a. Quantities and description of products and equipment.
  - b. Taxes, insurance and bonds.
  - c. Overhead and profit as noted in Document 00700 – “General Conditions”.
  - d. Dates, times, and by whom Work was performed.
  - e. Time records and certified copies of applicable payrolls.
  - f. Invoices, receipts for products, rented equipment and subcontracts, similarly documented.
5. For changes in Work performed on a time-and-materials basis, payment for rental equipment will be as follows:
  - a. Actual invoice cost for duration required to complete extra work without markup for overhead and profit. When extra work comprises only a portion of rental invoice where equipment would otherwise be

on site, compute hourly equipment rate by dividing the actual monthly invoice by 176. (One day equals 8 hours and 22 work days in 1 month.)

- b. Do not exceed estimated operating costs given in Blue Book for items of equipment. Overhead and profit will be allowed on operating cost.
6. For changes in Work performed on a time-and-materials basis using Contractor-owned equipment, use Blue Book rates as follows:
- a. Contractor-owned equipment will be paid at Blue Book Rental Rate for duration of time required to complete extra work without markup for overhead and profit. Utilize lowest cost combination of hourly, daily, weekly, or monthly rates. Use 150 percent of Rental Rate for double shifts (one extra shift per day) and 200 percent of Rental Rate for more than two shifts per day. Standby rates shall be 50 percent of appropriate Rental Rate shown in Blue Book. No other rate adjustments apply.
  - b. Do not exceed estimated operating costs given in Blue Book. Overhead and profit will be allowed on operating cost. Operating costs will be allowed for equipment on standby.

C. Change Procedures

- 1. Changes to Contract Price or Contract Time can only be made by issuance of Change Order. Issuance of Work Change Directive will be formalized into a Change Order. Changes will be in accordance with requirements of Document 00700 – “General Conditions”.
- 2. Project Manager will advise of minor changes in Work not involving an adjustment to Contract Price or Contract Time as authorized by Document 00700 – “General Conditions” by issuing supplemental instructions.
- 3. Request clarification of Plans, Specifications, Contract Documents, or other information by using Request for Information. Response by Project Manager to Requests for Information does not authorize Contractor to perform tasks outside scope of Work. Changes must be authorized as described in this section.

D. Proposals and Contract Modifications

- 1. Project Manager may issue Request for Proposal, which includes detailed description of proposed change with supplementary or revised Plans and Specifications. Project Manager may also request a proposal in response to Request for Information. Prepare and submit proposal within 7 days or as specified in request.

2. Submit request for Contract changes to Project Manager describing proposed change and its full effect on Work, with a statement describing reason for change and effect on Contract Price and Contract Time including full documentation.
3. The Owner may use Engineer to review change orders.

E. Work Change Directive

1. Project Manager may issue a signed Work Change Directive instructing Contractor to proceed with a change in Work. Work Change Directive will subsequently be incorporated in Change Order.
2. Document will describe changes in Work and designate method of determining change in Contract Price or Contract Time.
3. Proceed promptly to execute changes in Work in accordance with Work Change Directive.

F. Stipulated Price Change Order

Stipulated Price Change Order will be based on accepted proposal.

G. Unit Price Change Order

1. Where Unit Prices for affected items of Work are included in Bid, unit price Change Order will be based on unit prices, subject to Document 00700 – “General Conditions”.
2. Where Unit Prices of Work are not pre-determined in original Bid, Work Change Directive or accepted proposal will specify unit prices to be used.

H. Time-and-Material Change Order

1. Provide itemized account and supporting data after completion of change, within time limits indicated for claims in Document 00700 – “General Conditions”.
2. Project Manager will determine change allowable in Contract Price and Contract Time as provided in Document 00700 – “General Conditions”.
3. Maintain detailed records of Work done on time-and-material basis as specified in paragraph 1.07.b, Documentation of Change in Contract Price and Contract Time.
4. Provide full information required for evaluation of changes and substantiate costs for changes in Work.

**I. Execution of Change Documentation**

Project Manager will issue Change Orders, Work Change Directives, or accepted proposal for signatures of parties as described in Document 00700 – “General Conditions”.

**J. Correlation of Contractor Submittals**

1. For Stipulated Price Contracts, promptly revise Schedule of Values and Application for Payment forms to record authorized Change Orders as separate line item.
2. For Unit Price Contracts, next monthly estimate of Work after acceptance of a Change Order will be revised to include new items not previously included and appropriate unit prices.
3. Promptly revise progress schedules to reflect change in Contract Time, and to adjust time for other items of work affected by change, and resubmit for review.
4. Promptly enter changes to on-site and record copies of Plans, Specifications, or Contract Documents as required in Section 01785 – “Project Record Documents”.

1.08 – 1.09 NOT USED

**1.10 DEFINITIONS**

- A. Blue Book is defined as the Rental Rate Blue Book for Construction Equipment.
- B. Rental Rate is defined as full unadjusted base rental rate for appropriate item of construction equipment.

1.11 – 1.13 NOT USED

**PART 2 PRODUCTS (NOT USED)****PART 3 EXECUTION (NOT USED)**

END OF SECTION

## Section 01270

## MEASUREMENT AND PAYMENT

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes procedures for measurement and payment plus conditions for nonconformance assessment and nonpayment for rejected products.

## 1.02 MEASUREMENT AND PAYMENT

## A. Authority

1. Measurement methods delineated in Specification sections are intended to complement criteria of this Section. In event of conflict, requirements of the Specification section shall govern.
2. Project Manager will take measurements and compute quantities accordingly.
3. Assist by providing necessary equipment, workers, and survey personnel.
4. There will be no separate payment for Work included in the Contract Documents unless there is a specifically established item in Section 00300 – "Bid".

## B. Unit Quantities Specified

1. Quantity and measurement estimates stated in Agreement are for contract purposes only. Quantities and measurements supplied or placed in Work and verified by Project Manager shall determine payment as stated in Document 00700 - General Conditions.
2. When actual Work requires greater or lesser quantities than those quantities indicated in Bid, provide required quantities at unit prices contracted except as otherwise stated in Article 11 of Document 00700 – "General Conditions".

## C. Measurement of Quantities

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

2. Measurement by Volume:
  - a. Stockpiles: Measured by cubic dimension using mean length, width, and height or thickness.
  - b. Excavation and Embankment Materials: Measured by cubic dimension using average end area method.
3. Measurement by Area: Measured by square dimension using mean length and width or radius.
4. Linear Measurement: Measured by linear dimension, at item centerline or mean chord.
5. Stipulated Price Measurement: By unit designated in Agreement.
6. Other: Items measured by weight, volume, area, or linear means or combination, as appropriate, as completed item or unit of Work.
7. Measurement by Each: Measured by each instance or item provided.
8. Measurement by Lump Sum: Measure includes all associated Work.

D. Payment

1. Payment Includes: Full compensation for required supervision, labor, products, tools, equipment, plant, transportation, services, and incidentals; and erection, application or installation of an item of Work; and Contractor's overhead and profit.
2. Total compensation for required Unit Price Work shall be included in Unit Price bid in Bid. Claims for payment as Unit Price Work, but not specifically covered in list of unit prices contained in Bid, will not be accepted.
3. 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.
4. Progress payments will be based on Project Manager observations and evaluations of quantities incorporated in Work multiplied by unit price.
5. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities determined by Project Manager multiplied by unit price for Work which is incorporated in or made necessary by the Work.



## E. Nonconformance Assessment

1. Remove and replace Work, or portions of Work, not conforming to Contract Documents, as directed by Project Manager.
2. When not practical to remove and replace Work, Project Manager will direct one of the following remedies:
  - a. Nonconforming Work will remain as is, but Unit Price will be adjusted lower at discretion of Project Manager.
  - b. Nonconforming Work will be modified as authorized by Project Manager, and Unit Price will be adjusted lower at discretion of Project Manager, when modified Work is deemed less suitable than specified.
3. Specification sections may modify above remedies or may identify a specific formula or percentage price reduction.
4. Authority of Project Manager to assess nonconforming work and identify payment adjustment is final.

## F. Nonpayment for Rejected Products

1. Payment will not be made for the following:
  - a. Products wasted or disposed of in unacceptable manner.
  - b. Products determined as nonconforming before or after placement.
  - c. Products not completely unloaded from transporting vehicle.
  - d. Products placed beyond lines and levels of required Work.
  - e. Products remaining on hand after completion of Work, unless specified otherwise.
  - f. Loading, hauling, and disposing of rejected products.

## 1.03 REFERENCES

- A. Concrete Reinforcing Steel Institute (CRSI) Manual
- B. American Institute of Steel Construction (AISC) Manual of Steel Construction

## 1.04 SUBMITTALS (NOT USED)

## 1.05 RELATED REQUIREMENTS

A. Section 00300 – “Bid”

B. Document 00700 – “General Conditions”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

This Section includes preparation and submittal of Schedule of Values for Stipulated Price Contracts or for major lump sum items in Unit Price Contracts for progress payments.

1.02 MEASUREMENT AND PAYMENT

No separate payment will be made for this item. Include cost of preparing Schedule of Values in overhead cost for this project.

1.03 REFERENCES (NOT USED)

1.04 SUBMITTALS

- A. Submit Schedule of Values in accordance with requirements of Section 01330 – “Submittal Procedures”. Submit at least 10 days prior to submitting first application for progress payment.
- B. Submit Schedule of Values in approved electronic spreadsheet file and PDF.
- C. Revise Schedule of Values and resubmit for items affected by Contract Modifications, Change Orders, and Work Change Directives. After changes are reviewed without exception by Project Manager, make submittal at least 10 days prior to submitting next application for progress payment.

1.05 RELATED REQUIREMENTS

- A. Section 01325 – “Construction Schedule”
- B. Section 01330 – “Submittal Procedures”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

- A. For Stipulated Price Contracts, subdivide Schedule of Values into logical portions of Work, such as major work items or work in contiguous construction areas. Use Section 01325 – “Construction Schedule” to guide subdivision of work items. Directly correlate Items in Schedule of Values with tasks enumerated in Construction Schedule. Organize each portion using Table of Contents of Project Manual as an outline for

listing value of Work by Sections. A pro rata share of Mobilization, Bonds and Insurance may be listed as separate items for each portion of Work.

- B. For Unit Price Contracts, items should include proportional share of Contractor's overhead and profit so that total of all items will equal Contract Price.
- C. For lump sum equipment items where submittal of operation/maintenance data and testing are required, include separate item for equipment operation and maintenance data submittal valued at 5 percent of lump sum amount for each equipment item and separate item for testing and adjusting valued at 5 percent of lump sum amount for each equipment item.
- D. Round off figures for each listed item to nearest \$100 except for value of one item, when necessary, to make total of items in Schedule of Values equal Contract Price for stipulated price contracts or lump sum amount in Schedule of Unit Price Work.

1.08 – 1.09 NOT USED

#### 1.10 DEFINITIONS

- A. Schedule of Values is itemized list that establishes value of each part of Work for Stipulated Price Contract and for major lump sum items in unit price contract. Schedule of Values is used as basis for preparing applications for payments. Quantities and unit prices may be included in Schedule when designated by Project Manager.
- B. Major lump sum item is a lump sum item in Schedule of Unit Price Work which qualifies as Major Unit Price Work. Major Unit Price Work is an individual unit price item, whichever is the least of the following values:
  - 1. whose value is greater than 5% of Original Contract Price
  - 2. whose value becomes greater than 5% of Original Contract Price as a result of an increase in quantity
  - 3. whose value is \$100,000
- C. Break down costs to list major products or operations for each line item which has an installed value of more than \$2000.

1.11 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

## Section 01312

## COORDINATION AND MEETINGS

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes general coordination including pre-construction conference, site mobilization conference, and progress meetings.

## 1.02 MEASUREMENT AND PAYMENT

No payment will be made for this item. Include cost of meetings and project coordination in overhead cost for this project.

## 1.03 REFERENCES

Coordination is required throughout documents. Refer to Contract Documents, coordinate as necessary.

## 1.04 – 1.06 NOT USED

## 1.07 SYSTEM DESCRIPTION

## A. Contractor Coordination

1. Coordinate scheduling, submittals, and Work of various Specification sections to assure efficient and orderly sequence of installation of interdependent construction elements.
2. Coordinate completion and clean-up of Work for Substantial Completion and for portions of Work designated for Owner's partial occupancy.
3. Coordinate access to site for correction of nonconforming Work to minimize disruption of Owner's activities where Owner's is in partial occupancy.

## B. Pre-Construction Conference

1. Project Manager will schedule pre-construction conference.
2. Attendance Required: Owner's and Project Manager's representatives, Engineer, Special Consultants and Testing Lab representatives as required by Project Manager, Contractor, and major Subcontractors.

3. Agenda:
  - a. Distribution of Contract Documents.
  - b. Designation of personnel representing parties in Contract, Project Manager, and Engineer.
  - c. Discussion of formats for Schedule of Values and Construction Schedule.
  - d. Procedures and processing of shop drawings, substitutions, pay estimates or applications for payment, Requests for Information, Request for Proposal, Change Orders, and Contract closeout, other submittals.
  - e. Scheduling of Work and coordination with other contractors.
  - f. Review of Subcontractors.
  - g. Procedures for testing.
  - h. Procedures for maintaining record documents.

C. Progress Meetings

1. Project Manager will schedule and conduct progress meetings.
2. Progress meetings will be held at Project field office or other location as designated by Project Manager. These meetings will be held at monthly intervals, or more frequently when directed by Project Manager.
3. Attendance Required: Project superintendent, major Subcontractors and suppliers, Project Manager's representatives, Testing Lab representatives and Engineer as appropriate to agenda topics for each meeting.
4. Project Manager or representative will make arrangements for recording minutes of the meeting.
5. Project Manager or representative will prepare the meeting agenda.
6. Provide required information and be prepared to discuss each agenda item.
7. Agenda:
  - a. Review minutes of previous meetings.
  - b. Review of Work progress schedule, pay estimates and record drawings.

- c. Field observations, problems, and decisions.
- d. Identification of problems which impede planned progress.
- e. Review of submittal schedule and status of submittals.
- f. Review of RFI and RFP status.
- g. Review Change Order status.
- h. Effect of proposed changes on progress schedule and coordination.
- i. Review of off-site fabrication and delivery schedules.
- j. Maintenance of construction schedule and corrective actions, as necessary.
- k. Planned progress during succeeding Work period.
- l. Coordination of projected progress.
- m. Quality of Work and compliance with standards.
- n. Maintenance of SWPPP.
- o. Other items relating to Work.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



## Section 01321

## CONSTRUCTION PHOTOGRAPHS

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes photographic requirements for construction photographs and submittals.

## 1.02 MEASUREMENT AND PAYMENT

No payment will be made for this item. Include cost of meetings and project coordination in overhead cost for this project.

## 1.03 REFERENCES (NOT USED)

## 1.04 SUBMITTALS

- A. Refer to Section 01330 - "Submittal Procedures", for submittal requirements.
- B. Format and Media. Digital photography shall be used. Submit color photographs, if required by Project Manager.
  - 1. Digital Photography: Submit digital photographic files on computer disks. Format disks for MS-DOS (Microsoft Disk Operating System) filing system and in JPEG (Joint Photographic Experts Group) format. File size of JPEG images not to exceed 2.0 megapixels.
  - 2. Prints: Submit two sets of both Progress and Pre-construction Photograph print in a three-hole plastic pocket or sleeve, bound in a three-ring notebook. Produce prints on photographic-quality paper approved by Project Manager. Minimum size for prints shall be 3-inches by 5-inches.
  - 3. Video: Submit digital video recordings on computer disks. Format disks for MS-DOS (Microsoft Disk Operating System) filing system.
- C. Submittal Quantities and Frequencies
  - 1. Pre-construction Photographs and Videos: Submit one digital set of Pre-construction Photographs and Videos prior to start of construction operations. Submit two hard copy sets of photographs, if required.
  - 2. Progress Photographs: For Stipulated Price Contracts, submit one digital set of Progress Photographs with each Application for Payment at the times established for submittal of Application of Payment. Submit two hard copy

sets, if required. Progress Photographs are not required for Unit Price Contracts.

D. Labeling.

1. Digital Photographs:

- a. Each photograph submitted shall have a unique file name containing the following information:
  - 1) Unique photograph ID number.
  - 2) Project Number.
  - 3) Date photograph was taken.
- b. Affix an adhesive label on each computer disk containing the following information:
  - 1) Name and Address of Project.
  - 2) Project Number.
  - 3) Name and Address of Contractor.
  - 4) Range of unique photograph ID numbers included on the disk.

2. Digital Videos:

- a. Each video submitted shall have a unique file name containing the following information:
  - 1) Unique photograph ID number.
  - 2) Project Number.
  - 3) Date video was taken.
- b. Affix an adhesive label on each computer disk containing the following information:
  - 1) Name and Address of Project.
  - 2) Project Number.
  - 3) Name and Address of Contractor.
  - 4) Range of unique video ID numbers included on the disk.

3. Hard Copy Sets: Place a label on the back of each photographic print, applied so as to not show through on the front. Labels shall contain the following information:

- a. Name and Address of Project.
- b. Project Number.
- c. Name and Address of Contractor.
- d. Date photograph was taken.
- e. Location photo was taken from and short description of photo subject.

- E. Photographic prints, photographic files and disks become the property of the Owner. Do not publish photographs without written consent by the Owner.

#### 1.05 RELATED REQUIREMENTS

Section 01330 – “Submittal Procedures”

#### 1.06 QUALITY ASSURANCE

Contractor shall be responsible for the quality of and timely execution and submittal of photographs.

#### 1.07 – 1.09 NOT USED

#### 1.10 DEFINITIONS

- A. Pre-construction Photographs and Videos: Photographs and videos taken, in sufficient numbers and detail, prior to Date of Commencement of the Work, to show original construction site conditions.
- B. Progress Photographs: Photographs, taken throughout the duration of construction at regular intervals and from fixed vantage points that documents process of the Work.
- C. Post-construction Videos: Videos taken, in sufficient detail, after the completion of construction to document final site conditions.

#### 1.11 – 1.13 NOT USED

#### PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

## 3.01 GENERAL / MANUFACTURER(S)

## A. Pre-Construction Photographs and Videos

1. Prior to commencement of construction operations, photograph and video the site to include initial construction corridor, detour routes, and staging or storage areas.
2. Photographs shall include all locates from Texas One call.
3. Prepare Pre-construction Photographs and Videos as follows:
  - a. Show the following information on a non-reflective chalkboard placed within the picture frame of each photograph:
    - 1) Project Number
    - 2) Date and time photographs were taken (Automatic date/time Stamp on image is acceptable).
    - 3) Baseline station, direction of view (i.e. N, S, NW, etc.) and house number or street address and street name.
  - b. Pre-construction Photographs and Videos shall indicate condition of the following:
    - 1) Esplanades and boulevards.
    - 2) Yards (near side and far side of street).
    - 3) House walks and sidewalks.
    - 4) Curbs.
    - 5) Areas between walks and curbs.
    - 6) Particular features (e.g. yard lights, shrubs, fences, trees).
    - 7) Construction access and haul routes.

## B. Progress Photographs

1. Progress Photographs document monthly advancement of the Work. Select vantage points for each shot so as to best show status of construction and progress since last photograph submittal. Select camera stations that will

require little or no movement or adjustment over the duration of construction for vertical Construction projects.

2. Take monthly Progress Photographs at regular intervals to coincide with cutoff dates associated with each Application for Payment.
3. Prepare Progress Photographs as follows:
  - a. Show the following information on a non-reflective chalkboard placed within the picture frame:
    - 1) Project Number
    - 2) Date and time photographs were taken (Automatic date/time Stamp on image is acceptable).
    - 3) Baseline station, direction of view (i.e. N, S, NW, etc.) and house number or street address and street name.
  - b. Progress Photographs shall indicate condition of the following:
    - 1) Esplanades and boulevards.
    - 2) Yards (near side and far side of street).
    - 3) House walks and sidewalks.
    - 4) Curbs.
    - 5) Areas between walks and curbs.
    - 6) Particular features (e.g. yard lights, shrubs, fences, trees).
    - 7) Construction access and haul routes.

C. Post-Construction Videos

1. After completion of construction operations, video the site to include the construction corridor, detour routes, and staging or storage areas.
2. Prepare Post-construction Videos as follows:
  - a. Post-construction Videos shall indicate condition of the following:
    - 1) Esplanades and boulevards.
    - 2) Yards (near side and far side of street).

- 3) House walks and sidewalks.
- 4) Curbs.
- 5) Areas between walks and curbs.
- 6) Particular features (e.g. yard lights, shrubs, fences, trees).
- 7) Construction access and haul routes.

3.02 – 3.10 NOT USED

END OF SECTION

Section 01325

CONSTRUCTION SCHEDULE

PART 1 GENERAL

1.01 SUMMARY

This Section includes the following:

- A. Provide Construction Schedules for Work included in Contract in accordance with requirements in this Section. Create Construction Schedule using Critical Path Method (CPM) computer software capable of mathematical analysis of Precedence Diagramming Method (PDM) plans. Provide printed activity listings and bar charts in formats described in this Section.
- B. Combine activity listings and bar charts with narrative report to form Construction Schedule submittal for Project Manager.

1.02 MEASUREMENT AND PAYMENT

No separate payment will be made for this item. Include the cost of construction scheduling in overhead cost for this project.

1.03 REFERENCES (NOT USED)

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. During preconstruction meeting, as described in Section 01312 – “Coordination and Meetings”, provide sample bar charts and activity listings produced from scheduling software proposed. Scheduling software is subject to review by Project Manager and must meet requirements provided in this Section.
- C. Within 10 days from the Effective Date of the Agreement, submit proposed Construction Schedule for review. Base Construction Schedule submittal on following:
  - 1. Level of detail and number of activities required in schedule are dependent on project type.
  - 2. For projects with multiple types of tasks within scope, indicate types of Work separately within schedule.

3. For projects with work at different physical locations or service areas, or different facilities within a site, indicate each location or facility separately within schedule.
  4. For projects with multiple crafts or significant subcontractor components, indicate elements separately within schedule. Unless permitted by Project Manager, tasks shall consist of work covered by only one division of Project Manual.
  5. Unless permitted by Project Manager, each scheduled task shall be same as Schedule of Values line item, and vice versa.
  6. For projects with significant major equipment items or materials representing over 5 percent of Total Contract Price, indicate shop drawing submittal and review, purchase, delivery, and installation dates. Include activities for testing, adjustment, and delivering O & M manuals.
  7. Duration of tasks may not exceed 30 calendar days.
  8. For projects where operating facilities are involved, identify each period of work which will impact any process or operation in schedule and must be agreed to by Project Manager and facility operator prior to starting work in area.
  9. Construction Schedule submittals shall include:
    - a. Color printed bar charts that meet criteria outlined in this Section and are produced by Contractor's approved scheduling software.
    - b. Activity listings that meet criteria outlined in this Section and are produced by Contractor's approved scheduling software.
    - c. Predecessor/successor listing sorted by Activity ID that meets criteria outlined in this Section and which is produced by Contractor's scheduling software.
    - d. A logic network diagram is required with first Construction Schedule submittal.
    - e. Narrative Report that provides information outlined in this Section.
- D. No payment will be made until Construction Schedule has been accepted by Project Manager.
- E. If Contractor desires to make changes in his method of operating and scheduling, after original schedule has been reviewed by Project Manager, notify Project Manager in writing, stating reasons for changes. When Project Manager considers these changes



to be significant, Contractor may be required to revise and resubmit for review all or affected portion of Contractor's Construction Schedule to show effect on Work.

- F. Upon written request from Project Manager, revise and submit for review all or any part of Construction Schedule submittal to reflect changed conditions in Work or deviations made from original plan and schedule.
- G. Updated Construction Schedule with Actual Start and Actual Finish Dates, Percent Complete, and Remaining Duration of each Activity shall be submitted monthly. Data date used in updating monthly Construction Schedule shall be same date as is used in monthly Payment Application. This monthly update of schedule shall be required before monthly Payment Application will be processed for payment.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01312 – “Coordination and Meetings”
- B. Section 01330 – “Submittal Procedures”

#### 1.06 – 1.11 NOT USED

#### 1.12 SCHEDULING

- A. Scheduling Staff

Employ or retain services of individual experienced in critical path scheduling for duration of Contract. Individual shall cooperate with Project Manager and update schedule monthly as required to indicate current status of Work.

- B. Scheduling Computer Software Requirements

1. Create Contractor's Construction Schedule using CPM computer software that provides mathematical analysis of PDM plans. Use software capable of creating bar charts and activity listings which can be sorted by various fields, i.e., Sort by Activity ID; Sort by Early Start; Sort by Total Float. Use software capable of producing logic network diagram.
2. Use PDM scheduling software capable of producing activity listings and bar charts with following information for each activity in schedule:
  - a. Activity ID
  - b. Activity Description
  - c. Estimated (Original) Duration
  - d. Remaining Duration

- e. Actual Duration
  - f. Early Start Date
  - g. Late Start Date
  - h. Early Finish Date
  - i. Late Finish Date
  - j. Free Float
  - k. Total Float
  - l. Activity Codes (such as Work Type, Specification Section, Subcontractor)
- 3. Use PDM scheduling software capable of printing calendars using mathematical analysis of schedule, indicating standard work days of week and scheduled holidays.
  - 4. Use Scheduling software capable of printing activity listing that indicates Predecessors and Successors, Lag Factors and Lag Relationships used in creating logic of schedule.
  - 5. Use scheduling software to provide monthly time in Bar Chart Format and scale with 12-month scale not to exceed one page width. Bar charts may be printed or plotted on 11x17 inch sheet size. Over-size plots are not acceptable.
- C. Narrative Schedule Report
- 1. Narrative Schedule Report shall list Activities Started This Month; Activities Completed This Month; Activities Continued This Month; Activities Scheduled To Start or Complete Next Month; Problems Encountered This Month; Actions Taken to Solve These Problems.
  - 2. Narrative Schedule Report shall describe changes made to Construction Schedule Logic (i.e., changes in Predecessors and Lags); Activities Added to Schedule; Activities Deleted from Schedule; any other changes made to Schedule other than addition of Actual Start Dates and Actual Finish Dates and changes of Data Date and Remaining Durations for recalculation of mathematical analysis.

### 1.13 WARRANTY (NOT USED)

### PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

## Section 01326

## CONSTRUCTION SCHEDULE (BAR CHART)

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

Provide initial Construction Schedule as required by this section for Work. Do not start construction until schedule is reviewed by Project Manager.

## 1.02 MEASUREMENT AND PAYMENT

No payment will be made for this item. Include the cost of construction scheduling in overhead cost for this project.

## 1.03 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, chlorination, clean up and punch out as separate activities on schedule.
2. Show week duration for activities.
3. Show separate activities for each shop drawing and product data submittal critical to timely completion. Show submission dates and dates approved submittals will be needed from Project Manager.
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 work day of each week.
6. Scale and Spacing: Notes must be legible. 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. List activities in chronological order within each phase or group.

## B. Narrative Description:

Submit Narrative Description of anticipated work sequence as indicated by sequence of activities presented in schedule.

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

#### 1.04 PROGRESS REVISIONS

- A. Submit Progress Revisions or necessary information to complete and process Payment Application. When required, resubmittal for rejected revision must be submitted and reviewed prior to following month's processing of Payment Application. Following month's Payment Application will not be processed until resubmittal is reviewed and required Progress Revisions received.
- B. Provide Narrative Report to describe:
  - 1. Major changes in scope.
  - 2. Revised projections in progress, completion, or changes in activity duration.
  - 3. Other identifiable changes.
  - 4. Problem areas, anticipated delays, and impact on schedule.
  - 5. Corrective action recommended and its effect.
  - 6. Effect of changes on schedules or other prime contractors.
  - 7. Material delivery lead times.
- C. Include additional data with Bar Chart described in Paragraph 1.03A of this section:
  - 1. Show original dates for each activity in approved initial progress schedule by narrow bar next to wider bar for current schedule.
  - 2. Show date each activity actually started or finished when event has occurred. Clearly identify actual dates in two right-most columns in left portion of 11- by 17-inch chart.
  - 3. Indicate percentage progress to date of submission for each activity.

#### 1.05 SUBMITTALS

- A. Submit initial progress schedule within 15 days after award of contract. Project Manager will review schedule and return copy within 21 days after receipt.
- B. Progress revisions cut-off date may be as early as twentieth of month to avoid delaying processing of Payment Application. Use cut-off day for first approved revision for all revisions.
- C. When required, resubmit within 7 days after return of review copy.

- D. Include in schedule connecting lines between bars to indicate sequence that activities will be accomplished. Impact will be known by corresponding changes to preceding or succeeding activities identified by connecting lines when activity's start or finish is modified. Submit minimum of six copies of bar chart on 11- by 17-inch opaque reproductions. Five copies will be retained by Project Manager and remaining copy will be returned.

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 GENERAL**

**1.01 SUMMARY**

This Section includes submittal procedures for the following:

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 Photographs
7. Project Record Documents and monthly certification
8. Design Mixes
9. Video Tapes

**1.02 – 1.03 NOT USED**

**1.04 SUBMITTALS**

**A. Scheduling and Handling:**

1. Submit shop drawings, data, and samples for related components as required by Specifications.
2. Schedule submittals well in advance of need for material or equipment for construction. Allow time to make delivery of material or equipment after submittal is approved.
3. Develop submittal schedule that allows a minimum of 30 days for initial review, correction, resubmission, and final review of all submittals. Project Manager will review and return submittals to Contractor as expeditiously as possible but amount of time required for review will vary depending on complexity and quantity of data submitted. This time for review is not justification for delays or additional compensation to Contractor.

4. Project Manager's review of submittals covers only general conformity to Plans, Specifications and dimensions that affect layout. Contractor is responsible for quantity determination. No quantities will be verified by Project Manager. Contractor is responsible for errors, omissions, or deviations from Contract requirements; review of submittals in no way relieves Contractor from the obligation to furnish required items according to Plans and Specifications.
5. Submit documents to the Owner's SharePoint site unless otherwise specified in Specifications.
6. Revise and resubmit submittals as required. Identify all changes made since previous submittal.
7. Assume risk for material or equipment which is fabricated or delivered prior to approval. No material or equipment shall be incorporated into Work or included in periodic progress payments until approval has been obtained in specified manner.

B. Transmittal Form and Numbering:

1. Transmit each submittal to Project Manager with Transmittal letter which includes:
  - a. Date and submittal number
  - b. Project title and number
  - c. Names of Contractor, Subcontractor, Supplier, and Manufacturer
  - d. Identification of product or material being supplied
  - e. Location of where product or material is being installed
  - f. Applicable Specification section number(s)
  - g. Statement if submittal meets Specifications or contains deviations
2. Identification of deviations from contract documents must be clouded on submitted drawings, and itemized and detailed on separate 8½- by 11-inch sheet titled "DEVIATIONS FOR \_\_\_\_\_."
3. Design deviations must be signed and sealed by Professional Engineer registered in State of Texas.



4. Sequentially number each transmittal letter beginning with number 1. Resubmittals use original number with numeric suffix (e.g., 2.1 for first resubmittal of Submittal 2 or 2.2 for second resubmittal of Submittal 2). Each submittal shall only contain one type of work, material, or equipment. Mixed submittals will not be accepted.

C. Submittal Response:

1. Submittal will be returned marked “ACKNOWLEDGE RECEIPT” when no response is required. Resubmittal is not required.
2. Submittal will be returned marked “NO EXCEPTION” when sufficient information is supplied to determine item described is equal to that specified. Resubmittal is not required.
3. Submittal will be returned marked “EXCEPTIONS AS NOTED” when sufficient information is supplied to determine that item will be acceptable when certain changes are made. Changes, or exceptions, will be clearly stated by the Engineer who shall indicate if a resubmittal is required.
4. When submittal does not contain sufficient information or when information provided does not meet contract requirements, submittal will be returned “REJECTED-RESUBMIT.” Additional data or details as requested by Project Manager for approval must be formulated and resubmitted as required.

D. Schedule of Values

Submit Schedule of Values in accordance with Section 01292 – “Schedule of Values”.

E. Construction Schedules

Submit Construction Schedules in accordance with Section 01325 – “Construction Schedule”.

F. Shop Drawings, Product Data, and Samples

Submit shop drawings in accordance with Section 01340 – “Shop Drawings, Product Data, and Samples”.

G. Operations and Maintenance Data

Submit Operations and Maintenance data in accordance with Section 01782 – “Operations and Maintenance Data”.

H. Manufacturer’s Certificates

1. When specified in Specification sections, submit manufacturers' certificate of compliance for review by Project Manager.
  2. Submit supporting reference data, affidavits, and certifications as appropriate.
  3. Certificates may be recent or previous test results on material or product, but must be acceptable to Project Manager.
- I. Construction Photographs
- Submit Construction Photographs in accordance with Section 01321 – "Construction Photographs".
- J. Project Record Documents
- Submit Project Record Documents in accordance with Section 01785 – "Project Record Documents".
- K. Design Mixes
1. When specified in Specifications, submit design mixes for review.
  2. Mark each design mix to identify proportions, gradations, and additives for each class and type of design mix submitted. Include applicable test results on samples for each mix. All tests and certifications shall have been performed within the last 12 months prior to date of submittal
  3. Maintain copy of approved design mixes at mixing plant
- L. Non-Inclusive Submittal List
1. See entire Specification Section 01292 – "Schedule of Values"
  2. See entire Specification Section 01330 – "Submittal Procedures"
  3. Construction Photographs (ref. Section 01321 – "Construction Photographs")
  4. Design of temporary utility relocations and permanent relocations initiated by Contractor
  5. Potentially petroleum contaminated material, if applicable
  6. Tree and shrub protection and name and experience of qualified tree surgeon (ref. Section 01562 – "Tree and Plant Protection")

7. Groundwater control for open cut excavation (ref. Section 01578 – “Control of Ground Water and Surface Water”)
8. Traffic control plan (ref. Section 01555 – “Traffic Control and Regulation”)
9. Project record documents (ref. Section 01785 – Project Record Documents”)
10. Operation and maintenance information (ref. Section 01782 – “Operations and Maintenance Data”)
11. Potential obstruction report (ref. Section 02317 – “Excavation and Backfill for Utilities”)
12. Hot-mix asphaltic base (ref. Section 02711 – “Hot Mix Asphalt Base Course”)
13. Geotextile (ref. Section 02621 – “Geotextile”)
14. Tunnel shafts (ref. Section 02400 – “Tunnel Shafts”)
15. All items listed in Section 02425 – “Tunnel Excavation and Primary Liner”
16. Auger pits (ref. Section 02447 – “Augering Pipe and Conduit”)
17. Tunneling grout (ref. Section 02431 – “Tunnel Grout”)
18. Asphaltic concrete paving (ref. Section 02741 – “Asphaltic Concrete Pavement”)
19. Concrete paving (ref. Section 03002 – “Concrete Pavement”)
20. Temporary and removable reflectorized pavement markings (ref. Section 02765 – “Temporary and Removable Reflectorized Pavement Markings”)
21. Manholes (ref. Section 02081 – “Cast-In-Place Concrete Manholes”, Section 02082 – “Precast Concrete Manholes”, and Section 02084 – “Frames, Grates, Rings and Covers”)
22. Ductile iron pipe (ref. Section 02501 – “Ductile Iron Pipe and Fittings”)
23. Steel pipe (ref. Section 02502 – “Steel Pipe and Fittings” and Section 02518 – “Steel Pipe and Fittings for large Diameter Water Lines”)
24. Pretensioned and prestressed concrete cylinder pipe (ref. Section 02613 – “Bar-Wrapped Steel Cylinder Pipe” and Section 02507 – “Prestressed Concrete Cylinder Pipe”)

25. PVC pipe (ref. Section 02506 – “Polyvinyl Chloride Pipe”)
26. Water main in tunnels or casings (ref. Section 02517 – “Water Line in Tunnels”)
27. Blocking pipe in tunnel (ref. Section 02517 – “Water Line in Tunnels”)
28. Polyurethane coatings on steel pipe, if applicable (ref. Section 02527 – “Polyurethane Coatings on Steel Pipe”)
29. Valves and appurtenances (ref. Section 02521 – “Gate Valves”, Section 02522 – “Butterfly Valves”, Section 02523 – “Pressure Reducing Valves”, and Section 02524 – “Air Release and Vacuum Relief Valves”)
30. Cathodic protection systems (ref. Section 16640 – “Cathodic Protection for Pipelines”)
31. Concrete for utility construction (ref. Section 03315 – “Concrete for Utility Construction”)
32. Miscellaneous metals

#### 1.05 RELATED REQUIREMENTS

- A. Section 01292 – “Schedule of Values”
- B. Section 01321 – “Construction Photographs”
- C. Section 01325 – “Construction Schedule”
- D. Section 01330 – “Submittal Procedures”
- E. Section 01340 – “Shop Drawings, Product Data, and Samples”
- F. Section 01555 – “Traffic Control and Regulation”
- G. Section 01562 – “Tree and Plant Protection”
- H. Section 01578 – “Control of Ground Water and Surface Water”
- I. Section 01782 – “Operations and Maintenance Data”
- J. Section 01785 – “Project Record Documents”
- K. Section 02081 – “Cast-In-Place Concrete Manholes”
- L. Section 02082 – “Precast Concrete Manholes”

- M. Section 02084 – “Frames, Grates, Rings and Covers”
- N. Section 02317 – “Excavation and Backfill for Utilities”
- O. Section 02400 – “Tunnel Shafts”
- P. Section 02425 – “Tunnel Excavation and Primary liner”
- Q. Section 02431 – “Tunnel Grout”
- R. Section 02447 – “Augering Pipe and Conduit”
- S. Section 02501 – “Ductile Iron Pipe and Fittings”
- T. Section 02502 – “Steel Pipe and Fittings”
- U. Section 02506 – “Polyvinyl Chloride Pipe”
- V. Section 02507 – “Prestressed Concrete Cylinder Pipe”
- W. Section 02517 – “Water Line in Tunnels”
- X. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”
- Y. Section 02521 – “Gate Valves”
- Z. Section 02522 – “Butterfly Valves”
- AA. Section 02523 – “Pressure Reducing Valves”
- BB. Section 02524 – “Air Release and Vacuum Relief Valves”
- CC. Section 02527 – “Polyurethane Coatings on Steel Pipe”
- DD. Section 02613 – “Bar-Wrapped Steel Cylinder Pipe”
- EE. Section 02621 – “Geotextile”
- FF. Section 02711 – “Hot Mix Asphalt Base Course”
- GG. Section 02741 – “Asphaltic Concrete Pavement”
- HH. Section 02765 – “Temporary and Removable Reflectorized Pavement Markings”
- II. Section 03002 – “Concrete Pavement”
- JJ. Section 03315 – “Concrete for Utility Construction”

KK. Section 11303 – “Chemical Analyzers”

LL. Section 16640 – “Cathodic Protection for Pipelines”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01340

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 GENERAL

1.01 SUMMARY

This Section includes methods, schedule, and process followed for Shop Drawings, Product Data, and Sample submittals.

1.02 – 1.03 NOT USED

1.04 SUBMITTALS

A. Requirement

1. Submit Shop Drawings, Product Data and Samples as required by Document 00700 – “General Conditions” and as designated in Specifications using procedures specified in Section 01330 – “Submittal Procedures” and requirements of this Section.
2. Shop Drawings, Product Data, and Samples are not considered Contract Documents.
3. Registered Professional Engineer licensed by State of Texas must sign and seal designed deviations from Contract Documents.

B. Shop Drawing/Submittal Schedule

Submit separate Shop Drawing/Submittal schedule at same time 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 Specifications. Include product data and sample submittals in schedule. Application for payment will not be processed until schedule of Shop Drawing submittals is approved by Project Manager.

C. Shop Drawings

1. Submit Shop Drawings as described in Section 01330 – “Submittal Procedures”.
2. Show the following accurately and distinctly.
  - a. Field and erection dimensions
  - b. Arrangement and section views

- c. Relation to adjacent materials or structure, including complete information for making connections between Work under this Contract and work under other contracts
  - d. Types of materials and finishes
  - e. Parts list and descriptions
  - f. Assembly drawings of equipment components and accessories showing respective positions and relationships to complete equipment package
  - g. Identify details by reference to drawing sheet and detail numbers, schedule or room numbers as shown on Plans where necessary for clarity.
- 3. Scale Shop Drawings to provide true representation of specific equipment or item furnished.
- 4. Coordinate and submit components, necessary for Engineer to adequately review submittal, as complete package. Reproduction of Plans for use of shop drawings is not allowed.
- 5. For major changes to original documents, submit CAD drawings.
- D. Product Data
  - 1. Submit Product Data for review as required in Specification sections.
  - 2. Submit in accordance with Section 01330 – “Submittal Procedures”.
  - 3. 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 Specifications.
  - 4. Give manufacturers’ trade name, model, or catalog designation and applicable reference standard for Products specified only by reference standard.
  - 5. Submit revised data and samples for resubmittal in manner required for initial submission.
- E. Samples
  - 1. Submit Samples for review as required by Specifications.
  - 2. Submit in accordance with Section 01330 – “Submittal Procedures”.



3. Submit number of Samples specified in Specifications; one will be retained by Project Manager.
4. Reviewed Samples that may be used in Work are identified in Specifications.
5. Provide mark up as identified in Specifications.

1.05 RELATED REQUIREMENTS

- A. Document 00700 – “General Conditions”
- B. Section 01330 – “Submittal Procedures”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01410

TPDES REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR150000 issued February 19, 2013 and effective on March 5, 2013 (the Construction General Permit) or its latest version.
- B. Implementation, maintenance inspection, and termination of stormwater pollution prevention control measures including, but not limited to, erosion and sediment controls, stormwater management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Plans or specified elsewhere in the Contract.
- C. Review of the Stormwater Pollution Prevention Plan (SWP3) implementation in a meeting with Project Manager prior to start of construction

1.02 MEASUREMENT AND PAYMENT

Measure and pay for pollution prevention implementation, including maintenance, inspections, and reporting for all pollution prevention measures on a per month basis not to exceed the BID Unit Quantity.

1.03 – 1.09 NOT USED

1.10 DEFINITIONS

- A. Commencement of Construction Activities: The disturbance of soil resulting from activities such as clearing, grading, and excavating.
- B. Large Construction Activity: Project that:
  - 1. Disturbs 5 acres or more, or
  - 2. Disturbs less than 5 acres but is part of a larger common plan of development that will disturb 5 acres or more of land.
- C. Small Construction Activity: Project that:

1. Disturbs 1 or more acres but less than 5 acres, or
2. Disturbs less than 1 acre but is part of a larger common plan of development that will ultimately disturb 1 or more acres but less than 5 acres.

D. TPDES Operator:

The person or persons who have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

1.11 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S)

A. Site Specific Stormwater Pollution Prevention Plan (SWP3)

1. Prepare a SWP3 following Part III of the Construction General Permit, the Regulations of Harris County, Texas for Storm Water Quality, and the Storm Water Management Handbook for Construction Activities issued by Harris County. If conflicts exist between the Construction General Permit, the Harris County regulations, and the handbook, the more stringent requirements will apply.
2. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.
3. Submit the SWP3 and any updates or revisions to Project Manager for review and address comments prior to commencing, or continuing, construction activities

B. Notice of Intent for Large Construction Activity

1. Fill out, sign, and date TCEQ Form 20022 (03/05/2013 or its latest version) Notice of Intent (NOI) for Stormwater Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR150000). An example of this form is shown in ATTACHMENT 1 of this Section 01410.
2. Submit the Notice of Intent by one of the following methods:

- a. Submit online at TCEQ ePermits (<https://www3.tceq.texas.gov/steers>) and pay the application fee. Transmit a copy of the electronic certificate provided by TCEQ to Project Manager.
    - b. Send a \$325 check and completed TCEQ Form 20022 (03/05/2013 or its latest version) to the Texas Commission on Environmental Quality. Transmit a copy of the check and completed form to Project Manager.
  3. Project Manager will complete a separate Owner's copy of TCEQ Form 20022 (03/05/2013 or its latest version) for NOI, and will submit Notice, along with application fee, to the TCEQ.
  4. Submission of the Notice of Intent form by Contractor to TCEQ is required a minimum of 7 days before Commencement of Construction Activities.
- C. Construction Site Notice for Large and Small Construction Activity
1. Based on the type of construction site (Large or Small) and the Contractor's role (Primary or Secondary) fill out, sign, and date the appropriate Construction Site Notice, for the TPDES General Permit TXR150000. An example of the "Large Construction Site Notice" for the Primary Operator is shown in ATTACHMENT 2-1 of this Section 01410; an example of the "Large Construction Site Notice" for the Secondary Operator is shown in ATTACHMENT 2-2; an example of the "Small Construction Site Notice" is shown in ATTACHMENT 2-3.
  2. Transmit the signed Construction Site Notice to Project Manager at least 7 days prior to Commencement of Construction Activity.
- D. Certification Requirements
1. Fill out TPDES Operator's Information form, ATTACHMENT 3 of this Section 01410, including Contractor's name, address, and telephone number and the names of persons or firms responsible for maintenance and inspection of erosion and sediment control measures. Use multiple copies as required to document full information.
  2. Contractor and Subcontractors shall sign and date the Contactor's/Subcontractor's Certification for TPDES Permitting, an example of which is shown in ATTACHMENT 4 of this Section 01410. Include this certification with other Project certification forms.
  3. Submit properly completed certification forms to Project Manager for review before beginning construction operations.

4. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the EPA NPDES Construction Inspection Form, an example of which is shown in ATTACHMENT 5 of this Section 01410; to record maintenance inspections and repairs.

E. Retention of Records

Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Stormwater Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to Project Manager.

F. Required Notices

Post the following notices from the effective date of the SWP3 until the date of final site stabilization as defined in the Construction General Permit:

1. Post the "Primary Operator" Notice and a copy of the signed Contractor's NOI and signed "Secondary Operator" Notices for Large Construction sites. For small construction sites, post a copy of the TCEQ Construction Site Notice for Small Construction Activity. The site notices must include the name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
2. Post notices near the main entrance of the construction site in a prominent place for public viewing.
  - a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with Project Manager to conform to requirements of the Construction General Permit.
  - b. If Project is a linear construction project (e.g., road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.

4. Post a notice of waste disposal procedures in a readily visible location on site.

G. On-Site Waste Material Storage

1. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.
2. Prepare a list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.
3. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to stormwater, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

H. Notice of Termination (NOT)

1. Submit a NOT, an example of which is shown in ATTACHMENT 6 of this Section 01410, to Project Manager within 10 days after:
  - a. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
  - b. Another operator has assumed control over all areas of the site that have not been stabilized; and
  - c. All silt fences and other temporary erosion controls have either been removed scheduled to be removed as defined in the SWP3, or transferred to a new operator, if the new operator has sought permit coverage.
2. Project Manager will complete NOT and submit Contractor's notices to the TCEQ and MS4 entities.

3.02 – 310 Not Used

ATTACHMENT 1

**TCEQ Office Use Only**

Permit No.:

RN:

CN:

Region:

**RESET FORM**



**TCEQ Notice of Intent (NOI) for Stormwater Discharges  
Associated with Construction Activity under TPDES  
General Permit (TXR150000)**

**IMPORTANT:**

- Use the [INSTRUCTIONS](#) to fill out each question in this form.
- Use the [CHECKLIST](#) to make certain all you filled out all required information. Incomplete applications **WILL** delay approval or result in automatic denial.
- Once processed your permit can be viewed at:  
[http://www2.tceq.texas.gov/wq\\_dpa/index.cfm](http://www2.tceq.texas.gov/wq_dpa/index.cfm)

**ePERMITS:** Sign up now for online NOI: <https://www3.tceq.texas.gov/steers/index.cfm>  
Pay a \$225 reduced application fee by using ePermits.

**APPLICATION FEE:**

- You must pay the **\$325** Application Fee to TCEQ for the paper application to be complete.
- Payment and NOI must be mailed to separate addresses.
- Did you know you can pay on line?
  - Go to <https://www3.tceq.texas.gov/epay/index.cfm>
  - Select Fee Type: GENERAL PERMIT CONSTRUCTION STORM WATER DISCHARGE NOI APPLICATION
- **Provide your payment information below, for verification of payment:**

☐ Mailed Check/Money Order No.: \_\_\_\_\_  
Name Printed on Check: \_\_\_\_\_  
☐ EPAY Voucher No.: \_\_\_\_\_  
Is the Payment Voucher copy attached? ☐ Yes

**RENEWAL: Is this NOI a Renewal of an existing General Permit Authorization?**  
**(Note: A permit cannot be renewed after June 3, 2013.)**

☐ Yes The Permit number is: TXR15 \_\_\_\_\_  
**(If a permit number is not provided, a new number will be assigned.)**  
☐ No

**1) OPERATOR (Applicant)**

- a)** If the applicant is currently a customer with TCEQ, what is the Customer Number (CN) issued to this entity? You may search for your CN at:  
<http://www12.tceq.texas.gov/crpub/index.cfm?fuseaction=cust.CustSearch>

CN \_\_\_\_\_

ATTACHMENT 1

- b) What is the Legal Name of the entity (applicant) applying for this permit?

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal document forming the entity.)

- c) What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in TAC 305.44(a).

Prefix (Mr. Ms. Miss): \_\_\_\_\_

First/Last Name: \_\_\_\_\_ Suffix: \_\_\_\_\_

Title: \_\_\_\_\_ Credential: \_\_\_\_\_

- d) What is the Operator Contact's (Responsible Authority) contact information and mailing address as recognized by the US Postal Service (USPS)? You may verify the address at:

<http://zip4.usps.com/zip4/welcome.jsp>

Phone #: \_\_\_\_\_ ext: \_\_\_\_\_ Fax #: \_\_\_\_\_

E-mail: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Internal Routing (Mail Code, Etc.): \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP Code: \_\_\_\_\_

If outside USA: Territory: \_\_\_\_\_ Country Code: \_\_\_\_\_ Postal Code: \_\_\_\_\_

- e) Indicate the type of Customer (The instructions will help determine your customer type):

<input type="checkbox"/> Individual	<input type="checkbox"/> Limited Partnership	<input type="checkbox"/> Sole Proprietorship-DBA
<input type="checkbox"/> Joint Venture	<input type="checkbox"/> General Partnership	<input type="checkbox"/> Corporation
<input type="checkbox"/> Trust	<input type="checkbox"/> Estate	<input type="checkbox"/> Federal Government
<input type="checkbox"/> State Government	<input type="checkbox"/> County Government	<input type="checkbox"/> City Government
<input type="checkbox"/> Other Government		

- f) Independent Operator? ☐ Yes ☐ No

(If governmental entity, subsidiary, or part of a larger corporation, check "No".)

- g) Number of Employees:

☐ 0-20; ☐ 21-100; ☐ 101-250; ☐ 251-500; or ☐ 501 or higher

- h) Customer Business Tax and Filing Numbers:

(REQUIRED for Corporations and Limited Partnerships. Not Required for Individuals, Government, or Sole Proprietors)

State Franchise Tax ID Number: \_\_\_\_\_

Federal Tax ID: \_\_\_\_\_

Texas Secretary of State Charter (filing) Number: \_\_\_\_\_

DUNS Number (if known): \_\_\_\_\_

**2) APPLICATION CONTACT**

If TCEQ needs additional information regarding this application, who should be contacted?

Is the application contact the same as the applicant identified above?

☐ Yes, go to Section 3). ☐ No, complete section below.

Prefix (Mr. Ms. Miss): \_\_\_\_\_

First/Last Name: \_\_\_\_\_ Suffix: \_\_\_\_\_

Title: \_\_\_\_\_ Credential: \_\_\_\_\_



ATTACHMENT 1

Organization Name: \_\_\_\_\_  
Phone No.: \_\_\_\_\_ ext: \_\_\_\_\_ Fax Number: \_\_\_\_\_  
E-mail: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
Internal Routing (Mail Code, Etc.): \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ ZIP Code: \_\_\_\_\_  
Mailing Information if outside USA:  
Territory: \_\_\_\_\_ Country Code: \_\_\_\_\_ Postal Code: \_\_\_\_\_

**3) REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE**

If the site of your business is part of a larger business site or if other businesses were located at this site before yours, a Regulated Entity Number (RN) may already be assigned for the larger site. Use the RN assigned for the larger site. Search TCEQ's Central Registry to see if the larger site may already be registered as a regulated site at:  
<http://www12.tceq.texas.gov/crpub/index.cfm?fuseaction=regent.RNSearch>.

If the site is found, provide the assigned Regulated Entity Reference Number and provide the information for the site to be authorized through this application below. The site information for this authorization may vary from the larger site information.

- a) TCEQ issued RE Reference Number (RN):      RN \_\_\_\_\_
- b) Name of project or site (the name known by the community where located):  
\_\_\_\_\_
- c) In your own words, briefly describe the primary business of the Regulated Entity: (Do not repeat the SIC and NAICS code):  
\_\_\_\_\_
- d) County (or counties if > 1) \_\_\_\_\_
- e) Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_
- f) Does the site have a physical address?  
☐ Yes, complete Section A for a physical address.  
☐ No, complete Section B for site location information.

**Section A:** Enter the physical address for the site.

Verify the address with USPS. If the address is not recognized as a delivery address, provide the address as identified for overnight mail delivery, 911 emergency or other online map tools to confirm an address.

Physical Address of Project or Site:

Street Number: \_\_\_\_\_ Street Name: \_\_\_\_\_  
City: \_\_\_\_\_ State: Texas ZIP Code: \_\_\_\_\_

ATTACHMENT 1

**Section B:** Enter the site location information.

If no physical address (Street Number & Street Name), provide a written location access description to the site. (Ex.: located 2 miles west from intersection of Hwy 290 & IH35 accessible on Hwy 290 South)

City where the site is located or, if not in a city, what is the nearest city:

State: Texas ZIP Code where the site is located: \_\_\_\_\_

**4) GENERAL CHARACTERISTICS**

- a)** Is the project/site located on Indian Country Lands?  
☐ Yes - If the answer is Yes, you must obtain authorization through EPA, Region 6.  
☐ No
- b)** Is your construction activity associated with a facility that, when completed, would be associated with the exploration, development, or production of oil or gas or geothermal resources?  
☐ Yes - If the answer is Yes, you may be under jurisdiction of the Railroad Commission of Texas and may need to obtain authorization through EPA, Region 6.  
☐ No
- c)** What is the Primary Standard Industrial Classification (SIC) Code that best describes the construction activity being conducted at the site?  
Primary SIC Code: \_\_\_\_\_
- d)** If applicable, what is the Secondary SIC Code(s): \_\_\_\_\_
- e)** What is the total number of acres disturbed? \_\_\_\_\_
- f)** Is the project site part of a larger common plan of development or sale?  
☐ Yes - If the answer is Yes, the total number of acres disturbed can be less than 5 acres.  
☐ No - If the answer is No, the total number of acres disturbed must be 5 or more. If the total number of acres disturbed is less than 5 then the project site does not qualify for coverage through this Notice of Intent. Coverage will be denied. See the requirements in the general permit for small construction sites.
- g)** What is the name of the first water body(s) to receive the stormwater runoff or potential runoff from the site?  
\_\_\_\_\_
- h)** What is the segment number(s) of the classified water body(s) that the discharge will eventually reach?  
\_\_\_\_\_

**ATTACHMENT 1**

**i) Is the discharge into an MS4?**

☐ Yes - If the answer is Yes, provide the name of the MS4 operator below.

☐ No

If Yes, provide the name of the MS4 operator:

Note: The general permit requires you to send a copy of the NOI to the MS4 operator.

**j) Are any of the surface water bodies receiving discharges from the construction site on the latest EPA-approved CWA 303(d) List of impaired waters?**

☐ Yes - If the answer is Yes, provide the name(s) of the impaired water body(s) below.

☐ No

If Yes, provide the name(s) of the impaired water body(s):

**k) Is the discharge or potential discharge within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer as defined in 30 TAC Chapter 213?**

☐ Yes - If the answer is Yes, complete certification below by checking "Yes."

☐ No

I certify that a copy of the TCEQ approved Plan required by the Edwards Aquifer Rule (30 TAC Chapter 213) is either included or referenced in the Stormwater Pollution Prevention Plan.

☐ Yes

ATTACHMENT 1

**5) CERTIFICATION**

Check Yes to the certifications below. Failure to indicate Yes to **ALL** items may result in denial of coverage under the general permit.

- a) I certify that I have obtained a copy and understand the terms and conditions of the Construction General Permit (TXR150000). ☐ Yes
- b) I certify that the full legal name of the entity applying for this permit has been provided and is legally authorized to do business in Texas. ☐ Yes
- c) I understand that a Notice of Termination (NOT) must be submitted when this authorization is no longer needed. ☐ Yes
- d) I certify that a Stormwater Pollution Prevention Plan has been developed, will be implemented prior to construction and to the best of my knowledge and belief is compliant with any applicable local sediment and erosion control plans, as required in the general permit TXR150000. Note: For multiple operators who prepare a shared SWP3, the confirmation of an operator may be limited to its obligations under the SWP3 provided all obligations are confirmed by at least one operator. ☐ Yes

**Operator Certification:**

I, \_\_\_\_\_  
Typed or printed name Title

certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code 305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
(Use blue ink)

ATTACHMENT 1

**NOTICE OF INTENT CHECKLIST (TXR150000)**

- Did you complete everything? Use this checklist to be sure!
- Are you ready to mail your form to TCEQ? Go to the General Information Section of the Instructions for mailing addresses.

This checklist is for use by the operator to ensure a complete application. Missing information may result in denial of coverage under the general permit. (See NOI process description in the Instructions)

**Application Fee:**

If paying by Check:

- ☐ Check was mailed **separately** to the TCEQs Cashier's Office. (See Instructions for Cashier's address and Application address.)
- ☐ Check number and name on check is provided in this application.

If using ePay:

- ☐ The voucher number is provided in this application or a copy of the voucher is attached.

**PERMIT NUMBER:**

- ☐ Permit number provided – if this application is for renewal of an existing authorization.

**OPERATOR INFORMATION - Confirm each item is complete:**

- ☐ Customer Number (CN) issued by TCEQ Central Registry
- ☐ Legal name as filed to do business in Texas (Call TX SOS 512/463-5555)
- ☐ Name and title of responsible authority signing the application
- ☐ Mailing address is complete & verifiable with USPS. [www.usps.com](http://www.usps.com)
- ☐ Phone numbers/e-mail address
- ☐ Type of operator (entity type)
- ☐ Independent operator
- ☐ Number of employees
- ☐ For corporations or limited partnerships – Tax ID and SOS filing numbers
- ☐ Application contact and address is complete & verifiable with USPS. <http://www.usps.com>

**REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE - Confirm each item is complete:**

- ☐ Regulated Entity Reference Number (RN) (if site is already regulated by TCEQ)
- ☐ Site/project name/regulating entity
- ☐ Latitude and longitude <http://www.tceq.texas.gov/gis/sqmapview.html>
- ☐ County
- ☐ Site/project physical address. Do not use a rural route or post office box.
- ☐ Business description

**GENERAL CHARACTERISTICS - Confirm each item is complete:**

- ☐ Indian Country Lands –the facility is not on Indian Country Lands
- ☐ Construction activity related to facility associated to oil, gas, or geothermal resources
- ☐ Standard Industrial Classification (SIC) Code [www.osha.gov/oshstats/sicser.html](http://www.osha.gov/oshstats/sicser.html)
- ☐ Acres disturbed is provided and qualifies for coverage through a NOI
- ☐ Common plan of development or sale
- ☐ Receiving water body(s)
- ☐ Segment number(s)
- ☐ Impaired water body(s)
- ☐ MS4 operator
- ☐ Edwards Aquifer rule

**CERTIFICATION**

- ☐ Certification statements have been checked indicating "Yes"
- ☐ Signature meets 30 Texas Administrative Code (TAC) 305.44 and is original.

ATTACHMENT 1

Notice of Intent (NOI) for Stormwater Discharges Associated with  
Construction Activity under TPDES General Permit  
(TXR150000)

General Information and Instructions

**GENERAL INFORMATION**

**Where to Send the Notice of Intent (NOI):**

BY REGULAR U.S. MAIL  
Texas Commission on  
Environmental Quality  
Stormwater Processing Center  
(MC228)  
P.O. Box 13087  
Austin, Texas 78711-3087

BY OVERNIGHT/EXPRESS MAIL  
Texas Commission on  
Environmental Quality  
Stormwater Processing Center  
(MC228)  
12100 Park 35 Circle  
Austin, TX 78753

**TCEQ Contact List:**

Application – status and form questions:	512/239-3700, <a href="mailto:supermit@tceq.texas.gov">supermit@tceq.texas.gov</a>
Technical questions:	512/239-4671, <a href="mailto:swgp@tceq.texas.gov">swgp@tceq.texas.gov</a>
Environmental Law Division:	512/239-0600
Records Management - obtain copies of forms:	512/239-0900
Reports from databases (as available):	512/239-DATA (3282)
Cashier's office:	512/239-0357 or 512/239-0187

**Notice of Intent Process:**

When your NOI is received by the program, the form will be processed as follows:

- 1) **Administrative Review:** Each item on the form will be reviewed for a complete response. In addition, the operator's legal name must be verified with Texas Secretary of State as valid and active (if applicable). The address(s) on the form must be verified with the US Postal service as receiving regular mail delivery. Never give an overnight/express mailing address.
- 2) **Notice of Deficiency:** If an item is incomplete or not verifiable as indicated above, a notice of deficiency (NOD) will be mailed to the operator. The operator will have 30 days to respond to the NOD. The response will be reviewed for completeness.
- 3) **Acknowledgment of Coverage:** An Acknowledgment Certificate will be mailed to the operator. This certificate acknowledges coverage under the general permit.  
-or-  
**Denial of Coverage:** If the operator fails to respond to the NOD or the response is inadequate, coverage under the general permit may be denied. If coverage is denied, the operator will be notified.

**General Permit (Your Permit)**

For NOIs submitted **electronically** through ePermits, provisional coverage under the general permit begins immediately following confirmation of receipt of the NOI form by the TCEQ.

For **paper** NOIs, provisional coverage under the general permit begins **7 days after a completed NOI is postmarked for delivery** to the TCEQ.

## ATTACHMENT 1

You should have a copy of your general permit when submitting your application. You may view and print your permit for which you are seeking coverage, on the TCEQ web site <http://www.tceq.texas.gov>. Search using key word TXR150000.

### General Permit Forms

The Notice of Intent (NOI), Notice of Termination (NOT), and Notice of Change (NOC) (including instructions) are available in Adobe Acrobat PDF format on the TCEQ web site <http://www.tceq.texas.gov>.

### Change in Operator

An authorization under the general permit is not transferable. If the operator of the regulated entity changes, the present permittee must submit a Notice of Termination and the new operator must submit a Notice of Intent. The NOT and NOI must be submitted no later than 10 days prior to the change in Operator status.

### TCEQ Central Registry Core Data Form

The Core Data Form has been incorporated into this form. Do not send a Core Data Form to TCEQ. After final acknowledgment of coverage under the general permit, the program will assign a Customer Number and Regulated Entity Number.

You can find the information on the Central Registry web site at <http://www12.tceq.texas.gov/crpub/index.cfm>. You can search by the Regulated Entity (RN), Customer Number (CN) or Name (Permittee), or by your permit number under the search field labeled "Additional ID". Capitalize all letters in the permit number.

The Customer (Permittee) is responsible for providing consistent information to the TCEQ, and for updating all CN and RN data for all authorizations as changes occur. For General Permits, a Notice of Change form must be submitted to the program area.

### Fees associated with a General Permit

Payment of the fee may be made by check or money order, payable to TCEQ, or through EPAY (electronic payment through the web).

**Application Fee:** This fee is required to be paid at the time the NOI is submitted. Failure to submit payment at the time the application is filed will cause delays in acknowledgment or denial of coverage under the general permit.

### Mailed Payments:

Payment must be mailed under separate cover at one of the addresses below using the attached Application Fee submittal form. (DO NOT SEND A COPY OF THE NOI WITH THE APPLICATION FEE SUBMITTAL FORM)

#### BY REGULAR U.S. MAIL

Texas Commission on Environmental Quality  
Financial Administration Division  
Cashier's Office, MC-214  
P.O. Box 13088  
Austin, TX 78711-3088

#### BY OVERNIGHT/EXPRESS MAIL

Texas Commission on Environmental Quality  
Financial Administration Division  
Cashier's Office, MC-214  
12100 Park 35 Circle  
Austin, TX 78753



## ATTACHMENT 1

**ePAY Electronic Payment:** <http://www.tceq.texas.gov/epay>

When making the payment you must select Water Quality, and then select the fee category "General Permit Construction Storm Water Discharge NOI Application". You must include a copy of the payment voucher with your NOI. Your NOI will not be considered complete without the payment voucher.

### INSTRUCTIONS FOR FILLING OUT THE NOI FORM

**Renewal of General Permit.** Dischargers holding active authorizations under the expired General Permit are required to submit a NOI to continue coverage. The existing permit number is required. If the permit number is not provided or has been terminated, expired, or denied a new permit number will be issued.

#### 1. Operator (Applicant)

##### a) Enter assigned Customer Number (CN)

TCEQ's Central Registry will assign each customer a number that begins with CN, followed by nine digits. **This is not a permit number, registration number, or license number.** If this customer has not been assigned a CN, leave the space for the CN blank. If this customer has already been assigned this number, enter the permittee's CN.

##### b) Legal Name

Provide the current legal name of the permittee, as authorized to do business in Texas. The name must be provided exactly as filed with the Texas Secretary of State (SOS), or on other legal documents forming the entity, that is filed in the county where doing business. You may contact the SOS at 512/463-5555, for more information related to filing in Texas. If filed in the county where doing business, provide a copy of the legal documents showing the legal name.

##### c) Person Signing Application

Provide information about person signing section 5) Certification.

##### d) Operator Contact's (Responsible Authority) Contact Information and Mailing Address

Provide a complete mailing address for receiving mail from the TCEQ. The address must be verifiable with the US Postal Service at <http://www.usps.com> for regular mail delivery (not overnight express mail). If you find that the address is not verifiable using the USPS web search, please indicate the address is used by the USPS for regular mail delivery.

The area code and phone number should provide contact to the operator. Leave Extension blank if not applicable.

The fax number and e-mail address are optional and should correspond to the operator.

##### e) Type of Customer (Entity Type)

Check only one box that identifies the type of entity. Use the descriptions below to identify the appropriate entity type. Note that the selected entity type also indicates the name that must be provided as an applicant for a permit, registration or authorization.



## ATTACHMENT 1

### **Sole Proprietorship – DBA**

A sole proprietorship is a customer that is owned by only one person and has not been incorporated. This business may:

- be under the person's name
- have its own name (doing business as or d.b.a.)
- have any number of employees

If the customer is a Sole Proprietorship or DBA, the 'legal name' of the individual business 'owner' must be provided. The DBA name is not recognized as the 'legal name' of the entity. The DBA name may be used for the site name (regulated entity).

### **Individual**

An individual is a customer who has not established a business, but conducts an activity that needs to be regulated by the TCEQ.

### **Partnership**

- A customer that is established as a partnership as defined by the Texas Secretary of State Office (TX SOS). A Limited Partnership or Limited Liability Partnership (Partnership) is required to file with the Texas Secretary of State. A General Partnership or Joint Venture is not required to register with the state.
- **Partnership (Limited Partnership or Limited Liability Partnership):** A limited partnership is defined in the Act as a partnership formed by two or more persons under the provisions of Section 3 of the Uniform Limited Partnership Act (Art. 6132a, Revised Civil Statutes of Texas) and having as members one or more general partners and one or more limited partners. The limited partners as such are not bound by the obligations of the partnership. Limited partners may not take part in the day-to-day operations of the business. A Limited Partnership must file with the Texas Secretary of State. A registered limited liability partnership is a general or limited partnership that is registered with the Texas Secretary of State. The partnership's name must contain the words "Registered Limited Liability Partnership" or the abbreviation "L.L.P." as the last words or letters of its name.
- **General Partnership:** A general partner may or may not invest, participates in running the partnership and is liable for all acts and debts of the partnership and any member of it. A General Partnership does not have limited partners. For a General Partnership, there is no registration with the state or even written agreement necessary for a general partnership to be formed. The legal definition of a partnership is generally stated as "an association of two or more persons to carry on as co-owners a business for profit" (Revised Uniform Partnership Act § 101 [1994]).
- **Joint Venture:** A joint venture is but another name for a special partnership. It might be distinguished from a general partnership in that the latter is formed for the transaction of a general business, while a joint venture is usually limited to a single transaction. That is, a joint venture is a special combination of persons in the nature of a partnership engaged in the joint prosecution of a particular transaction for mutual benefit or profit.

### **Corporation**

A customer meets all of these conditions:

- is a legally incorporated entity under the laws of any state or country
- is recognized as a corporation by the Texas Secretary of State

## ATTACHMENT 1

- has proper operating authority to operate in Texas.
- The corporation's 'legal name' as filed with the Texas Secretary of State must be provided as applicant. An 'assumed' name of a corporation is not recognized as the 'legal name' of the entity.

### **Government**

Federal, state, county, or city government (as appropriate)  
The customer is either an agency of one of these levels of government or the governmental body itself. The government agency's 'legal name' must be provided as the applicant. A department name or other description of the organization should not be included as a part of the 'legal name' as applicant.

### **Trust or Estate**

A trust and an estate are fiduciary relationships governing the trustee/executor with respect to the trust/estate property.

### **Other Government**

A utility district, water district, tribal government, college district, council of governments, or river authority. Write in the specific type of government.

### **f) Independent Entity**

Check No if this customer is a subsidiary, part of a larger company, or is a governmental entity. Otherwise, check Yes.

### **g) Number of Employees**

Check one box to show the number of employees for this customer's entire company, at all locations. This is not necessarily the number of employees at the site named in the application.

### **h) Customer Business Tax and Filing Numbers**

These are required for Corporations and Limited Partnerships. These are not required for Individuals, Government, and Sole Proprietors.

### **State Franchise Tax ID Number**

Corporations and limited liability companies that operate in Texas are issued a franchise tax identification number. If this customer is a corporation or limited liability company, enter this number here.

### **Federal Tax ID**

All businesses, except for some small sole proprietors, individuals, or general partnerships should have a federal taxpayer identification number (TIN). Enter this number here. Use no prefixes, dashes, or hyphens. Sole proprietors, individuals, or general partnerships do not need to provide a federal tax ID.

### **TX SOS Charter (filing) Number**

Corporations and Limited Partnerships required to register with the Texas Secretary of State are issued a charter or filing number. You may obtain further information by calling SOS at 512/463-5555.

### **DUNS Number**

Most businesses have a DUNS (Data Universal Numbering System) number issued by Dun and Bradstreet Corp. If this customer has one, enter it here.

## ATTACHMENT 1

### 2. APPLICATION CONTACT

Provide the name, title and communication information of the person that TCEQ can contact for additional information regarding this application.

### 3. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE

#### a) Regulated Entity Reference Number (RN)

A number issued by TCEQ's Central Registry to sites (a location where a regulated activity occurs) regulated by TCEQ. This is not a permit number, registration number, or license number. If this regulated entity has not been assigned an RN, leave this space blank.

If the site of your business is part of a larger business site, a Regulated Entity Number (RN) may already be assigned for the larger site. Use the RN assigned for the larger site. Search TCEQ's Central Registry to see if the larger site may already be registered as a regulated site at:

<http://www12.tceq.texas.gov/crpub/index.cfm?fuseaction=regent.RNSearch>

If the site is found, provide the assigned Regulated Entity Reference Number (RN) and provide the information for the site to be authorized through this application. The site information for this authorization may vary from the larger site information.

An example is a chemical plant where a unit is owned or operated by a separate corporation that is accessible by the same physical address of your unit or facility. Other examples include industrial parks identified by one common address but different corporations have control of defined areas within the site. In both cases, an RN would be assigned for the physical address location and the permitted sites would be identified separately under the same RN.

#### b) Site/Project Name/Regulated Entity

Provide the name of the site as known by the public in the area where the site is located. The name you provide on this application will be used in the TCEQ Central Registry as the Regulated Entity name.

#### c) Description of Activity Regulated

In your own words, briefly describe the primary business that you are doing that requires this authorization. Do not repeat the SIC Code description.

#### d) County

Identify the county or counties in which the regulated entity is located.

#### e) Latitude and Longitude

Enter the latitude and longitude of the site in degrees, minutes, and seconds or decimal form.

For help obtaining the latitude and longitude, go to:

<http://www.tceq.texas.gov/gis/sqmapview.html> or <http://nationalmap.gov/ustopo>

#### f) Site/Project (RE) Physical Address/Location Information

Enter the complete address for the site in Section A if the address can be validated through the US Postal Service. If the physical address is not recognized as a USPS delivery address, you may need to validate the address with your local police (911 service) or through an online map site used to locate a site. Please confirm this to be a complete and valid address. Do not use a rural route or post office box for a site location.

## ATTACHMENT 1

If a site does not have an address that includes a street (or house) number and street name, enter NO ADDRESS for the street name in Section A. In Section B provide a complete written location description. For example: "The site is located 2 miles west from intersection of Hwy 290 & IH35, located on the southwest corner of the Hwy 290 South bound lane." Provide the city (or nearest city) and zip code of the facility location.

### 4. GENERAL CHARACTERISTICS

#### a) Indian Country Lands

If your site is located on Indian Country Lands, the TCEQ does not have authority to process your application. You must obtain authorization through EPA, Region 6, Dallas. Do not submit this form to TCEQ.

#### b) Construction activity associated with facility associated with exploration, development, or production of oil, gas, or geothermal resources

If your activity is associated with oil and gas exploration, development, or production, you may be under jurisdiction of the Railroad Commission of Texas and may need to obtain authorization from EPA Region 6. For more information, see:

[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.TacPage?sl=R&app=9&p\\_dir=&p\\_rloc=&p\\_tloc=&p\\_ploc=&p\\_pg=1&p\\_tac=&ti=16&pt=1&ch=3&tl=30](http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&p_pg=1&p_tac=&ti=16&pt=1&ch=3&tl=30)

Construction activities associated with a facility related to oil, gas or geothermal resources may include the construction of a well site; treatment or storage facility; underground hydrocarbon or natural gas storage facility; reclamation plant; gas processing facility; compressor station; terminal facility where crude oil is stored prior to refining and at which refined products are stored solely for use at the facility; a carbon dioxide geologic storage facility; and a gathering, transmission, or distribution pipeline that will transport crude oil or natural gas, including natural gas liquids, prior to refining of such oil or the use of the natural gas in any manufacturing process or as a residential or industrial fuel.

Where required by federal law, discharges of stormwater associated with construction activities under the Railroad Commission's jurisdiction must be authorized by the EPA and the Railroad Commission of Texas, as applicable. Activities under Railroad Commission of Texas jurisdiction include construction of a facility that, when completed, would be associated with the exploration, development, or production of oil or gas or geothermal resources, such as a well site; treatment or storage facility; underground hydrocarbon or natural gas storage facility; reclamation plant; gas processing facility; compressor station; terminal facility where crude oil is stored prior to refining and at which refined products are stored solely for use at the facility; a carbon dioxide geologic storage facility under the jurisdiction of the Railroad Commission of Texas; and a gathering, transmission, or distribution pipeline that will transport crude oil or natural gas, including natural gas liquids, prior to refining of such oil or the use of the natural gas in any manufacturing process or as a residential or industrial fuel. The Railroad Commission of Texas also has jurisdiction over stormwater from land disturbance associated with a site survey that is conducted prior to construction of a facility that would be regulated by the Railroad Commission of Texas. Under 33 U.S.C. §1342(l)(2) and §1362(24), EPA cannot require a permit for discharges of stormwater from "field activities or operations associated with {oil and gas} exploration, production, processing, or treatment operations, or transmission facilities, including activities necessary to prepare a site for drilling and for the movement and placement of drilling equipment, whether or not such field activities or operations may be considered to be construction activities" unless the discharge is contaminated by contact with any overburden, raw material, intermediate product, finished product, byproduct, or waste product located on the site of the facility. Under §3.8 of this title (relating to Water Protection), the Railroad



## ATTACHMENT 1

Commission of Texas prohibits operators from causing or allowing pollution of surface or subsurface water. Operators are encouraged to implement and maintain best management practices (BMPs) to minimize discharges of pollutants, including sediment, in stormwater during construction activities to help ensure protection of surface water quality during storm events.

### **c) Primary Standard Industrial Classification (SIC) Code**

Provide the SIC Code that best describes the construction activity being conducted at this site.

Common SIC Codes related to construction activities include:

- 1521 - Construction of Single Family Homes
- 1522 - Construction of Residential Bldgs. Other than Single Family Homes
- 1541 - Construction of Industrial Bldgs. and Warehouses
- 1542 - Construction of Non-residential Bldgs, other than Industrial Bldgs. and Warehouses
- 1611 - Highway and Street Construction, except Highway Construction
- 1622 - Bridge, Tunnel, and Elevated Highway Construction
- 1623 - Water, Sewer, Pipeline and Communications, and Power Line Construction

For help with SIC Codes, go to:

<http://www.osha.gov/pls/imis/sicsearch.html>

### **d) Secondary SIC Code**

Secondary SIC Code(s) may be provided. Leave blank if not applicable. For help with SIC Codes, go to:

<http://www.osha.gov/pls/imis/sicsearch.html>

### **e) Total Number of Acres Disturbed**

Provide the approximate number of acres that the construction site will disturb. Construction activities that disturb less than one acre, unless they are part of a larger common plan that disturbs more than one acre, do not require permit coverage. Construction activities that disturb between one and five acres, unless they are part of a common plan that disturbs more than five acres, do not require submission of an NOI. Therefore, the estimated area of land disturbed should not be less than five, unless the project is part of a larger common plan that disturbs five or more acres. Disturbed means any clearing, grading, excavating, or other similar activities.

If you have any questions about this item, please contact the stormwater technical staff by phone at (512)239-4671 or by email at [swgp@tceq.texas.gov](mailto:swgp@tceq.texas.gov).

### **f) Common Plan of Development**

Construction activities that disturb less than five acres do not require submission of an NOI unless they are part of a common plan of development or for sale where the area disturbed is five or more acres. Therefore, the estimated area of land disturbed should not be less than five, unless the project is part of a larger common plan that disturbs five or more acres. Disturbed means any clearing, grading, excavating, or other similar activities.

For more information on "What is a common plan of development?" go to:

[www.tceq.texas.gov/permitting/stormwater/common\\_plan\\_of\\_development\\_steps.html](http://www.tceq.texas.gov/permitting/stormwater/common_plan_of_development_steps.html)

For further information, go to the TCEQ stormwater construction webpage at:

[www.tceq.texas.gov/goto/construction](http://www.tceq.texas.gov/goto/construction) and search for "Additional Guidance and Quick Links". If

## ATTACHMENT 1

you have any further questions about this item, please call the stormwater technical staff at (512)239-4671.

**g) Identify the water body(s) receiving stormwater runoff**

The stormwater may be discharged directly to a receiving stream or through a MS4 from your site. It eventually reaches a receiving water body such as a local stream or lake, possibly via a drainage ditch. You must provide the name of the water body that receives the discharge from the site (a local stream or lake).

If your site has more than one outfall you need to include the name of the first water body for each outfall, if they are different.

**h) Identify the segment number(s) of the classified water body(s)**

Identify the classified segment number(s) receiving a discharge directly or indirectly. Go to the following link to find the segment number of the classified water body where stormwater will flow from the site: [www.tceq.texas.gov/waterquality/monitoring/viewer.html](http://www.tceq.texas.gov/waterquality/monitoring/viewer.html)

You may also find the segment number in TCEQ publication GI-316:  
[www.tceq.texas.gov/publications/gi/gi-316](http://www.tceq.texas.gov/publications/gi/gi-316)

If the discharge is into an unclassified receiving water and then crosses state lines prior to entering a classified segment, select the appropriate watershed:

- 0100 (Canadian River Basin)
- 0200 (Red River Basin)
- 0300 (Sulfur River Basin)
- 0400 (Cypress Creek Basin)
- 0500 (Sabine River Basin)

Call the Water Quality Assessments section at (512)239-4671 for further assistance.

**i) Discharge into MS4 – Identify the MS4 Operator**

The discharge may initially be into a municipal separate storm sewer system (MS4). If the stormwater discharge is into an MS4, provide the name of the entity that operates the MS4 where the stormwater discharges. An MS4 operator is often a city, town, county, or utility district, but possibly can be another form of government. Please note that the Construction General Permit requires the Operator to supply the MS4 with a copy of the NOI submitted to TCEQ. For assistance, you may call the technical staff at (512)239-4671.

**j) Surface Water bodies on list of impaired waters – Identify the impaired water body(s)**

Indicate Yes or No if any surface water bodies receiving discharges from the construction site are on the latest EPA-approved CWA 303(d) List of impaired waters. Provide the name(s) of surface water bodies receiving discharges or potential discharges from the construction site that are on the latest EPA-approved CWA 303(d) List of impaired waters. The EPA-approved CWA 303(d) List of impaired waters in Texas can be found at:

[www.tceq.texas.gov/waterquality/assessment/305\\_303.html](http://www.tceq.texas.gov/waterquality/assessment/305_303.html)

NOTE: Do not use any "draft" documents.

## ATTACHMENT 1

### **k) Discharges to the Edwards Aquifer Recharge Zone and Certification**

See maps on the TCEQ website to determine if the site is located within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer at: [www.tceq.texas.gov/field/eapp/viewer.html](http://www.tceq.texas.gov/field/eapp/viewer.html)

If the discharge or potential discharge is within the Recharge Zone, Contributing Zone, or Contributing Zone within the Transition Zone of the Edwards Aquifer, a site specific authorization approved by the Executive Director under the Edwards Aquifer Protection Program (30 TAC Chapter 213) is required before construction can begin. The certification must be answered "Yes" for coverage under the Construction General Permit. The TCEQ approved plan must be readily available for TCEQ staff to review at the time that the NOI is submitted.

The general permit requires the approved Contributing Zone Plan or Water Pollution Abatement Plan to be included or referenced as a part of the Stormwater Pollution Prevention Plan.

For questions regarding the Edwards Aquifer Protection Program, contact the appropriate TCEQ Regional Office. For projects in Hays, Travis and Williamson Counties: Austin Regional Office, 12100 Park 35 Circle, Austin, TX 78753, 512-339-2929. For Projects in Bexar, Comal, Kinney, Medina and Uvalde Counties: TCEQ San Antonio Regional Office, 14250 Judson Rd., San Antonio, TX 78233-4480, 210-490-3096.

## **5. CERTIFICATIONS**

Failure to indicate **Yes** to ALL of the certification items may result in denial of coverage under the general permit.

### **a) Certification of Understanding the Terms and Conditions of Construction General Permit (TXR150000)**

Provisional coverage under the Construction General Permit (TXR150000) begins 7 days after the completed paper NOI is postmarked for delivery to the TCEQ. (Electronic applications submitted through ePermits have immediate provisional coverage). You must obtain a copy and read the Construction General Permit before submitting your application. You may view and print the Construction General Permit for which you are seeking coverage at the TCEQ web site: [www.tceq.texas.gov/goto/construction](http://www.tceq.texas.gov/goto/construction)

### **b) Certification of Legal Name**

The full legal name of the applicant as authorized to do business in Texas is required. The name must be provided exactly as filed with the Texas Secretary of State (SOS), or on other legal documents forming the entity, that is filed in the county where doing business. You may contact the SOS at (512)463 5555, for more information related to filing in Texas.

### **c) Understanding of Notice of Termination**

A permittee shall terminate coverage under this Construction General Permit through the submittal of a NOT when the operator of the facility changes, final stabilization has been reached, the discharge becomes authorized under an individual permit, or the construction activity never began at this site.

### **d) Certification of Stormwater Pollution Prevention Plan**

The SWP3 identifies the areas and activities that could produce contaminated runoff at your site and then tells how you will ensure that this contamination is mitigated. For example, in describing your mitigation measures, your site's plan might identify the devices that collect and

## ATTACHMENT 1

filter stormwater, tell how those devices are to be maintained, and tell how frequently that maintenance is to be carried out. You must develop this plan in accordance with the TCEQ general permit requirements. This plan must be developed and implemented before you complete this NOI. The SWP<sub>3</sub> must be available for a TCEQ investigator to review on request.

### **Operator Certification:**

The certification must bear an original signature of a person meeting the signatory requirements specified under 30 Texas Administrative Code (TAC) §305.44.

### **IF YOU ARE A CORPORATION:**

The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a)(1) (see below). According to this code provision, any corporate representative may sign an NOI or similar form so long as the authority to sign such a document has been delegated to that person in accordance with corporate procedures. By signing the NOI or similar form, you are certifying that such authority has been delegated to you. The TCEQ may request documentation evidencing such authority.

### **IF YOU ARE A MUNICIPALITY OR OTHER GOVERNMENT ENTITY:**

The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a)(3) (see below). According to this code provision, only a ranking elected official or principal executive officer may sign an NOI or similar form. Persons such as the City Mayor or County Commissioner will be considered ranking elected officials. In order to identify the principal executive officer of your government entity, it may be beneficial to consult your city charter, county or city ordinances, or the Texas statute(s) under which your government entity was formed. An NOI or similar document that is signed by a government official who is not a ranking elected official or principal executive officer does not conform to §305.44(a)(3). The signatory requirement may not be delegated to a government representative other than those identified in the regulation. By signing the NOI or similar form, you are certifying that you are either a ranking elected official or principal executive officer as required by the administrative code. Documentation demonstrating your position as a ranking elected official or principal executive officer may be requested by the TCEQ.

If you have any questions or need additional information concerning the signatory requirements discussed above, please contact the Texas Commission on Environmental Quality's Environmental Law Division at (512)239-0600.

### **30 Texas Administrative Code**

#### **§305.44. Signatories to Applications**

(a) All applications shall be signed as follows.

(1) For a corporation, the application shall be signed by a responsible corporate officer. For purposes of this paragraph, a responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit or post-closure order applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.



## ATTACHMENT 1

(2) For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

(3) For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this paragraph, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., regional administrator of the EPA).

ATTACHMENT 1

Texas Commission on Environmental Quality  
General Permit Payment Submittal Form

**Use this form to submit your Application Fee only if you are mailing your payment.**

- Complete items 1 through 5 below:
- Staple your check in the space provided at the bottom of this document.
- Do not mail this form with your NOI form.
- Do not mail this form to the same address as your NOI.

**Mail this form and your check to:**

*BY REGULAR U.S. MAIL*

Texas Commission on Environmental  
Quality  
Financial Administration Division  
Cashier's Office, MC-214  
P.O. Box 13088  
Austin, TX 78711-3088

*BY OVERNIGHT/EXPRESS MAIL*

Texas Commission on Environmental  
Quality  
Financial Administration Division  
Cashier's Office, MC-214  
12100 Park 35 Circle  
Austin, TX 78753

Fee Code: GPA	General Permit: TXR150000
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1. Check / Money Order No:
2. Amount of Check/Money Order:
3. Date of Check or Money Order:
4. Name on Check or Money Order:
5. NOI INFORMATION

If the check is for more than one NOI, list each Project/Site (RE) Name and Physical Address exactly as provided on the NOI. DO NOT SUBMIT A COPY OF THE NOI WITH THIS FORM AS IT COULD CAUSE DUPLICATE PERMIT ENTRIES.

See Attached List of Sites (If more space is needed, you may attach a list.)

Project/Site (RE) Name:

Project/Site (RE) Physical Address:

Staple Check in This Space

ATTACHMENT 2-1



# LARGE CONSTRUCTION SITE NOTICE

FOR THE

Texas Commission on Environmental Quality (TCEQ)

Stormwater Program

**TPDES GENERAL PERMIT TXR150000**

## ***“PRIMARY OPERATOR” NOTICE***

This notice applies to construction sites operating under Part II.E.3. of the TPDES General Permit Number TXR150000 for discharges of stormwater runoff from construction sites equal to or greater than five acres, including the larger common plan of development. The information on this notice is required in Part III.D.2. of the general permit. Additional information regarding the TCEQ stormwater permit program may be found on the internet at:

[http://www.tceq.state.tx.us/nav/permits/wq\\_construction.html](http://www.tceq.state.tx.us/nav/permits/wq_construction.html)

Site-Specific TPDES Authorization Number:	
Operator Name:	
Contact Name and Phone Number:	
Project Description: <i>Physical address or description of the site's location, and estimated start date and projected end date, or date that disturbed soils will be stabilized.</i>	
Location of Stormwater Pollution Prevention Plan:	

ATTACHMENT 2-2



LARGE CONSTRUCTION SITE NOTICE

FOR THE  
Texas Commission on Environmental Quality (TCEQ)  
Stormwater Program

TPDES GENERAL PERMIT TXR150000

“SECONDARY OPERATOR” NOTICE

This notice applies to secondary operators of construction sites operating under Part II.E.3. of the TPDES General Permit Number TXR150000 for discharges of stormwater runoff from construction sites equal to or greater than five acres, including the larger common plan of development. The information on this notice is required in Part III.D.2. of the general permit. Additional information regarding the TCEQ stormwater permit program may be found on the internet at:

[http://www.tceq.state.tx.us/nav/permits/wq\\_construction.html](http://www.tceq.state.tx.us/nav/permits/wq_construction.html)

Site-Specific TPDES Authorization Number:	
Operator Name:	
Contact Name and Phone Number:	
Project Description: <i>Physical address or description of the site's location, and estimated start date and projected end date, or date that disturbed soils will be stabilized.</i>	
Location of Stormwater Pollution Prevention Plan (SWP3):	

For Large Construction Activities Authorized Under Part II.E.3. (Obtaining Authorization to Discharge) the following certification must be completed:

I \_\_\_\_\_ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization under Part II.E.3. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. A stormwater pollution prevention plan has been developed and will be implemented prior to construction, according to permit requirements. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_ Date Notice Removed  
\_\_\_\_\_ MS4 operator notified per Part II.F.3.

ATTACHMENT 2-3



SMALL CONSTRUCTION SITE NOTICE  
FOR THE  
Texas Commission on Environmental Quality (TCEQ)  
Stormwater Program  
TPDES GENERAL PERMIT TXR150000

The following information is posted in compliance with **Part II.E.2.** of the TCEQ General Permit Number TXR150000 for discharges of stormwater runoff from small construction sites. Additional information regarding the TCEQ stormwater permit program may be found on the internet at:

[http://www.tceq.state.tx.us/nav/permits/wq\\_construction.html](http://www.tceq.state.tx.us/nav/permits/wq_construction.html)

Operator Name:	
Contact Name and Phone Number:	
Project Description: <i>Physical address or description of the site's location, estimated start date and projected end date, or date that disturbed soils will be stabilized</i>	
Location of Stormwater Pollution Prevention Plan:	

For Small Construction Activities Authorized Under Part II.E.2. (Obtaining Authorization to Discharge) the following certification must be completed:

I \_\_\_\_\_ (Typed or Printed Name Person Completing This Certification) certify under penalty of law that I have read and understand the eligibility requirements for claiming an authorization under Part II.E.2. of TPDES General Permit TXR150000 and agree to comply with the terms of this permit. A stormwater pollution prevention plan has been developed and will be implemented prior to construction, according to permit requirements. A copy of this signed notice is supplied to the operator of the MS4 if discharges enter an MS4. I am aware there are significant penalties for providing false information or for conducting unauthorized discharges, including the possibility of fine and imprisonment for knowing violations.

Signature and Title \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_ *Date Notice Removed*

\_\_\_\_\_ *MS4 operator notified per Part II.F.3.*

**ATTACHMENT 3**

**TPDES OPERATOR'S INFORMATION**

Owner's Name and Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone:

\_\_\_\_\_  
\_\_\_\_\_

Contractor's Names and Addresses:

General Contractor:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone:

\_\_\_\_\_  
\_\_\_\_\_

Site Superintendent:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone:

\_\_\_\_\_  
\_\_\_\_\_

Erosion Control and Maintenance Inspection:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone:

\_\_\_\_\_  
\_\_\_\_\_

Subcontractor's Names and Addresses:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone:

\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone:

\_\_\_\_\_

**Note: Insert name, address, and telephone number of persons or firms.**

**ATTACHMENT 4**

**CONTRACTOR'S / SUBCONTRACTOR'S**

**CERTIFICATION FOR TPDES PERMITTING**

I certify under penalty of law that I understand the terms and conditions of TPDES General Permit No. TXR150000 and the Stormwater Pollution Prevention Plan for the construction site identified as part of this certification.

Signature: \_\_\_\_\_  
Name: (printed or typed) \_\_\_\_\_  
Title: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
Date: \_\_\_\_\_

Signature: \_\_\_\_\_  
Name: (printed or typed) \_\_\_\_\_  
Title: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
Date: \_\_\_\_\_

Signature: \_\_\_\_\_  
Name: (printed or typed) \_\_\_\_\_  
Title: \_\_\_\_\_  
Company: \_\_\_\_\_  
Address: \_\_\_\_\_  
Date: \_\_\_\_\_

ATTACHMENT 5



# EPA NPDES Construction Inspection Form

The following inspection is being performed in compliance with Part 3.10. of the NPDES Region 6 Storm Water Construction General Permit [68 FR 39087, July 7, 2003]. Qualified personnel (provided by the permittee or cooperatively by multiple permittees) shall inspect disturbed areas of the construction site that have not been finally stabilized, areas used for storage of materials that are exposed to precipitation, placement and effectiveness of structural control measures, and locations where vehicles enter or exit the site. Inspections shall be performed either once every 7 days (this option not available in New Mexico per Part 9.C.1.c.) or once every 14 days and within 24 hours of the end of a storm event of 0.5 inches or greater. Where sites have been temporarily stabilized, runoff is unlikely due to winter conditions, or during seasonal arid periods in arid areas (0-10 inches of rainfall annually) and semi-arid areas (10-20 inches annually) such inspections shall be conducted at least once every month. This form is primarily intended for use with construction projects in New Mexico. Permittees on Indian Country lands in Texas, Oklahoma, Louisiana and Arkansas and some oil and gas facilities in Texas and Oklahoma may use this form if they are eligible for this permit and EPA is their NPDES permitting authority. Other facilities need to check with their NPDES authority before using this form.

If you do not know your NPDES Permit Number, contact the NOI Processing Center at 866-352-7755. This form was prepared as an example and it is not a required form for use with the permit. Alternative forms may be used if they contain all of the required information as set forth in the permit. This form and additional information regarding the NPDES Region 6 storm water program may be found on the Internet at [www.epa.gov/region6/gen/w/formsw.htm](http://www.epa.gov/region6/gen/w/formsw.htm). Any person with a complaint about the operation of this facility in regards to this permit should contact EPA Region 6 at (214)665-8060.

Permit Number(s) covered by this inspection (e.g., owners, developers, general contractor, builders).	
Signature and Certification in accordance with Appendix G, Section 11 of the permit.	I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. (Clean Water Act, 33 U.S.C. 1251 et seq.)
Date of Inspection.	
Inspector Name.	
Is there a copy of the permit language with the SWPPP?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Is the inspector qualified and are the qualifications documented in the SWPPP?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Is an NPDES storm water construction sign posted at the entrance for all permittees?	<input type="checkbox"/> Yes <input type="checkbox"/> No
<p>You may want to use EPA Region 6 construction checklist to assure components of the SWPPP are complete. This form, the construction sign, and the checklist are available on the Region 6 NPDES Storm Water Forms and Documents web page which may be found on the internet at <a href="http://www.epa.gov/earth1r6/gen/w/formsw.htm">http://www.epa.gov/earth1r6/gen/w/formsw.htm</a> In addition to the checklist, you should provide a narrative (see next page) on the existing Best Management Practices and Structural Controls found during each inspection. Any problems identified in an inspection should be corrected within 7 days. The inspection should cover all components of the SWPPP and all potential pollutants. While eroded soil is the primary pollutant of concern, do not forget to inspect for other pollutant sources such as fuel tanks, paints, solvents, stabilization materials, concrete hardner, batch plants, and construction debris. The inspector will need to update the SWPPP to reflect findings of the inspection. The site map should be updated after an inspection to show controls that have been added or removed, to ensure the site map is kept current in accordance with Part 3.11.A. of the permit.</p>	

July 29, 2003



**ATTACHMENT 5**



**Narrative Findings of the inspection:**

Observations should include any findings of Best Management Practices or controls that are not in accordance with the SWPPP. If a control is not in place or failed, observe the reason why. A control removed temporarily for work is not necessarily a violation if properly recorded in the SWPPP. If it has been removed, record why it was removed and, if applicable, when it will be reinstalled. If the control has failed, observe the conditions so a conclusion may be made as to whether the control failed for improper maintenance or improper design. The qualified inspector will know when a failed control is inadequate and should be replaced by an improved control mechanism. Qualified inspectors are to have authority to make changes to the SWPPP to assure compliance. Controls that have not been installed should be given a reason why they are not installed and/or a scheduled date for installation if they are designed for a later phase of construction. After the inspection, the SWPPP and its site map should be updated to reflect current conditions of controls and Best Management Practices at the time of the inspection. This includes removing uninstalled controls from the site map or otherwise denoting on the site map if they are no longer installed if the controls have been removed because they are no longer necessary (e.g., stabilization has been achieved in that area).

Part 3.10.G. of the permit: For each inspection required above, you must complete an inspection report. At a minimum, the inspection report must include: 1. The inspection date; 2. Names, titles, and qualifications of personnel making the inspection; 3. Weather information for the period since the last inspection (or since commencement of construction activity if the first inspection) including a best estimate of the beginning of each storm event, duration of each storm event, approximate amount of rainfall for each storm event (in inches), and whether any discharges occurred; 4. Weather information and a description of any discharges occurring at the time of the inspection; 5. Location(s) of discharges of sediment or other pollutants from the site; 6. Location(s) of BMPs that need to be maintained; 7. Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location; 8. Location(s) where additional BMPs are needed that did not exist at the time of inspection; and 9. Corrective action required including any changes to the SWPPP necessary and implementation dates.

July 29, 2003

ATTACHMENT 6

	<b>Notice of Termination (NOT)</b> <b>for Authorizations under</b> <b>TPDES General Permit TXR150000</b>	<b>TCEQ Office Use Only</b> Permit No.: _____ RN: _____ CN: _____
		<div style="border: 1px solid black; padding: 5px; display: inline-block; color: red; font-weight: bold;">Reset Form</div>
 <b>Sign up now for on line NOT at <a href="http://www.tceq.state.tx.us/permitting/steers/steers.html">http://www.tceq.state.tx.us/permitting/steers/steers.html</a></b> Get your NOT Confirmation letter immediately after submitting the on line NOT form.		
<b>What is the permit number to be terminated?</b> Processing will be delayed without the permit number. TXR15 _____		
<b>A. OPERATOR (applicant)</b>		
1. What is the Customer Number (CN) issued to this entity? CN _____		
2. What is the full Legal Name of the current permittee? _____  <i>This must be the current permittee of the permit to be terminated.</i>		
3. What is the applicant's mailing address as recognized by the <b>US Postal Service</b> ?		
Address: _____ Suite No./Bldg. No./Mail Code: _____		
City: Houston State: _____ ZIP Code: _____		
Country Mailing Information (if outside USA). Country Code: _____ Postal Code: _____		
4. Phone No.: ( ) Extension: _____		
5. Fax No.: ( ) E-mail Address: _____		
<b>B. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE</b>		
1. What is the TCEQ Issued RE Reference Number (RN)? RN _____		
2. Name of Project or Site as currently permitted): _____  (example: phase and name of subdivision or name of project that's unique to the site)		
3. Physical Address of Project or Site as currently permitted: (enter in spaces below)		
Street Number: _____ Street Name: _____		
City: _____ ZIP Code: _____ County (Counties if >1): _____		
4. If no physical address (Street Number & Street Name), provide the written location access description to the site: _____		
<b>C. REASON FOR TERMINATION</b>		
Check the reason for termination:		
<input type="checkbox"/> Final stabilization has been achieved on all portions of the site that are the responsibility of the Operator and all silt fences and other temporary erosion controls have either been removed, or scheduled for removal as defined in the SWP3.		
<input type="checkbox"/> Another permitted Operator has assumed control over all areas of the site that have not been finally stabilized, and temporary erosion controls that have been defined in the SWP3 have been transferred to the new Operator.		
<input type="checkbox"/> The activity is now authorized under an alternate TPDES permit.		
<input type="checkbox"/> The activity never began at this site that is regulated under the general permit.		
<b>D. CERTIFICATION</b>		
I, _____ Title _____ <div style="text-align: center;">Typed or printed name</div>		
certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.		
I further certify that I am authorized under <b>30 Texas Administrative Code §305.44</b> to sign and submit this document, and can provide documentation in proof of such authorization upon request.		
Signature: _____ Date: _____ <div style="text-align: center;">(Use blue ink)</div>		

ATTACHMENT 6

<b>Notice of Termination (NOT) for Authorizations under TPDES General Permit TXR150000 General Information and Instructions</b>													
<b>GENERAL INFORMATION</b>													
<p>Where to Send the Notice of Intent (NOI):</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> <p>BY REGULAR U.S. MAIL Texas Commission on Environmental Quality Storm Water Processing Center (MC228) P.O. Box 13087 Austin, TX 78711-3087</p> </td> <td style="width: 50%;"> <p>BY OVERNIGHT/EXPRESS MAIL Texas Commission on Environmental Quality Storm Water Processing Center (MC228) 12100 Park 35 Circle Austin, TX 78753</p> </td> </tr> </table>		<p>BY REGULAR U.S. MAIL Texas Commission on Environmental Quality Storm Water Processing Center (MC228) P.O. Box 13087 Austin, TX 78711-3087</p>	<p>BY OVERNIGHT/EXPRESS MAIL Texas Commission on Environmental Quality Storm Water Processing Center (MC228) 12100 Park 35 Circle Austin, TX 78753</p>										
<p>BY REGULAR U.S. MAIL Texas Commission on Environmental Quality Storm Water Processing Center (MC228) P.O. Box 13087 Austin, TX 78711-3087</p>	<p>BY OVERNIGHT/EXPRESS MAIL Texas Commission on Environmental Quality Storm Water Processing Center (MC228) 12100 Park 35 Circle Austin, TX 78753</p>												
<p>TCEQ Contact list:</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;"> <p>Application Processing Questions relating to the status and form requirements:</p> </td> <td style="width: 50%;">512/239-4671</td> </tr> <tr> <td>Technical Questions relating to the general permit:</td> <td>512/239-4671</td> </tr> <tr> <td>Environmental Law Division:</td> <td>512/239-0600</td> </tr> <tr> <td>Records Management for obtaining copies of forms submitted to TCEQ:</td> <td>512/239-0900</td> </tr> <tr> <td>Information Services for obtaining reports from program data bases (as available):</td> <td>512/239-DATA (3282)</td> </tr> <tr> <td>Financial Administration's Cashier's office:</td> <td>512/239-0357 or 512/239-0187</td> </tr> </table>		<p>Application Processing Questions relating to the status and form requirements:</p>	512/239-4671	Technical Questions relating to the general permit:	512/239-4671	Environmental Law Division:	512/239-0600	Records Management for obtaining copies of forms submitted to TCEQ:	512/239-0900	Information Services for obtaining reports from program data bases (as available):	512/239-DATA (3282)	Financial Administration's Cashier's office:	512/239-0357 or 512/239-0187
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Information Services for obtaining reports from program data bases (as available):	512/239-DATA (3282)												
Financial Administration's Cashier's office:	512/239-0357 or 512/239-0187												
<p><b>Notice of Termination Process:</b></p> <p>A Notice of Termination is <b>effective on the date postmarked for delivery to TCEQ</b>. When your NOT is received by the program, the form will be processed as follows:</p> <ol style="list-style-type: none"> <li><b>Administrative Review:</b> The form will be reviewed to confirm the following: <ul style="list-style-type: none"> <li>the permit number is provided</li> <li>the permit is active and has been approved</li> <li>the entity terminating the permit is the current permittee</li> <li>the site information matches the original permit record</li> <li>the form has the required original signature with title and date</li> </ul> </li> <li><b>Notice of Deficiency:</b> If an item is incomplete or not verifiable as indicated above, a phone call will be made to the applicant to clear the deficiency. A letter will not be sent to the permittee if unable to process the form.</li> <li><b>Confirmation of Termination:</b> A Notice of Termination Confirmation letter will be mailed to the operator.</li> </ol>													
<p><b>General Permit (Your Permit)</b> Coverage under the general permit begins <b>48 hours after a completed NOI is postmarked for delivery to the TCEQ</b>. You should have a copy of your general permit when submitting your application. You may view and print your permit for which you are seeking coverage, on the TCEQ web site <a href="http://www.tceq.state.tx.us">www.tceq.state.tx.us</a></p>													
<p><b>General Permit Forms</b> The Notice of Intent (NOI), Notice of Termination (NOT), and Notice of Change (NOC) with instructions are available in Adobe Acrobat PDF format on the TCEQ web site <a href="http://www.tceq.state.tx.us">www.tceq.state.tx.us</a>.</p>													
<p><b>Change in Operator</b> An authorization under the general permit is not transferable. If the operator or owner of the regulated entity changes, the present permittee must submit a Notice of Termination and the new operator must submit a Notice of Intent. The NOT and NOI must be submitted not later than 10 days prior to the change in Operator status.</p>													
<p><b>TCEQ Central Registry Core Data Form</b> The Core Data Form has been incorporated into this form. <b>Do not send a core data form to TCEQ.</b></p> <p>After final acknowledgment of coverage under the general permit, the program will assign a Customer Number (CN) and Regulated Entity Number (RN). For Construction Permits, a new RN will be assigned for each Notice of Intent filed with TCEQ, since construction project sites can overlap with other Customers. The RN assigned to your construction project will not be assigned to any other TCEQ authorization.</p> <p>You can find the information on the Central Registry web site at <a href="https://www6.tceq.state.tx.us/epay/">https://www6.tceq.state.tx.us/epay/</a>. You can search by the Regulated Entity (RN), Customer Number (CN) or Name (Permittee), or by your permit number under the search field labeled "Additional ID" Capitalize all letters in the permit number.</p>													

## ATTACHMENT 6

<p>The Customer (Permittee) is responsible for providing consistent information to the TCEQ, and for updating all CN and RN data for all authorizations as changes occur. For General Permits, a Notice of Change form must be submitted to the program area.</p>
<p><b>Annual Water Quality Fee:</b> This fee is assessed to operators with an active authorization under the general permit on September 1 of each year. The operator will receive an invoice for payment of the annual fee in November of each year. The payment will be due 30 days from the invoice date. A 5% penalty will be assessed if the payment is received by TCEQ after the due date. Annual fee assessments cannot be waived as long as the authorization under the general permit is active on September 1.</p> <p>It's important for the operator to submit a <b>Notice of Termination (NOT)</b> when coverage under the general permit is no longer required. A NOT is effective on the postmarked date of mailing the form to TCEQ. It is recommended that the NOT be mailed using a method that documents the date mailed and received by TCEQ.</p> <ul style="list-style-type: none"> <li>• <b>Mailed Payments:</b> You must return your payment with the billing coupon provided with the billing statement.</li> <li>• <b>ePAY Electronic Payment:</b> Go to <a href="https://www6.tceq.state.tx.us/epay/">https://www6.tceq.state.tx.us/epay/</a> You must enter your account number provided at the top portion of your billing statement. Payment methods include Mastercard, Visa, and electronic check payment (ACH). A transaction over \$500 can only be made by ACH.</li> </ul>
<h3>INSTRUCTIONS FOR FILLING OUT THE NOT FORM</h3>
<p><b>A. OPERATOR (current permittee.)</b></p> <p>1. TCEQ Issued Customer Number (CN)</p> <p>2. Legal Name of Operator The operator must be the same entity as previously submitted on the original Notice of Intent for the permit number provided.</p> <p>3. Operator Mailing Address Provide a complete mailing address for receiving mail from the TCEQ. Update the address if different than previously submitted in the Notice of Intent or Notice of Change.</p> <p>4. Phone Number, Fax Number, and E-mail Address Provide updated contact information.</p>
<p><b>B. REGULATED ENTITY (RE) INFORMATION ON PROJECT OR SITE</b></p> <p>1. Regulated Entity Reference Number (RN)</p> <p>2. Site/Project Name/Regulated Entity Provide the name of the site as previously submitted in the Notice of Intent for the permit number provided.</p> <p>3. Site/Project (RE) Physical Address Provide the physical address or location access description as previously submitted for the permit number provided.</p>
<p><b>C. REASON FOR TERMINATION</b></p> <p>Indicate the reason for terminating the permit by checking one of the options. If the reason is not listed then provide an attachment that explains the reason for termination.</p> <p>Please read your general permit carefully to determine when to terminate your permit. Permits will not be reactivated after submitting a termination form. The termination is effective on the date postmarked for delivery to TCEQ.</p>
<p><b>D. CERTIFICATIONS</b></p> <p>The certification must bear an original signature of a person meeting the signatory requirements specified under 30 Texas Administrative Code (TAC) §305.44.</p> <p><b>IF YOU ARE A CORPORATION:</b></p> <p>The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a)(1) (see below). According to this code provision, any corporate representative may sign an NOI or similar form so long as the authority to sign such a document has been delegated to that person in accordance with corporate procedures. By signing the NOI or similar form, you are certifying that such authority has been delegated to you. The TCEQ may request documentation evidencing such authority.</p> <p><b>IF YOU ARE A MUNICIPALITY OR OTHER GOVERNMENT ENTITY:</b></p> <p>The regulation that controls who may sign an NOI or similar form is 30 Texas Administrative Code §305.44(a)(3) (see below). According to this code provision, only a ranking elected official or principal executive officer may sign an NOI or similar form. Persons such as the City Mayor or County Commissioner will be considered ranking elected officials. In order to identify the principal executive officer of your government entity, it may be beneficial to consult your city charter, county or city ordinances, or the Texas statute(s) under which your government entity was formed. An NOI or similar document that is signed by a government official who is not a ranking elected official or principal executive officer does not conform to</p>

ATTACHMENT 6

§305.44(a)(3). The signatory requirement may not be delegated to a government representative other than those identified in the regulation. By signing the NOI or similar form, you are certifying that you are either a ranking elected official or principal executive officer as required by the administrative code. Documentation demonstrating your position as a ranking elected official or principal executive officer may be requested by the TCEQ.

If you have any questions or need additional information concerning the signatory requirements discussed above, please contact the Texas Commission on Environmental Quality's Environmental Law Division at 512/239-0600.

**30 Texas Administrative Code**

**§305.44. Signatories to Applications.**

(a) All applications shall be signed as follows.

(1) For a corporation, the application shall be signed by a responsible corporate officer. For purposes of this paragraph, a responsible corporate officer means a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures. Corporate procedures governing authority to sign permit or post-closure order applications may provide for assignment or delegation to applicable corporate positions rather than to specific individuals.

(2) For a partnership or sole proprietorship, the application shall be signed by a general partner or the proprietor, respectively.

(3) For a municipality, state, federal, or other public agency, the application shall be signed by either a principal executive officer or a ranking elected official. For purposes of this paragraph, a principal executive officer of a federal agency includes the chief executive officer of the agency, or a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., regional administrator of the EPA).

END OF SECTION

01410-36

June 2017

Section 01422

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SUMMARY

This Section includes general quality assurance related to Reference Standards and list of references.

1.02 MEASUREMENT AND PAYMENT (NOT USED)

1.03 REFERENCES

AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, N.W., Suite 249 Washington, D.C. 20001
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439
AGC	Associated General Contractors of America 2300 Wilson Blvd., Suite 300 Arlington, VA 22201
AI	Asphalt Institute Research Park Drive 2096 Research Park Drive Lexington, KY 40511-8480
AITC	American Institute of Timber Construction 7012 S. Revere Parkway, Suite 140 Centennial, CO 80112
AISC	American Institute of Steel Construction 130 East Randolph Street, Suite 2000 Chicago, IL 60601-6219
AISI	American Iron and Steel Institute 25 Massachusetts Ave., NW, Suite 800 Washington, D.C. 20001
ASME	American Society of Mechanical Engineers Two Park Avenue New York, NY 10016-5590
ANSI	American National Standards Institute 1899 L Street, NW, 11 <sup>th</sup> Floor

	Washington, D.C. 20036
APA	APA-The Engineered Wood Association 7011 S. 19 <sup>th</sup> Street Tacoma, WA 98466-5333
API	American Petroleum Institute 1220 L Street, N.W. Washington, D.C. 20005-4070
AREMA	American Railway Engineering and Maintenance-of-Way Association 4501 Forbes Blvd., Suite 130 Lanham, MD 20706
ASTM	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959
AWPA	American Wood Protection Association 100 Chase Park South, Suite 116 Birmingham, AL 35244-1851
AWS	American Welding Society 8669 NW 36 <sup>th</sup> Street, Suite 130 Miami, FL 33166-6672
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235-3098
COH	City of Houston P.O. Box 1562 Houston, TX 77251-1562
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Colombia Rd., Suite B215 Columbia, MD 21046
CRSI	Concrete Reinforcing Steel Institute 933 North Plum Grove Road Schaumburg, IL 60173-4758
EJMA	Expansion Joint Manufacturers Association 25 North Broadway Tarrytown, NY 10591
FS	Federal Standardization Documents General Services Administration Specifications Unit (WFSIS) 7th and D Streets, S.W. Washington, DC 20407

ICEA	Insulated Cable Engineer Association. Inc. P.O. Box 2694 Alpharetta, GA 30023
IEEE	Institute of Electrical and Electronics Engineers 445 Hoes Lane Piscataway, NJ 08854-4141
ISA	International Society of Arboriculture P.O. Box 3129 Champaign, IL 61826-3129
MIL	Military Specifications General Services Administration Specifications Unit (WFSIS) 7 <sup>th</sup> and D Streets, S.W. Washington, DC 20407
NACE	NACE International 1440 South Creek Drive Houston, TX 77084-4906
NEMA	National Electrical Manufacturers' Association 1300 North 17th Street, N, Suite 900 Arlington, VA 22209
NFPA	National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471
OSHA	Occupational Safety Health Administration U.S. Department of Labor Occupational Safety & Health Administration 200 Constitution Avenue Washington, D.C. 20210
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 60077-1083
PCI	Precast/Prestressed Concrete Institute 200 W. Adams Street, Suite 2100 Chicago, IL 60606
SDI	Steel Deck Institute P.O. Box 426 Glenshaw, PA 15116
SSPC	Society for Protective Coatings (Steel Structures Painting Council) 800 Trumbull Drive Pittsburgh, PA 15205



TAC	Texas Administrative Code Texas Natural Resources Conservation Commission P. O. Box 13087 Library MC-196 Austin, TX 78711-3087
TxDOT	Texas Department of Transportation 125 East 11th Street Austin, TX 78701-2483
UL	Underwriters' Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062
UNI-BELL	UNI-BELL Pipe Association 2711 LBJ Freeway, Suite 1000 Dallas, TX 75234

1.04 – 1.05 NOT USED

1.06 QUALITY ASSURANCE

- A. For Products or workmanship specified by association, trade, or Federal Standard, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by current date of issue as stated in Document 0700 - General Conditions.
- C. Request clarification from Project Manager before proceeding when specified reference standards conflict with Contract Documents.

1.07 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

## Section 01450

**CONTRACTOR'S QUALITY CONTROL****PART 1 GENERAL****1.01 SUMMARY**

This Section includes quality assurance, control of installation and manufacturer's field services and reports.

**1.02 MEASUREMENT AND PAYMENT**

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

**1.03 REFERENCES**

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

**1.04 – 1.05 NOT USED****1.06 QUALITY ASSURANCE**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality at no additional cost to the Owner.
- B. Comply fully with manufacturers' installation instructions, including each step in sequence.
- C. Request clarification from Project Manager before proceeding when manufacturers' instructions conflict with Contract.
- D. Comply with specified standards as minimum requirements for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform the Work by persons qualified to produce a specified level of workmanship.

**1.07 SYSTEM DESCRIPTION**

- A. Manufacturer's Field Services and Reports
  - 1. When specified in individual Specification sections or as required by Project Manager, 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 when defined in Specification sections.

2. At Project Manager's request, submit qualifications of manufacturers' representative to Project Manager 15 days in advance of required representatives' services. Representative is subject to approval by Project Manager.
3. A manufacturers' representative is to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to a manufacturer's written instructions. Submit report within 14 days of observation to Project Manager for review.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01452

**INSPECTION SERVICES**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes inspection services and references.

1.02 – 1.06 NOT USED

**1.07 SYSTEM DESCRIPTION**

**A. Inspection**

1. Project Manager will appoint Project Representative as representative of the Owner to perform inspections, tests, and other services specified in individual specification Sections.
2. Alternately, Project Manager may appoint, employ, and pay independent firm to provide additional inspection or construction management services.
3. Reports will be submitted to Project Manager, indicating observations and results of tests and indicating compliance or non-compliance with Contract.
4. Assist and cooperate with the selected independent firm or Project Representative; furnish samples of materials, design mix, equipment, tools, and storage.
5. Notify Project Manager 24 hours prior to expected time for operations requiring services.
6. Sign and acknowledge report for Project Representative.

1.08 – 1.13 NOT USED

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

## Section 01454

## TESTING LABORATORY SERVICES

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes testing laboratory services and Contractor responsibilities related to those services.

## 1.02 MEASUREMENT AND PAYMENT

- A. The Owner will select, employ, and pay for services of independent testing laboratory to perform inspection and testing identified in individual Specification sections.
- B. No separate payment for Contractor employment for services of independent testing laboratory or laboratories to perform inspection and testing identified in Part 2 of individual Specification sections.
- C. The Owner may deduct all charges incurred by testing laboratory for time and materials from Contractor's periodic progress payment when operations requiring testing or inspection are canceled by the Contractor without prior notification.
- D. The Owner shall deduct cost of retesting from Contractor's periodic progress payment whenever failed work is removed, replaced, and retested.

## 1.03 REFERENCES

- A. ASTM C 1077 Rev A- Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
- B. ASTM D 3666 - Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving.
- C. ASTM D 3740 Rev A- 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 Rev A- Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
- E. ISO/IEC 17025 - General Requirements for the Competence of Calibration and Testing Laboratories.

## 1.04 SUBMITTALS (NOT USED)

## 1.05 RELATED REQUIREMENTS

Document 00700 – “General Conditions”

## 1.06 QUALITY ASSURANCE

## A. Qualification of Laboratory

1. Meet laboratory requirements of ASTM E 329 Rev A and applicable requirements of ASTM C 1077 Rev A, ASTM D 3666, and ASTM D 3740 Rev A.
2. Meet ISO/IEC 17025 conditions for accreditation by the American Association for Laboratory Accreditation (A2LA) in specific fields of testing required in individual Specification sections.
3. If laboratory subcontracts are part of testing services, such work will be placed with laboratory complying with requirements of this Section.

## 1.07 SYSTEM DESCRIPTION

## A. Laboratory Reports

1. Testing laboratory provides and distributes copies of laboratory reports to distribution list provided by Project Manager at Pre-construction Conference.
2. Keep one copy of each laboratory report distributed at site field office for duration of project.
3. Testing Laboratory will email reports which indicate failed test results to Contractor, Project Manager and Project Representative no later than close of business on the first working day following test completion.

## B. Limits on Testing Laboratory Authority

1. Laboratory may not release, revoke, alter, or enlarge requirements of Contract.
2. Laboratory may not approve or accept any portion of the Work.
3. Laboratory may not assume duties of Contractor.
4. Laboratory has no authority to stop the Work.
5. Laboratory has the authority to request inspection of materials and Work as directed by the Project Manager.

## C. Contractor Responsibilities

1. Provide safe access to the Work and to manufacturer's facilities for Project Manager, Project Representative, and for testing laboratory personnel.
2. Provide testing laboratory with copy of construction schedule and copy of each update to construction schedule.
3. Notify Project Representative and testing laboratory during normal working hours of day previous to expected time for operations requiring inspection and testing services. When Contractor fails to make timely prior notification, then Contractor shall not proceed with operations requiring inspection and testing services.
4. Notify Engineer 24 hours in advance when Specification requires presence of Engineer is required for sampling or testing.
5. Request and monitor testing as required to provide timely results and avoid delay to the Work. Provide samples to laboratory in sufficient time to allow required test to be performed in accordance with specified test methods before intended use of material.
6. 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 site or at source of products to be tested; and to facilitate tests and inspections including storage and curing of test samples.
7. Contractor shall Pay for additional testing for the following in accordance with Document 00700 - General Conditions:
  - a. Retesting required for failed tests
  - b. Retesting for nonconforming Work
  - c. Additional sampling and tests requested beyond specified requirements
  - d. Insufficient notification of cancellation of tests for Work scheduled but not performed.
8. Employment of testing laboratory by the Owner does not relieve the Contractor of obligation to perform the Work in accordance with requirements of Contract Documents.
9. Contractor shall schedule and monitor testing. Provide 24 hours' notice of testing to Project Representative.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

- A. Conform laboratory sampling and testing specified in individual Specification sections to latest issues of ASTM standards, TxDOT methods, or other recognized test standards as approved by Project Manager.
- B. Requirements of this section also apply to those tests for approval of materials, for mix designs and for quality control of materials as performed by employed testing laboratories.

3.09 – 3.10 NOT USED

END OF SECTION



Section 01502

**MOBILIZATION**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes mobilization of construction equipment and facilities onto site.

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Price Contract. Measurement for mobilization is on lump sum basis.
- B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.
- C. Payments will be included in periodic progress payment upon written application subject to following provisions:
  - 1. Authorization for payment of 50 percent of Contract Price for mobilization will be made upon receipt and approval by Project Manager of following items, as applicable:
    - a. Schedule of Values (Section 01292), if applicable.
    - b. Trench safety program (Section 02260), if applicable.
    - c. Construction Schedule (Section 01325).
    - d. Submittal Schedule (Section 01330).
    - e. Preconstruction photographs (Section 01321).
    - f. Establishment of Field Office for Project Representative where an office is required by other sections (Section 01520).
    - g. Installation of Project Sign(s) (Section 01580).
    - h. Storm Water Pollution Prevention Plan.
    - i. Dewatering plan, when required.
    - j. Contractor's Quality Control Plan (Section 01450), if required.
  - 2. Authorization for payment of remaining 50 percent of Contract Price for mobilization will be made upon completion of Work amounting to 5 percent of Contract Price less mobilization unit price.

- D. Mobilization payments will be subject to retainage amounts stipulated in Document 0700 – “General Conditions”.
- E. A reduction of 10 percent of mobilization amount bid in Schedule for Unit Price Work will be applied to each Payment Application when Field Office is not properly maintained. Proper maintenance consists of operational plumbing and sanitary facilities, adequate potable water supply, operational telephone, internet access and functional temperature control.

1.03 – 1.04 NOT USED

1.05 RELATED REQUIREMENTS

- A. Document 00700 – “General Conditions”
- B. Section 01292 – “Schedule of Values”
- C. Section 01321 – “Construction Photographs”
- D. Section 01325 – “Construction Schedule”
- E. Section 01330 – “Submittal Procedures”
- F. Section 01450 – “Contractor’s Quality Control”
- G. Section 01520 – “Temporary Field Office”
- H. Section 01580 – “Project Identification Signs”
- I. Section 02260 – “Trench Safety System”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01504

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Temporary facilities and necessary controls for project including utilities, telephone, sanitary facilities, storage sheds and building, safety requirements, first aid equipment, fire protection, security measures, protection of Work and property, access roads and parking, environmental controls, pest and rodent control and disposal of trash, debris and excavated material.
- B. Facilities and controls specified in this section are considered minimum for Project. Provide additional facilities and controls for proper execution of Work and to meet Contractor's responsibilities for protection of persons and property.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices:
  - 1. No separate payment will be made for any temporary facilities and controls required under this section. Include cost of such work in contract price listed for mobilization.
  - 2. No separate payment will be made for construction fencing.
- B. Stipulated Price (Lump Sum). If Contract is a Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. Texas Occupational Safety Act (Art. 5182a, V.C.S.)
- B. U.S. Department of Labor 29 CFR Part 1926 – "Safety and Health Regulations for Construction" Section 107 of Contract Work Hours and Standards Act.
- C. U.S. Environmental Protection Agency, National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514 – "Protection and enhancement of environmental quality."

1.04 SUBMITALLS (NOT USED)

1.05 RELATED REQUIREMENTS

Document 00700 – “General Conditions”

1.06      QUALITY ASSURANCE (NOT USED)

1.07      SYSTEM DESCRIPTION

A.      Contractor’s Responsibility

Comply with the following and all other applicable requirements specified in other sections of Specifications.

1.      Maintain and operate temporary facilities and systems to assure continuous service.
2.      Modify and extend systems as Work progress requires.
3.      Completely remove temporary materials and equipment when no longer required.
4.      Restore existing facilities used for temporary services to specified or to original condition.

1.08 – 1.13 NOT USED

PART 2   PRODUCTS (NOT USED)

PART 3   EXECUTION

3.01 – 3.02 NOT USED

3.03      ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A.      Temporary Utilities

1.      Obtaining Temporary Service:
  - a.      Make arrangements with utility service companies for temporary services.
  - b.      Abide by rules and regulations of utility service companies or authorities having jurisdiction.
  - c.      Be responsible for utility service costs until Work is substantially complete. Included are fuel, power, light, heat, and other utility services necessary for execution, completion, testing, and initial operation of Work.

2. Water:
  - a. Contractor to provide water required for and in connection with Work to be performed and for specified tests of piping, equipment, devices, or for other use as required for proper completion of Work.
  - b. Provide and maintain adequate supply of potable water for domestic consumption by Contractor personnel, Project Manager and representatives of the Owner.
3. Electricity and Lighting:
  - a. Provide electric powered service required for Work, including testing of Work. Provide power for lighting, operation of equipment, or other use.
  - b. Electric power service includes temporary power service or generator to maintain plant operations during scheduled shutdown.
  - c. Minimum lighting level shall be 10 foot-candles for open areas; 20 foot-candles for stairs and shops. Provide minimum of one 300-watt lamp for each 200 square feet in work area.
4. Temporary Heat and Ventilation:
  - a. Provide temporary heat as necessary for protection or completion of Work.
  - b. Provide temporary heat and ventilation to assure safe working conditions; maintain enclosed areas at minimum of 50°F.
5. Telephone:

Provide emergency telephone service at Project Site for use by Contractor personnel and others performing work or furnishing services at site.
6. Sanitary Facilities:
  - a. Provide and maintain sanitary facilities for persons on job site; comply with regulations of State and local departments of health.
  - b. Enforce use of sanitary facilities by construction personnel at job site. Enclose sanitary facilities. 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 nuisance or health problem. Haul sewage and waste off-site and properly dispose in accordance with applicable regulation.

- c. Locate toilets near Work site and secluded from view insofar as possible. Keep toilets clean and supplied throughout course of Work.

B. Storage Sheds and Buildings

1. Provide adequately ventilated, watertight storage facilities with floor above ground level for materials and equipment susceptible to weather damage.
2. Storage of materials not susceptible to weather damage may be on blocks off ground.
3. Store materials in neat and orderly manner. Place materials and equipment to permit easy access for identification, inspection, and inventory.
4. Fill and grade site for temporary structures to provide drainage away from temporary and existing buildings.

C. Safety Requirements

1. Conduct operations in strict accord with applicable Federal, State, and local safety codes and statutes and with good construction practice. Establish and maintain procedures for safety of all work, personnel, and equipment involved in Project.
2. Observe and comply with Texas Occupational Safety Act (Art. 5182a, V.C.S.) and with all safety and health standards promulgated by Secretary of Labor under Section 107 of Contract Work Hours and Standards Act, published in 29 CFR Part 1926 and adopted by Secretary of Labor as occupational safety and health standards under Williams-Steiger Occupational Safety and Health Act of 1970, and to other legislation enacted for safety and health of Contractor employees. Safety and health standards apply to subcontractors and their employees as well as to Contractor and its employees.
3. Comply with regulations without reliance or superintendence of or direction by the Owner or Project Manager. Immediately advise Project Manager of investigation or inspection by Federal Safety and Health Inspectors of Contractor or subcontractor's work or place of work on job site under this Contract, and after investigation or inspection, advise Project Manager of results. Submit one copy of accident reports to Project Manager within 10 days of occurrence.
4. Protect areas occupied by workmen using best available devices for detection of lethal and combustible gases. Test devices frequently to assure functional capability. Constantly observe infiltration of liquids into Work area for visual or odor evidences of contamination, immediately take appropriate steps to seal off entry of contaminated liquids to Work area.

5. Implement safety measures, including but not limited to safety personnel, first-aid equipment, ventilating equipment and other safety equipment, as specified or detailed on Plans.
6. Maintain required coordination with Police and Fire Departments during entire period covered by Contract.
7. In safety plan include project safety analysis. Itemize major tasks and potential safety hazards. Plan to eliminate hazards or protect workers and public from each hazard

D. First Aid Equipment

1. Provide first aid kit throughout construction period. List telephone numbers for physicians, hospitals, and ambulance services in each first aid kit.
2. Have at least one person thoroughly trained in first aid and CPR procedures present on site whenever Work is in progress. Contractor to conform to protocols and requirements for training and protection against “blood borne pathogens.”

E. Fire Protection

Conform to specified fire protection and prevention requirements established by Federal, State, or local governmental agencies and as provided in Safety Program.

F. Security Measures

1. Protect all Work materials, equipment, and property from loss, theft, damage, and vandalism. Protect property of the Owner used in connection with performance of Contract.
2. If existing fencing or barriers are breached or removed for purposes of construction, provide and maintain temporary security fencing equal to existing.

G. Protection of Utilities and Pipelines

1. Prevent damage to existing public utilities during construction. Approximate locations of known utilities are shown on Plans, but all lines may not be shown. Excavate with caution and repair lines damaged by construction operations.
2. Use the Utility Coordinating Committee One Call System, telephone number, 811, which must be called 48 hours in advance. The toll free telephone number is 1-800-545-6005, Lone Star 811.

3. Before excavating, locate underground utilities by appropriate means including the use of metal detection equipment, and probes, or by excavation or surveys. Repair damage caused by investigative work and by failure to locate or to preserve underground utilities.
4. Give utility owners a minimum five days' notice before commencing excavation to allow time to locate utilities. Include cost for temporary relocation of water, wastewater, and storm drainage lines, necessary to accommodate construction, in unit prices for utility construction unless otherwise noted. Bypassing of sanitary waste to storm drainage facilities is not allowed.
5. Prior to excavation near pipelines, request a representative of the pipeline company to meet with Contractor and Project Manager at the site to discuss procedures to be used. Request pipeline company's representative to locate the pipelines in at least three locations: at each side and at centerline of proposed excavation of proposed utility. Also request representative and Project Manager to be present to observe Contractor operations when excavation is conducted within 15 feet of pipeline.
6. Utility service lines are not shown on the construction document Plans. Contractor should anticipate that such service lines exist and should exercise extreme caution during construction. The utility service lines should be repaired and restored immediately as per the specification, if damaged due to any construction activities. No separate payment will be made for this repair and restoration work. Include payment in unit price for work in appropriate sections.
7. Prior to abandonment of utility, make appropriate arrangements with Project Manager and owner of utility to terminate service, remove meters, transformers, and poles as may be required by site conditions.

H. Protection of Work and Property

1. Preventive Actions:
  - a. Take necessary precautions, provide programs and actions necessary to prevent damage, injury or loss to Work, public and private property.
  - b. Take action to prevent damage, injury or loss, including, but not limited to, the following:
    - 1) Store apparatus, materials, supplies, and equipment in orderly, safe manner that shall not interfere with progress of Work or Work of others.



- 2) Provide suitable storage for materials subject to damage by exposure to weather, theft, breakage, or otherwise.
    - 3) Place upon Work or any part thereof only safe loads.
    - 4) Frequently clean up refuse, rubbish, scrap materials, and debris caused by construction operations, keeping Project site safe and orderly.
    - 5) Provide safe barricades, construction fencing and guard rails to protect pedestrian and vehicular traffic around openings, scaffolding, temporary stairs and ramps, excavations, elevated walkways, and other hazardous areas.
  - c. Obtain written consent from proper parties before entering or occupying privately-owned land except on easements provided for construction.
  - d. Assume full responsibility for preservation of public and private property on or adjacent to site. When direct or indirect damage is done by or on account of any act, omission, neglect, or misconduct in execution of Work by Contractor, restore to condition equal to or better than that existing before damage was done.
2. Barricades and Warning Signals: Where Work is performed on or adjacent to any roadway, right-of-way, or public place, furnish and erect barricades, fences, lights, warning signs, and danger signals; and take other precautionary measures for protection of persons or property and of the Work. Barricades shall be visible at night. Erect sufficient barricades to keep vehicles and pedestrians from being driven on or into Work under construction. Maintain barricades, signs, lights, and provide watchmen until Project is accepted by the Owner. Whenever Work creates encroachment on public roadways, station flagmen to manage traffic flow in accordance with approved traffic control plan.
3. Protection of Existing Structures:
  - a. Underground Structures:
    - 1) Underground structures are defined to include, but not be limited to, sewer, water, gas, and other piping, manholes, chambers, electrical signal and communication conduits, tunnels, and other existing subsurface installations located within or adjacent to limits of Work.

- 2) Known underground structures including water, sewer, electric, and telecommunication service connections are shown on Plans. This information is not guaranteed to be correct or complete.
  - 3) Explore ahead of trenching and excavation work and sufficiently uncover obstructing underground structures to determine their location, to prevent damage to them and to prevent interruption of utility services. Restore damage to underground structure to original condition at no additional cost.
  - 4) Necessary changes in location of Work may be made by the Owner to avoid unanticipated underground structures.
  - 5) If permanent relocation of underground structure or other subsurface installations is required and not otherwise provided in Contract, the Owner will direct Contractor in writing to perform Work, which is paid for under provisions for changes as described in Document 00700 - General Conditions.
- b. Surface Structures: Surface structures are defined as existing buildings, structures and other constructed installations above ground surface. Included with structures are their foundations or extension below the surface. Surface structures include, but are not limited to buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks, guard cables, fencing, and other facilities visible above ground surface.
- c. Protection of Underground and Surface Structures:
- 1) Support in place and protect from direct or indirect injury underground and surface structures located within or adjacent to limits of Work. Install supports carefully and as required by party owning or controlling structure. Before installing structure supports, satisfy Project Manager that methods and procedures have been approved by owner of structure.
  - 2) Avoid moving or changing property of public utilities or private corporations without prior written consent of responsible official of that service or public utility. Representatives of these utilities reserve the right to enter within limits of this Project for purpose of maintaining their properties, or of making changes or repairs to their property that may be considered necessary by performance of this Contract.
  - 3) Notify owners and/or operators of utilities and pipelines of the nature of construction operations and dates when operations will

be performed. When construction operations are required in immediate vicinity of existing structures, pipelines, or utilities, give minimum of 5 working days advance notice. Probe and flag location of underground utilities prior to commencement of excavation. Keep flags in place until construction operation reaches and uncovers utility.

- 4) Assume risks attending presence or proximity of underground and surface structures within or adjacent to Work including but not limited to damage and expense for direct or indirect injury caused by his work to structure. Immediately repair damage.
- 5) Employ structural engineer to ensure safety and integrity of structures and facilities.

4. Protection of Installed Products:

- a. Provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed, prior to completion of Work.
- b. Control traffic to prevent damage to equipment, materials, and surfaces.
- c. Provide coverings to protect equipment and materials from damage. Cover projections, wall corners, jambs, sills, and exposed sides of openings in areas used for traffic and passage of materials in subsequent work.

I. Roads and Parking

1. Prevent interference with traffic on existing roads.
2. Designate temporary parking areas to accommodate construction and management personnel. When site space is not adequate, provide additional off-site parking. Locate as approved by Project Manager.
3. Minimize use by construction traffic of existing streets and driveways.
4. Do not allow heavy vehicles or construction equipment in existing parking areas.

J. Environmental Controls

1. Provide and maintain methods, equipment, and temporary construction as necessary for controls over environmental conditions at construction site and adjacent areas.

2. Comply with statutes, regulations, and ordinances which relate to proposed Work for prevention of environmental pollution and preservation of natural resources, including but not limited to National Environmental Policy Act of 1969, PL 91-190, Executive Order 11514.
3. Work to minimize impact to surrounding environment. Adopt construction procedures that do not cause unnecessary excavation and filling of terrain, indiscriminate destruction of vegetation, air or stream pollution, nor harassment or destruction of wildlife.
4. Recognize and adhere to environmental requirements of Project. Limit disturbed areas to boundaries established by Contract. Avoid pollution of “on-site” streams, sewers, wells, or other water sources.
5. Do not burn rubbish, debris, or waste materials.

K. Pollution Control

1. Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by discharge of noxious substances from construction operations.
2. Provide equipment and personnel to perform required emergency measures to contain spillage, and to remove contaminated soils or liquids. Excavate and dispose of contaminated earth off-site, and replace with suitable compacted fill and topsoil.
3. Provide systems for control of atmospheric pollutants.
  - a. Prevent toxic concentrations of chemicals.
  - b. Prevent harmful dispersal of pollutants into atmosphere.
4. Use equipment that conforms to current Federal, State, and local laws and regulations.
5. Install or otherwise implement positive controls to prevent hazardous materials migrating from Work area.

L. Pest and Rodent Control

1. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.
2. Employ methods and use materials which will not adversely affect conditions at site or on adjoining properties.

M. Noise Control

1. Provide vehicles, equipment, and construction activities that minimize noise to greatest degree practicable. Conform noise levels to latest OSHA standards. Do not permit noise levels to interfere with Work or create nuisance in surrounding areas.
2. Conduct construction operations during daylight hours except as approved by Project Manager.
3. Select construction equipment to operate with minimum noise and vibration. When in opinion of Project Manager, objectionable noise or vibration is produced by equipment, rectify conditions without additional cost to Owner. Sound Power Level (PWL) of equipment shall not exceed 85 dbA (re: 10-12 watts) measured 5 feet from piece of equipment. Explicit equipment noise requirements are specified with equipment specifications.

N. Dust Control

Control objectionable dust caused by operation of vehicles and equipment. Apply water or use other methods, subject to approval of Project Manager, to control amount of dust generated.

O. Water Runoff and Erosion Control

1. Comply with Texas Pollutant Discharge Elimination System (TPDES) permit when required.
2. In addition to TPDES requirements:
  - a. Provide methods to control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to Work, site, or adjoining properties.
  - b. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff courses so as to prevent erosion, sedimentation or damage.
  - c. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.
  - d. Dispose of drainage water in manner to prevent flooding, erosion, or other damage to portion of site or to adjoining areas and in conformance with environmental requirements.

- e.      Retain existing drainage patterns external to construction site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as needed to control conditions.
- f.      Plan and execute construction and earth work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
  - 1)      Minimize area of bare soil exposed at one time.
  - 2)      Provide temporary control measures, as berms, dikes, and drains.
- g.      Construct fills and waste areas by selective placement to eliminate erosion of surface silts or clays.
- h.      Inspect earthwork periodically to detect evidence of start of erosion. Apply corrective measures as required to control erosion.

3.04 – 3.10 NOT USED

END OF SECTION

Section 01520

TEMPORARY FIELD OFFICE

PART 1 GENERAL

1.01 SUMMARY

This Section includes temporary field office building and associated parking area.

1.02 MEASUREMENT AND PAYMENT

No separate payment will be made for any temporary facilities and controls required under this section. Include cost of such work in contract price listed for mobilization.

1.03 – 1.04 NOT USED

1.05 RELATED REQUIREMENTS

- A. Section 01770 – “Closeout Procedures”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

- A. Temporary field office will be utilized by Project Representative to coordinate and monitor daily construction activities performed by Contractor. Field office may also be used by duly authorized representatives or contract services retained to test or inspect materials furnished and work performed.
- B. Designate field office as non-smoking facility.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. FIELD OFFICE

- 1. General:

- a. Locate temporary field office in the vicinity of the project in a location approved by the Project Manager.

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
STANDARD SPECIFICATION

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- b. Furnish, install and maintain field office for exclusive use of Project Representative. Provide sufficient room for project meetings and office for Project Representative.
  - c. Provide office space ready for operation within 10 days of Date of Commencement for Project.
  - d. Construct two all-weather, hard-surfaced parking spaces for exclusive use by Project Representative. Provide all-weather surfaced walk between parking spaces and field office.
2. Minimum Construction Specifications:
- a. Structurally sound foundation and superstructure.
  - b. Completely weather tight with insulated roof, walls, and 7-foot ceiling (minimum).
  - c. Stairs or walkway with handrail and covered entrance platform (minimum 4 feet by 4 feet) with mud scraper at door.
  - d. Resilient floor covering.
  - e. Screened windows with area equal to approximately 10 percent of floor area sufficient for light, view, and ventilation. Provide each window with operable sash and burglar bars.
  - f. Secure, lockable exterior doors with dead-bolt cylinder locks and burglar bars.
  - g. Floor space of at least 600 square feet.
3. Minimum Service Requirements:
- a. Exterior light at entrance.
  - b. Interior lighting of 75 foot-candles minimum at desk-top height.
  - c. Automatic heating to maintain 65°F in winter.
  - d. Automatic cooling to maintain 75°F in summer.
  - e. Electric power service.
  - f. Telephone service for exclusive use by Project Representative.



NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
STANDARD SPECIFICATION

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- g. High speed internet access with Wi-Fi capability for exclusive use by Project Representative.
  - h. Potable water.
  - i. Sanitary facilities in field office with one water closet and one lavatory and medicine cabinet for the exclusive use of Project Representative.
- 4. Minimum Furnishings to be provided:
  - a. One 5-drawer desk.
  - b. Two swivel-desk chairs with casters.
  - c. One plan table.
  - d. One drawing plan rack.
  - e. One, 4-drawer legal file cabinet complete with 50 legal-size hanging folders and two full sized carriers.
  - f. One 4-shelf bookcase.
  - g. One marker board with cleaner and markers.
  - h. Two waste baskets.
  - i. One tack board 30 inches by 36 inches.
  - j. One all-purpose fire extinguisher.
  - k. Six new protective helmets (hard hats) with ratchet adjustment.
  - l. Conference table and chairs to accommodate ten persons.
  - m. Color printer capable of printing, copying, and scanning on 8 1/2 x 11 and 11 x 17 paper, including ink cartridges as necessary.
  - n. Telephone.
  - o. First aid kit.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Maintenance

1. Provide maintenance of all-weather, surface driveway and parking areas, buildings and furnishings and equipment or materials furnished and supplied as part of temporary field office for duration of Contract.
2. Provide pest control services for temporary field office for duration of Contract.
3. Janitorial services consist of twice weekly sweeping and mopping floors and trash removal, weekly cleaning of restrooms, and weekly dusting of furniture and equipment.
4. Provide soap, paper towels, toilet paper, cleansers, and other necessary consumables to properly maintain temporary field office.
5. Immediately repair damage, leaks, or defective service.

B. Project Closeout

Remove temporary field office and signs and restore site as specified in Section 01770 – “Closeout Procedures”.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 01555

## TRAFFIC CONTROL AND REGULATION

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes:

- A. Requirements for signs, signals, control devices, traffic barriers, flares, lights, and traffic signals, as well as construction parking control, designated haul routes and bridging of trenches and excavations.
- B. Requirements for and qualifications of flagmen.

## 1.02 MEASUREMENT AND PAYMENT

- A. Traffic Control and Regulation. Measurement is on a lump sum basis for traffic control and regulation, including submittal of traffic control plan if different from plan shown on Plans, provision of traffic control devices, and provision of equipment and personnel as necessary to protect Work and public. Amount invoiced shall be based on Schedule of Values submitted for traffic control and regulation.
- B. Payment for traffic control is on a lump sum basis and shall be authorized by Project Manager in three parts. Partial payments shall be made according to following schedule:
  - 1. Payment of 25 percent traffic control amount shall be authorized when permanent control devices and necessary temporary markings, sufficiently deployed along job site as required to maintain progress of Work, are installed at job site and approved. This limiting percentage shall be prorated based upon extent of Contractor's setup.
  - 2. Payment of 50 percent traffic control amount shall be authorized when pavement replacement commences. This limiting percentage shall be prorated based upon linear footage of pavement replaced, as measured along centerline axis of utility.
  - 3. Payment of 25 percent traffic control amount shall be authorized when permanent pavement markings are restored and unnecessary permanent and temporary control devices removed. This limiting percentage shall be prorated based upon extent of restoration.
- C. Flagmen. No separate payment. Include in unit price for Traffic Control.
- D. Refer to Section 01270 - Measurement and Payment for unit price procedures.

## 1.03 REFERENCES

- A. Texas Manual on Uniform Traffic Control Devices (TMUTCD)
- B. Texas Code of Criminal Procedure Article 2.12
- C. Texas Legislature Private Investigators and Private Security Agencies Act

## 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Traffic control plan responsive to Texas Manual on Uniform Traffic Control Devices (TMUTCD) sealed by Registered Professional Engineer is incorporated into Plans. If Contractor proposes to implement traffic control without modification to plan provided, submit a letter confirming decision. If contractor proposes to implement traffic control different than plan provided, submit a traffic control plan in conformance with TMUTCD sealed by Registered Professional Engineer.
- C. Submit copies of approved permits.
- D. Should traffic control plan be required, submit Schedules of Values in accordance with Section 01292 within 30 days following Notice to Proceed.
- E. Provide information and records regarding use of qualified flagmen to verify use of “peace officers” as flagmen in compliance with Contract and Texas law, including but not limited to, Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.
- F. Provide information and records regarding use of qualified flagmen to verify Contractor’s use of “certified flagmen” as flagmen is in compliance with Contract.

## 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01292 – “Schedule of Values”
- C. Section 01330 – “Submittal Procedures”

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 SYSTEM DESCRIPTION

- A. Flagmen

1. Use either (1) Uniformed Peace Officers as described in Section 1.07.A.2 or (2) Certified Flagmen as described in Section 1.07.A.3, to control, regulate, and direct even flow and movement of vehicular and pedestrian traffic when required by the traffic control plan.
2. Uniformed Peace Officer: Individual who has full-time employment as peace officer and receives compensation as flagman for private employment as individual employee or independent contractor. Private employment may be either employee-employer relationship or on an individual basis. Flagmen may not be in employ of another peace officer and may not be a reserve peace officer.
  - a. Uniformed Peace officer is defined as:
    - 1) Sheriffs and their deputies
    - 2) Constables and deputy constables
    - 3) Marshals or police officers of an incorporated city, town, or village
    - 4) As otherwise provided by Article 2.12, Code of Criminal Procedure, as amended
  - b. Individual who has full-time employment as a peace officer is one who is actively employed in a full-time capacity as a peace officer working, on average, a minimum of 32 paid hours per week, being paid a rate of pay not less than prevailing minimum hourly wage rate set by federal Wage and Hour Act and entitled to full benefits of participation in retirement plan, vacation, holidays, and insurance benefits.
3. Certified Flagman: Individual who receives compensation as flagman and meets the following qualifications and requirements:
  - a. Formally trained and certified in traffic control procedures.
  - b. Required to wear distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices.
  - c. English speaking, with Spanish as advantageous, but not required, primary, or secondary language.
  - d. Required to carry proof of training/certification and photographic identification card issued by training institute to allow Project Manager to easily determine necessary full-time traffic control is actually provided when and where construction work encroaches upon traffic lanes.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Signs, Signals, and Devices

Comply with Texas State Manual on Uniform Traffic Control Devices.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Public Roads

1. Abide by laws and regulations of governing authorities when using public roads. If Work requires public roads be temporarily impeded or closed, obtain approvals from governing authorities and pay permits before starting any Work. Coordinate activities with Project Manager.
2. Unless otherwise specifically noted on Traffic Control Plan and/or Construction Plans, the following shall apply:
  - a. Maintain 10-foot-wide, all-weather lane adjacent to work areas for use of emergency vehicles. Keep all-weather lane free of construction equipment and debris
  - b. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials as approved by Project Manager when maintaining temporary driveway access to commercial and residential driveways.
  - c. Cleanliness of Surrounding Streets: Keep streets used for entering and leaving job area free of excavated material, debris, and foreign material resulting from construction operations.
  - d. Provide Project Manager 1-week notice prior to implementing each approved traffic control phase. Warn businesses of impending traffic control plans.

- e. Notify local schools, churches, METRO bus lines, police department, commercial businesses, and fire department in writing of construction a minimum of 5 working days prior to beginning Work.
- f. Remove existing signing and striping that are in conflict with construction activities or may cause driver confusion.
- g. Provide safe access for pedestrians along major cross streets.
- h. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.
- i. Do not close more than two consecutive esplanade openings at a time without prior approval by Project Manager.

**B. Construction Parking Control**

- 1. Control vehicular parking to prevent interference with public traffic and parking, and access by emergency vehicles.
- 2. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- 3. Prevent parking on or adjacent to access roads or in non-designated areas.

**C. Sidewalks**

Advanced warning signs shall be installed warning pedestrians of sidewalk closures ahead. Any sidewalk closed will be fully barricaded.

**D. Flares and Lights**

Provide flares and lights as required by the traffic control plan.

**E. Haul Routes**

- 1. Obtain approval for haul routes from the Project Manager prior to use.
- 2. Confine construction traffic to designated haul routes.
- 3. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

**F. Traffic Signs and Signals**

- 1. Construct necessary traffic control devices for temporary signals including but not limited to loop detectors, traffic signal conduits, traffic signal wiring, and

crosswalk signals required to complete Work. Should modifications to the existing equipment be required, notify, a minimum of 60 days in advance, the appropriate agency concerning control boxes and switchgear. Coordinate with the agency to perform service, programming, or adjustments, to signal boxes and switchgear should this work be required during construction.

2. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control and areas affected by Contractor's operations. Establish notices, signs, and traffic controls before moving into next phase of traffic control.
3. Relocate traffic signs and signals as Work progresses to maintain effective traffic control.
4. Unless otherwise approved by Project Manager, provide driveway signs with name of business that can be accessed from particular cross-over. Use two signs for each cross-over.
5. Replace existing traffic control devices in project area.
6. Project Manager may direct Contractor to make minor traffic control sign adjustments to eliminate driver confusion and maintain traffic safety during construction at no additional payment.

G. Bridging Trenches and Excavations

1. Whenever necessary, bridge trenches and excavation to permit an unobstructed flow of traffic. Provide steel plates that can be laid across construction areas and major drives of commercial businesses.
2. Secure bridging against displacement by using adjustable cleats, angles, bolts, or other devices whenever bridge is installed:
  - a. On existing bus route
  - b. When more than 5 percent of daily traffic is comprised of commercial or truck traffic
  - c. When more than two separate plates are used for bridge
  - d. When bridge is to be used for more than 5 consecutive days
3. Install bridging to operate with minimum noise.
4. Adequately shore trench or excavation to support bridge and traffic.



5. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials (premix) to feather edges of plates to minimize wheel impact on secured bridging.
6. Use steel plates of sufficient thickness to support H-20 loading, truck or lane, that produces maximum stress.

#### H. Removal

1. Remove equipment and devices when no longer required.
2. Repair damage caused by installation.
3. Remove post settings to a depth of 2 feet

#### I. Traffic Control, Regulation, and Direction

1. Use flagmen to control, regulate, and direct even flow and movement of vehicular and pedestrian traffic including but not limited to the following conditions:
  - a. Where multi-lane vehicular traffic must be diverted into single lane vehicular traffic
  - b. Where vehicular traffic must change lanes abruptly
  - c. Where construction equipment must enter or cross vehicular traffic lanes and walks
  - d. Where construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks
  - e. Where traffic regulation is needed due to rerouting of vehicular traffic around Work site.
  - f. Other areas of Work where construction activities might affect public safety and convenience.
2. Use and maintain flagmen at points for periods of time as may be required to provide for public safety and convenience of travel.
3. Use of flagmen is for purpose of assisting in regulation of traffic flow and movement and does not relieve Contractor of full responsibility for taking other steps and providing other flaggers or personnel as Contractor may deem necessary to protect Work and public.

#### J. Installation Standards

1. Work in other phases shall be permitted, provided 1) phases are not continuous to one work is being done in presently, 2) installation of utility occurs in only one phase. Keep Work and operation in second phase to an absolute minimum. Perform Work in no more than two phases at a time. Authorization to perform Work in second phase shall not relieve any responsibility of completing backfilling and paving operations in accordance with Contract.
2. Place temporary pavement with a single lane closure, in accordance with TMUTCD.
3. Reinstall temporary and permanent pavement markings as directed by Project Manager. Alternative markings shall be considered when marking manufacturer's weather conditions cannot be met. These alternatives are to be submitted and approved by Project Manager prior to installation. No extra payment will be made for use of alternative markings.

K. Maintenance of Equipment and Material

1. Designate individual to be responsible for maintenance of traffic handling around construction area. Individual must be accessible at all times to immediately correct any deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings. Give name, address, and telephone number of designated individual to Project Manager.
2. Make daily inspections of signs, barricades, drums, lamps, and temporary pavement markings to verify that these are visible, in good working order both day and night, and conform to traffic handling plans. When not in compliance, immediately bring equipment and materials into compliance by replacement, repair, cleaning, relocation, and realignment.
3. Keep equipment and materials, especially signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.
4. Project Manager shall decide if damaged or vandalized signs, drums, and barricades can be reused.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 01562

## TREE AND PLANT PROTECTION

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes:

- A. Tree and plant protection and maintenance for project areas where existing trees are to remain in place.
- B. Relocating and replanting existing trees.
- C. Employment of qualified Arborist acceptable to Project Manager to move and relocate trees, or to preserve existing trees needing to be trimmed.

## 1.02 MEASUREMENT AND PAYMENT

Unless a separate bid item has been established, 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.

## 1.03 REFERENCES (NOT USED)

## 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit name and experience of qualified Arborist to Project Manager when required.

## 1.05 RELATED REQUIREMENTS

Section 01330 – “Submittal Procedures”

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 SYSTEM DESCRIPTION

- A. When Trees and Plants are Identified to be Protected:
  - 1. Preserve and protect existing trees and plants from foliage, branch, trunk, or root damage that could result from construction operations.
  - 2. Do not allow any vehicular traffic, construction equipment, parking of vehicles or stockpiling of excavated material or construction materials within protected

tree root zone areas. Refer to Section 1.10 DEFINITIONS, for Dripline/Root Zone Area definition.

3. Prevent the following types of damage:
  - a. Compaction of root zone area by equipment, vehicles, foot traffic or materials storage.
  - b. Suffocating roots by placing soil in excess of three inches (3") within root zone areas, including placement of any select fill or soil with high clay content.
  - c. Trunk and limb damage resulting from contact with equipment and vehicles.
  - d. Poisoning by pouring solvents, fuel, and other injurious materials on or near root zone areas or in areas where such materials will leak or wash into root zone areas.
  - e. Changing soil pH within root zones by depositing concrete, powdered lime or other materials used to stabilize or dehydrate soils.
  - f. Cutting roots measuring one inch (1") in diameter and larger within protected areas unless required for root pruning.
  - g. Scorching of foliage, twigs and limbs caused by direct contact with expulsion of hot exhaust from equipment or vehicles.
  - h. Branch damage due to improper pruning or trimming.
  - i. Damage from permanently altering drainage patterns near root zones.
  - j. Trunk and branch damage resulting from nailing or bolting.

#### B. DAMAGE ASSESSMENT

When trees other than those designated for removal are destroyed or badly damaged as result of construction operations, remove and replace with same size, species, and variety. Compensation for any tree larger than 8 inches in diameter shall be negotiated with the tree owner.

1.08 – 1.09 NOT USED

## 1.10 DEFINITIONS

- A. Dripline/Root Zone Area - The ground area delineated by the branch spread of a single plant or group of plants. This arm is considered the most critical area of roots and should be protected, excluding the area within the street located between curbs.
- B. Zero Curb Cut - The process in which required street work is conducted without cutting or otherwise disturbing soil located immediately behind the existing curb.

## 1.11 – 1.13 NOT USED

## PART 2 PRODUCTS

## 2.01 MANUFACTURER(S) (NOT USED)

## 2.02 MATERIALS AND/OR EQUIPMENT

- B. Protection Fencing - Orange, plastic mesh fencing, four feet (4') in height with six feet (6') high steel T-bar posts. Set posts eighteen inches (18") into ground at a maximum spacing of eight-foot (8'). Stretch fencing material taut prior to securing.
- C. Fertilizer - A low salt, slow release fertilizer containing twenty-seven percent (27%) nitrogen, nine percent (9%) phosphorus and nine percent (9%) potassium (potash) or similar.
- D. Plastic Vapor Barrier - Polyethylene sheeting at least 6-mil thickness and three feet width to prevent leaching of stabilized material into native soil.
- E. Tree Replacements - Shall be as approved by Project Manager as necessary.

## 2.03 – 2.04 NOT USED

## PART 3 EXECUTION

## 3.01 – 3.02 NOT USED

## 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Protection and Maintenance of Existing Trees and Shrubs
  - 1. Except for trees shown on Plans or determined by Project Manager to be removed or relocated, trees within Project area are to remain in place, protected from damage and maintained by Contractor.
  - 2. Arborist, if required, must be approved by Project Manager and shall have a minimum of 5 (five) years of experience in the field of tree protection.

3. Perform the following services as required by construction activities for trees that remain:
  - a. Trimming
    - 1) Trees shall be pruned in accordance ANSI A300 (Part 1) - 2001 Pruning Revision of ANSI A300-1995 Tree, Shrub and Other Woody Plant Maintenance - Standard Practices. Pruning shall be done by a professional arborist who has received training in proper pruning techniques.
    - 2) Pruning shall not alter the natural shape or character of the tree or leave holes in the canopy. Trees and shrubs should be pruned for balance as well as to maintain proper form and branching habit.
    - 3) Cut limbs at branch collar. No stubs should remain on trees. Branch cuts should not gouge outer layer of tree structure or trunk.
    - 4) Limit pruning to young branches as much as possible. Take care to maintain older branches that provide basic form of tree. The extent of pruning shall be based upon proximity of pavement to trunk, size of tree blockouts, and requirements of construction adjacent to tree.
  - b. Root Pruning
    - 1) When excavating with equipment within the root zone area is unavoidable and roots cannot be preserved, root prune prior to excavation to minimize damage to the portion of the root system that will remain.
    - 2) Prune roots using a conventional trenching machine. Trench along the proposed edge of excavation limits to a depth of three feet (3'). Do not allow ripping of roots with a backhoe or other equipment.
    - 3) Following trenching with the machine, re-cut roots measuring one inch (1") in diameter and larger using appropriate sharpened, pruning shears or pruning saws to make a clean, smooth-cut surface. Cut roots flush with edge of soil to limit root exposure.
    - 4) Backfill trench in a manner that will not allow settling using clean, native soil.

## c. Fertilizing and Watering

- 1) Trees should be fertilized in accordance with the American National Standard for tree fertilization ANSI A300 (Part 2) - 1998 Tree, Shrub and Other Woody Plant Maintenance - Standard Practices (Fertilization).
- 2) Deep root fertilize all trees that have received disturbance or damage to their root zone area.
- 3) Fertilize entire root zone area within the dripline of the tree and continue ten feet (10') beyond the dripline.
- 4) Mixture shall be injected into the top ten inches (10") of soil, under pressure of one hundred and fifty pounds per square inch (150 psi) to two hundred pounds per square inch (200 psi). Mix and apply per product label instructions.
- 5) Inject one-half gallon (1/2) of solution at a depth of ten inches (10") on spacing of three feet (3') between injection points.
- 6) Fertilizer shall be mixed in a tank with mechanical agitation.
- 7) Fertilizer to be added to tank and mixed on site.
- 8) During periods of inadequate rainfall, water trees once weekly to saturate soil to a depth of six inches (6") to eight inches (8") within root zones. Allow soils to dry between watering. Do not allow soils to remain wet.

d. Water areas currently being served by private sprinkler systems to maintain health of existing landscapes if the affected systems are temporarily taken out of service due to construction activities.

e. Shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist when approved by Project Manager

## B. Protection

## 1. Construction Methods

## a. General

- 1) Protect tree limbs, trunks and foliage from direct exposure to hot exhaust from equipment and vehicles by providing adequate exhaust pipe deflectors.

- 2) Cover exposed roots within 24 hours to reduce damage caused by desiccation. Roots may be covered with soil or mulch to help protect them from drying.
- 3) Protect root zone areas from damage that may result from soil compaction or from noxious materials in solution caused by run-off or spillage during mixing and placement of construction materials, or drainage from stored materials.
- 4) Minimize cut to two inches (2") below grade when installing silt fence within tree root zones or anchor base of fabric on grade using gravel or staples. Do not cut roots 1" in diameter or larger.
- 5) Site preparation work and/or construction work shall not begin in any area where tree preservation measures have not been completed and approved by the Project Manager.

b. Preparation

- 1) Contractor shall not allow any vehicular traffic, parking of vehicles or stockpiling of excavated material or construction material within the root zone area of trees to be preserved.
- 2) When access within protected root zone areas by equipment traffic or frequent foot traffic cannot be avoided, contact Project Manager for review prior to entrance. Place a three-quarter inch (3/4") thick layer of plywood on natural grade within root zones to minimize soil compaction. Overlap edges of plywood by six inches (6") to twelve inches (12") to ensure adequate coverage. This is not acceptable bridging for driving over exposed tree roots. Exposed roots should not be driven over.
- 3) Contractor shall notify Project Manager if existing tree locations differ from locations represented on the Plans. The tree location and dripline/root zone area as observed in the field shall supersede that outlined on construction plans.

c. Tree Protection Fencing

- 1) Each tree located adjacent to proposed soil excavation shall be protected with a tree protection fence or as designated on the plans. Fence locations shall be approved by Project Manager.



- 2) Contractor shall not remove or relocate tree protection fencing and shall not operate within the limits shown without approval of the Project Manager.
  - 3) Fences shall be placed in continuous alignment to protect a tree or group of trees.
  - 4) Posts shall be installed on eight-foot (8') centers at eighteen inches (18") below grade. The fencing shall be continuous between posts, shall be pulled taut prior to securing to posts, and shall be firmly attached to the posts with a minimum of three (3) wire ties.
  - 5) Place fencing in a manner that will not obstruct traffic site lines at curbs, intersections or driveways.
  - 6) Fencing shall be removed only after all work within the immediate area is complete.
  - 7) Contractor shall immediately repair fences if damage occurs at no additional charge to client.
- d. Excavation within Root Zone Areas
- 1) For excavation within root zone areas, where required for personal safety, provide excavation protection by using vertical-wall-shoring techniques at excavations to minimize excavation width. Do not bench cut or step cut edge where such techniques will encroach on root zone areas.
  - 2) If roots are encountered and must be severed, roots measuring one inch (1") in diameter and larger shall be cut using a sharpened pruning instrument to leave a smooth, clean-cut surface.
- e. Zero Curb Cut and Vapor Barrier Installation
- 1) Where existing curb is to be removed within tree root zone areas, do not disturb soil immediately back of curb. Do not allow forms and stakes to disturb roots.
  - 2) A vapor barrier shall be installed to provide a non-leaching barrier between any stabilized material and/or concrete and tree roots and soils.

- 3) Vapor barrier shall be installed vertically to a depth of five inches (5") below limits of stabilized material. Vapor barrier to be extended ten inches (10") above natural grade and ten feet (10') beyond the dripline limits of the tree. Trim vertical vapor barrier to approximately one inch (1") above grade after installation of final grade.

f. Boring/Tunneling

- 1) In areas indicated, bore under root systems of trees at a minimum depth of four feet (4') from the top of pipe to the soil surface at natural grade.
- 2) Bore pits and receiving pits shall be located outside of protected root zone areas.
- 3) Equipment and material shall be positioned outside of protected root zone areas. When access within protected root zone area by equipment traffic or frequent foot traffic cannot be avoided, place a three-quarter inch (3/4") thick layer of plywood on natural grade within root zones to minimize soil compaction, refer to Section 3.03.B.1.b.

g. Trunk Barricading

- 1) Install trunk barricading to protect trees in close proximity of moving or mechanical equipment and construction work when work is required within the tree protection fencing as shown on the plans.
- 2) Place trunk barricading around entire tree trunks to protect tree trunks located within five feet (5') of construction activities.
- 3) Install 2x4's or 2x6's (5-foot to 6-foot lengths) spaced 3 inches (3") apart around the circumference of the tree trunk.
- 4) Tie in place with 9 to 12 gauge steel wire.

2. Sequence of Tree Protection and Services

- a. Fertilize trees affected by construction between the months of October and May.
- b. Prune/trim trees for clearance and safety.
- c. Root Prune trees.

d. Place tree protection fence and trunk barricades to protect trees. Place fencing prior to any construction activities.

e. Remove tree protection upon completion of project.

3. Existing Stressed and Declining Trees

Prior to beginning the construction phase, trees located within the right-of-way should be reviewed and trees that appear to be stressed or declining in health should be documented. Immediately notify the Project Manager of any dead and dying trees.

4. Accidental Spills of Toxic Materials

Concrete, lime or other chemicals placed or accidentally spilled within root zone protection areas shall be completely removed. Contaminated soil shall be completely removed at the time of the spill and removed by hand shovel. Fresh soil shall be added as necessary to bring the soil level to that of natural grade.

C. Maintenance of Newly Planted Trees and Replanted Trees

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

2. Guarantee trees planted for this Project shall remain alive and healthy at least until end of 1-year warranty period.

a. Within 4 weeks' notice from Project Manager, replace dead trees or trees that in opinion of Project Manager have become unhealthy, unsightly or have lost their natural shape as result of additional growth, improper pruning or maintenance or weather conditions.

b. When tree must be replaced, guarantee period begins on date of tree replacement, subject to Project Manager's inspection, for no less than 1 year.

c. Straighten leaning trees and bear entire cost.

d. Dispose of trees rejected by Project Manager and bear entire cost.

3.04 – 3.10 NOT USED

END OF SECTION

Section 01572

SOURCE CONTROLS FOR EROSION AND SEDIMENTATION

PART 1 G E N E R A L

1.01 SECTION INCLUDES

Description of erosion, sediment control, and other control-related practices utilized during construction activities.

1.02 UNIT PRICES

Unless indicated in Unit Price Schedule as a pay item, no separate payment shall be made for Work performed under this Section. Include cost of Work performed under this Section in pay items of which this Work is a component.

1.03 REFERENCE STANDARDS

- A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- B. Storm Water Quality Management Guidance Manual prepared by City of Houston, Harris County, and Harris County Flood Control District.

1.04 SUBMITTALS

- A. Submit manufacturer's catalog sheets and other product data on dispensing equipment, pump, and aboveground fuel storage tanks, indicating capacity and dimensions of tank.
- B. Submit drawings to show location of tank protection area and driveway. Indicate nearest inlet or channelized flow area. Clearly dimension distances and measurements.
- C. Submit list of spill containment equipment, and quantities thereof, located at fueling area.
- D. Submit manufacturer's catalog sheets and other product data on geotextile fabric.

1.05 QUALITY ASSURANCE

Person conducting visual examination for pollutant shall be fully knowledgeable about the TPDES Construction General Permit, detecting sources of storm water contaminants, inspection of aboveground storage tank and appurtenances for leakage, and the day-to-day operations that may cause unexpected pollutant releases.

PART 2   P R O D U C T S

2.01      ABOVEGROUND STORAGE TANK

- A.      Tank Assembly: Must be listed with UL 1709 and UL 2085.
- B.      Inner Steel Storage Tank: Follow UL 142, with minimum thickness of 1/8-inch welded construction.
- C.      Tank Encasement: Either concrete or steel to provide minimum of 110 percent containment of inner tank capacity. Provide 5-gallon overspill containment pan for tank refueling.
- D.      Dispenser Pump: For submersible pump, UL listed emergency shut-off valve to be installed at each dispenser. For suction pump, UL listed vacuum-activated shut-off valve, with shear section, is to be installed at each dispenser. Fuel may not be dispensed from tank by gravity flow or by pressurization of tank. Means must be provided to prevent release of fuel by siphon flow.
- E.      Representative Manufacturers: Convault, Fireguard, Ecovault, SuperVault, or equal.

2.02      CONCRETE

Provide concrete with minimum strength of 4,000 psi at 28 days.

2.03      AGGREGATES

- A.      Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or 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 following gradation requirements.

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

- A. Provide woven or non-woven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material in continuous rolls of longest practical length.
- B. Geotextile fabric shall have a grab strength of 270 psi in any principal direction (ASTM D4632), Mullen burst strength exceeding 200 psi (ASTM D-3786) and equivalent opening size between 50 and 70.
- C. Filter fabric material shall contain ultraviolet inhibitors and stabilizers to provide minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.
- D. Representative Manufacturers: Mirafi, Inc., Synthetic Industries, or equal.

### 3.01 PREPARATION AND INSTALLATION

- A. No clearing and grubbing or rough cutting permitted until erosion and sediment control systems are in place, other than site Work specifically directed by Project Manager to allow soil testing and surveying.
- B. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control systems.
- C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manager to remove and discard existing system.
- D. Regularly inspect and repair or replace damaged components of erosion and sediment control systems as specified in this Section. Unless otherwise directed, maintain erosion and sediment control systems until project area stabilization is accepted by the Authority. Remove erosion and sediment control systems promptly when directed by Project Manager. Discard removed materials off site.
- E. Remove and dispose sediment deposits at designated spoil site for Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at location not in or adjacent to stream or flood plain. Assume responsibility for off-site disposal. Spread sediment evenly throughout site, compacted and stabilized. Prevent sediment from flushing into a stream or drainage way. If sediment has been contaminated, dispose of in accordance with existing federal, state, and local rules and regulations.

- F. Assume responsibility for collecting, storing, hauling, 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.
- G. Employ protective measures to avoid damage to existing trees to be retained on project site. Conduct construction operations under this Contract in conformance with erosion control practices described in Drawings and this Specification.
- H. Prepare spill response and containment procedures to be implemented in event of significant materials spill. Significant materials include but are not limited to: raw materials; fuels; materials such as solvent, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under Section 101(14) of CERCLA; chemical required to be reported pursuant to Section 313 of Title III of SARA; fertilizers; pesticides, and waste products such as slag, ashes and sludge that have potential to be released with storm water discharges. Spill containment procedures shall be kept on-site or in construction field office.
- I. Spill containment equipment appropriate to size of operation is to be located in close proximity of fueling area. Such equipment includes, but not limited to, suitable waste containers for significant materials, drip pans, booms, inlet covers, or absorbent.
- J. Properly label significant materials or waste containers used for construction activities and stored on-site overnight.
- K. Install, maintain, and inspect erosion, sediment control measures and practices as specified in Drawings and in this or other Specifications.

### 3.02 TOPSOIL PLACEMENT FOR EROSION AND SEDIMENT CONTROL SYSTEMS

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

1. When placing topsoil, maintain erosion and sediment control systems consisting of 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 areas to receive topsoil have been brought to grade, and immediately prior to dumping and spreading topsoil, loosen subgrade by discing or by scarifying to a depth of at least 2 inches to permit bonding of topsoil to subsoil. Compact by passing bulldozer up and down slope, tracking over entire surface area of slope to create horizontal erosion control slots.

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

### 3.03 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 following methods:
  1. Mulches bound with chemical binders such as Carasol, Terratack, or equal.
  2. Temporary vegetative cover.
  3. Spray-on adhesives on mineral soils when not used by traffic.
  4. Tillage to roughen surface and bring clods to surface.
  5. Irrigation by water sprinkling.
  6. Barriers using solid board fences, snow fences, burlap fences, crate walls, bales of hay, or similar materials.
- C. Implement dust control methods immediately whenever dust can be observed blowing on project site.

### 3.04 KEEPING STREETS CLEAN

- A. Keep streets clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas. Vehicle/equipment wash area (stabilized with coarse aggregate) may be installed adjacent to stabilized construction exit, as needed. Release wash water into a drainage swale or inlet protected by erosion and sediment control measures. Construction exit and wash areas are specified in Section 01575 - Stabilized Construction Exit.
- B. In addition to stabilized construction exits, shovel or sweep pavement to extent necessary to keep street clean. Water hosing or sweeping of debris and mud off of street into adjacent areas is not allowed.

### 3.05 EQUIPMENT MAINTENANCE AND REPAIR

- A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose. Locate 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 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.

### 3.06 WASTE COLLECTION AND DISPOSAL

- A. Formulate and implement a plan for collection and disposal of waste materials on construction site. In plan, designate locations for trash and waste receptacles and establish a collection schedule. Specify and carry out methods for ultimate disposal of waste in accordance with applicable local, state, and federal health and safety regulations. Make special provisions for collection and disposal of liquid wastes and toxic or hazardous materials.
- B. Keep receptacles and waste collection areas neat and orderly to extent possible. Waste shall not be allowed to overflow its container or accumulate from day-to-day. Locate trash collection points where they shall least likely be affected by concentrated storm water runoff.

### 3.07 WASHING AREAS

Avoid washing concrete delivery trucks or dump trucks and other construction equipment at locations where runoff shall flow directly into a watercourse or storm water conveyance system. Designate special areas for washing vehicles. Locate these areas where wash water shall spread out and evaporate or infiltrate directly into ground, or where runoff can be collected in temporary holding or seepage basin. Beneath wash areas construct a gravel or rock base to minimize mud production.

### 3.08 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 shall not cause runoff pollution.
- B. Store toxic chemicals, materials, 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 areas where toxic liquids are to be opened and stored.

### 3.09 DEMOLITION AREAS

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, retain water or slurry used to control dust contaminated with heavy metals or toxic pollutants on site, and

### 3.10 SANITARY FACILITIES

### 3.11 PESTICIDES

### 3.12 CONSTRUCTION METHODS

- 01572-7  
September 2007

- G. Install portable concrete Jersey Barrier around concrete foundation. Provide minimum clearance of 2 feet from edge of foundation. In lieu of Jersey barrier, install 4-inch diameter steel pipe bollards around foundation. Bury bollards minimum of 3 feet deep, 3 feet above ground, and 4 feet on center, encased in 12-inch wide concrete foundation.

3.13 MAINTENANCE

- A. Inspections shall be conducted by designated health and safety officer qualified to conduct health and safety inspections.
- B. Inspect stabilized areas after every storm event and at least once a week. Provide periodic top dressing with additional coarse aggregate to maintain required depth. Repair and clean out damaged control measures used to trap sediment.
- C. Inspect fuel tank foundation's bermed area after every storm event and at least once a week. Visually examine storm water contained in tank's bermed foundation area for oil sheen or other obvious indicators of storm water pollution. Properly dispose of storm water when pollutant is present. Record visual examination of storm water discharge in Report noting date and time of examination, name of examiner, observations of water quality, and volume of storm water discharged from bermed area. Keep Report with other storm water pollution control inspection reports on site, in readily accessible location.

3.14 TEMPORARY FUELING AREA CLOSURE

Dispose of temporary vehicle and equipment fueling area by removal of sediment and erosion controls properly off site. Project Representative will inspect top soils in fueling area and immediate vicinity for evidence of fuel leaks. If Project Representative determines that sufficient pollutants have been released, remove soil and properly dispose off site. Other remediation methods may be required.

END OF SECTION

Section 01574

**REINFORCED FILTER FABRIC BARRIERS**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes the installation of reinforced filter fabric barriers, for erosion and sediment control used during construction and prior to final development of site. Reinforced filter fabric barriers are used to retain sedimentation.

**1.02 MEASUREMENT AND PAYMENT**

Unit Prices:

- A. Measure and pay for reinforced filter fabric barrier by linear feet of completed and accepted filter fabric barrier between limits of beginning and ending steel fence posts.
- B. Measure and pay for inspection maintenance and repair of the systems will be paid in accordance with 01410 – “TPDES Requirements”.

**1.03 REFERENCES**

- A. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> [600 kN-m/m<sup>3</sup>]).
- B. ASTM D 4491/D 4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- C. ASTM D 4632/D 4632M Rev A - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- D. ASTM D 6382/D 6382M - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.
- E. ASTM D 3786/D 3786M – Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit manufacturer’s catalog sheets and other product data on geotextile or filter fabrics.

**1.05 RELATED REQUIREMENTS**

A. Section 01330 – “Submittal Requirements”

B. Section 01410 – “TPDES Requirements”

1.06 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Filter Fabric

1. Provide woven or non-woven geotextile filter fabric made of polypropylene, polyethylene, ethylene, or polyamide material.
2. Geotextile fabric: minimum grab strength of 100 psi in any principal direction (ASTM D4632/D 4632M Rev A); Mullen burst strength exceeding 200 psi (ASTM D3786/D 3786M); equivalent opening size between 50 and 140 for soils with more than 15 percent by weight passing No. 200 sieve and between 20 and 50 for soils with less than 15 percent by weight passing No. 200 sieve; and maximum water flow rate of 40 gallons per minute per square feet (ASTM D4491/D 4491M).
3. 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°F to 120°F.

B. Fencing

Woven wire shall be galvanized 2-inch by 4-inch welded wire fabric, 12½ gauge.

## PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Preparation and Installation

1. Provide erosion and sediment control systems at locations shown on Plans.
2. No clearing, grubbing, or rough cutting permitted until erosion and sediment control systems are in place, other than as specifically directed by Project Manager to allow soil testing and surveying.

3. Regularly inspect, maintain and repair or replace damaged components of the erosion control systems. Unless otherwise directed, maintain erosion and sediment control systems until project area stabilization is accepted by the Owner. Remove erosion and sediment control systems promptly when directed by Project Manager. Discard removed materials off site in accordance with Section 01576 – Waste Material Disposal.
4. Remove and dispose of sediment deposits at designated spoil site for Project. If a project spoil site is not designated on Plans, dispose of sediment off site in accordance with Section 01576 – Waste Material Disposal.
5. Prohibit equipment and vehicles 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.
6. Conduct construction operations under this Contract in conformance with erosion control practices described in Section 01410 – “TPDES Requirements”.

**B. Reinforced Filter Fabric Barrier Construction Methods**

1. Install erosion and sedimentation systems in manner so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.
2. Inspect erosion and sedimentation control systems after each rainfall, daily during periods of prolonged rainfall, and at minimum once each week. Repair or replace damaged sections immediately.
3. Attach woven wire support to steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) spaced maximum 6 feet apart and embedded minimum of 12 inches. Maximum spacing of 8 feet is allowed when posts are made of hot rolled steel, at least 4 feet long with Tee or Y-bar sections with surface painted or galvanized. Install stakes at slight angle toward source of anticipated runoff.
4. Trench in toe of filter fabric barrier with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow as shown on Plans. Trench shall be minimum of 6-inch by 6-inch. Lay filter fabric along edges of trench. Backfill and compact trench.
5. Securely fasten filter fabric material to woven wire with tie wires.
6. Reinforced filter fabric barrier shall have a minimum installed height of 18 inches.

7. Provide filter fabric in continuous rolls and cut to length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6-inch overlap and seal securely.
8. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.
9. Remove sediment deposits when silt reaches a depth of one-third height of barrier.

END OF SECTION

## Section 01575

**STABILIZED CONSTRUCTION EXIT****PART 1 GENERAL****1.01 SUMMARY**

This Section includes the installation of erosion and sediment control for stabilized construction exits used during construction and prior to final development of site.

**1.02 MEASUREMENT AND PAYMENT**

Measure and pay for stabilized construction roads, parking areas, exits and truck washing area by square yard of aggregate placed in 8-inch layer. No separate payment shall be made for Street Cleaning as required by NPDES. Include cost of Work for Street Cleaning under Section in pay items for which Work is a component. No separate payment shall be made for repair or replacement of stabilized construction exits.

**1.03 REFERENCES**

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

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit manufacturer’s catalog sheets and other product data on geotextile fabric.
- C. Submit sieve analysis of aggregates conforming to requirements of this Specification.

**1.05 RELATED REQUIREMENTS**

Section 01330 – “Submittal Procedures”

**1.06 – 1.13 NOT USED****PART 2 PRODUCTS****2.01 MANUFACTURER(S) (NOT USED)****2.02 MATERIALS AND/OR EQUIPMENT**

- A. Geotextile Fabric



1. Provide woven or non-woven geotextile fabric made of polypropylene, polyethylene, ethylene, or polyamide material.
2. Geotextile fabric shall have minimum grab strength of 270 psi in any principal direction (ASTM D 4632/D 4632M Rev A) and equivalent opening size between 50 and 140.
3. Geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide minimum of 6 months of expected usable life at temperature range of 0°F to 120°F.

**B. Coarse Aggregates**

1. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or combination of these materials. Aggregate shall be composed of clean, hard, durable materials free from steel reinforcement material, adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.
2. Coarse aggregates shall conform to following gradation requirements.

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

2.03 – 2.04 NOT USED

**PART 3 EXECUTION**

3.01 – 3.02 NOT USED

**3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION**

**A. Preparation and Installation**

1. If necessary to keep street clean of mud carried by construction vehicles and equipment, provide stabilized construction roads and exits at construction, staging, parking, storage, and disposal areas. Construct erosion and sediment controls in accordance with requirements shown on Plans and specified in this Section.

2. No clearing, grubbing or rough cutting permitted until erosion and sediment control systems are in place, other than as specifically directed by Project Manager to allow soil testing and surveying.
3. Maintain existing erosion and sediment control systems located within Project site until acceptance of Project or until directed by Project Manager to remove and discard existing system.
4. Regularly inspect, maintain, repair, or replace components of stabilized construction exits. Unless otherwise directed, maintain stabilized construction roads and exits until project is accepted by the Owner. Remove stabilized construction roads and exits promptly when directed by Project Manager. Discard removed materials off site.
5. Remove and dispose of sediment deposits at designated spoil site for Project. If project spoil site is not designated on Plans, dispose of sediment off site at location not in or adjacent to stream or flood plain. Assume responsibility for offsite disposal. Spread sediment evenly throughout site, compacted and stabilized. Do not allow sediment to flush into stream or drainage way. If sediment has been contaminated, dispose in accordance with existing federal, state, and local rules and regulations.
6. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control systems.
7. Conduct construction operation under this Contract in conformance with erosion control practices.

**B. Construction Methods**

1. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Plans.
2. Provide stabilized construction exits and truck washing areas when approved by Project Manager, of sizes and locations where shown on Plans or as specified in this Section.
3. 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, construct truck washing area. Truck washing shall be done on stabilized areas which drain into drainage system protected by erosion and sediment control measures.
4. Details for stabilized construction exit are shown on Plans. Construct other stabilized areas to same requirements. Maintain roadway width at least 14 feet

for one-way traffic and 20 feet for two-way traffic and sufficiently for ingress and egress. Furnish and place geotextile fabric as permeable separator to prevent mixing of coarse aggregate with underlying soil. Maximum exposure of geotextile fabric to elements between laydown and cover of 14 days to minimize damage potential.

5. Grade roads and parking areas 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.
6. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional coarse aggregates to maintain required depth. Repair and clean out damaged control measures used to trap sediment. Immediately remove sediment spilled, dropped, washed, or tracked onto public right-of-way.
7. Maintain length of stabilized area as shown on Plans, but not less than 50 feet. Maintain thickness less than 8 inches. Maintain width less than full width of all points of ingress or egress.
8. Stabilization for other areas shall have same coarse aggregate, thickness, and width requirements as stabilized construction exit, except where shown otherwise on Plans.
9. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Project Manager.
10. Alternative methods of construction may be utilized when shown on Plans, or when approved by Project Manager.
11. Provide street cleaning, such as sweeping or vacuuming, at locations around project site where construction traffic has caused tracking of sediments onto roadways. Do not wash or flush sediments into adjacent drainage systems.
12. Mechanical sweepers shall be vacuum-type or regenerative sweepers. Sweeping speed not to exceed 6 mph. Make two passes.
13. Clean street daily before end of workday. When excess sediments have tracked onto streets, Project Manager may direct contractor to clean street as often as necessary. Remove and dispose of sediments properly.
14. Use other erosion and sediment control measures to prevent sediment runoff during period of rains and non-working hours and when storm discharges are expected.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 01576

## WASTE MATERIAL DISPOSAL

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes the disposal of waste and salvageable material.

## 1.02 MEASUREMENT AND PAYMENT

No separate payment will be made for waste material disposal under this Section. Include payment in unit price for related sections.

## 1.03 REFERENCES (NOT USED)

## 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Obtain and submit disposal permits for proposed disposal sites if required by local ordinances.
- C. Submit copy of written permission from property owner, with description of property and vicinity map, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

## 1.05 RELATED REQUIREMENTS

Section 01330 – “Submittal Procedures”

## 1.06 – 1.13 NOT USED

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

## 3.01 – 3.02 NOT USED

## 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Salvageable Material
  - 1. Excavated Material: When indicated on Plans, load, haul, and deposit excavated material outside limits of Project or at location(s) shown on Plans.

2. Other Salvageable Materials: Conform to requirements of individual Specification Sections.
3. Coordinate with Project Manager loading of salvageable material.

**B. Excess Material**

1. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.
2. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 above.
3. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless the proper permit has been obtained. Remove excess material placed in "100-year Flood Hazard Area" at no additional cost to the Owner.
4. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 01577

## INLET PROTECTION BARRIERS

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes the installation of sediment control inlet protection barriers used during construction and prior to final development of site.

## 1.02 MEASUREMENT AND PAYMENT

## A. UNIT PRICES

1. Measure and pay for inlet protection barrier on a per each basis.
2. Measure and pay for inspection, maintenance and repair of the systems will be paid in accordance with Section 01410 – “TPDES Requirements”.

## 1.03 REFERENCES

- A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.
- B. ASTM D 4355/D 4355M – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
- C. ASTM D 4632/D 4632M Rev A - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- D. ASTM D 4833– Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

## 1.04 SUBMITTALS

Manufacturer’s catalog sheets and other product data on filter fabric.

## 1.05 RELATED REQUIREMENTS

Section 01410 – “TPDES Requirements”

## 1.06 – 1.13 NOT USED

## PART 2 PRODUCTS

## 2.01 MANUFACTURER(S) (NOT USED)

## 2.02 MATERIALS AND/OR EQUIPMENT

## A. Gravel Bag

1. Provide woven geotextile filter fabric material made of polypropylene, polyethylene, or polyamide material.
2. Minimum unit weight of 4 ounces per square yard.
3. Minimum grab strength of 100 psi in any principal direction (ASTM D4632)
4. Mullen burst strength exceeding 300 psi (ASTM D4833).
5. Ultraviolet stability exceeding 70 percent after 500 hours of exposures (ASTM 4355).
6. Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 40 to 50 pounds not to exceed 75 pounds.

2.03 – 2.04 NOT USED

## PART 3 EXECUTION

3.01 – 3.02 NOT USED

## 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

## A. Preparation and Installation

1. Provide sediment control systems at locations shown on Plans.
2. No clearing, grubbing or rough cutting permitted until sediment control systems are in place, other than site work specifically directed by Project Manager to allow soil testing and surveying.
3. Regularly inspect, maintain and repair or replace damaged components of sediment control systems. Unless otherwise directed, maintain sediment control systems until project area stabilization is accepted by the Owner. Remove sediment control systems promptly when directed by Project Manager. Discard removed materials off site in accordance with Section 01576 – Waste Material Disposal.
4. Remove and dispose sediment deposits at designated spoil site for Project. If a project spoil site is not designated on Plans, dispose of sediment off site in accordance with Section 01576 – Waste Material Disposal.



5. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage caused by construction traffic to sediment control.
6. Conduct all construction operations under this Contract in conformance with control practices described in Section 01410 – TPDES Requirements.

**B. General Construction Methods**

1. Provide sedimentation control systems in accordance with Plan details.
2. Inspect sedimentation control systems after each rainfall, daily during periods of prolonged rainfall, and at minimum once each week. Repair or replace damaged components immediately.
3. Remove sediment deposits when sediment has accumulated to one-third height of barrier.

3.04 – 3.10 NOT USED

END OF SECTION

Section 01578

CONTROL OF GROUND WATER AND SURFACE WATER

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations, and foundation beds in 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 MEASUREMENT AND PAYMENT

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 component.

1.03 REFERENCES

- A. ASTM D698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600kN-m/m<sup>3</sup>).
- B. Federal Regulations, 29 CFR Part 1926, Occupational Safety and Health Administration (OSHA).

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittals Procedures.
- B. Submit Ground Water and Surface Water Control Plan for review by Project Manager prior to start of any field work. Plan shall be signed by Professional Engineer registered in State of Texas. Submit plan to include following:
  - 1. Results of subsurface investigation and description of extent and characteristics of water bearing layers subject to ground water control
  - 2. Names of equipment suppliers and installation subcontractors

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
STANDARD SPECIFICATION

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3. Description of proposed ground water control systems indicating arrangement, location, depth, and capacities of system components, installation details and criteria and operation and maintenance procedures
4. Description of proposed monitoring and control system indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics
5. Description of proposed filters including types, sizes, capacities, and manufacturer's application recommendations
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas
7. Operating requirements, including piezometric control elevations for dewatering and depressurization
8. Excavation drainage methods including typical drainage layers, sump pump application and other necessary means
9. Surface water control and drainage installations
10. Proposed methods and locations for disposing of removed water

C. Submit following records upon completed initial installation:

1. Installation and development reports for well points, eductors, and deep wells
2. Installation reports and baseline readings for piezometers and monitoring wells
3. Baseline analytical test data of water from monitoring wells
4. Initial flow rates

D. Submit the following records weekly during operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02.B, Requirements for Eductor, Well Points, or Deep Wells

E. Maintenance records for ground water control installations, piezometers and monitoring wells.

1.05 RELATED REQUIREMENTS

- A. Section 01330 – “Submittal Procedures”
- B. Section 02260 – “Trench Safety System”
- 1.06 QUALITY ASSURANCE (NOT USED)
- 1.07 SYSTEM DESCRIPTION
  - A. Performance Requirements
    - 1. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit prepared method and spacing of readings for review prior to obtaining water level readings.
    - 2. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Section 02260 – “Trench Safety Systems”, to produce following results:
      - a. Effectively reduce hydrostatic pressure affecting:
        - 1) Excavations
        - 2) Tunnel excavation, face stability, or seepage into tunnels
      - b. Develop substantially dry and stable subgrade for subsequent construction operations
      - c. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities, and other work
      - d. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata
      - e. Maintain stability of sides and bottom of excavations
    - 3. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor, and ejector-type systems, deep wells, or combinations of these equipment types.
    - 4. Provide drainage of seepage water and surface water, as well as water from any other source entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.
    - 5. Provide ditches, berms, pumps, and other methods necessary to divert and drain surface water from excavation and other work areas.

6. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.
7. Assume sole responsibility for ground 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 ground water control operations. Modify ground water 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 ground water control systems or resulting from failure of system to protect property as required.
8. Provide adequate number of piezometers installed at proper locations and depths as required providing meaningful observations of conditions affecting excavation, adjacent structures and water wells.
9. Provide environmental monitoring wells installed at proper locations and depths as required to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

B. Environmental Requirements

1. Comply with requirements of agencies having jurisdiction.
2. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.
3. Obtain necessary permits from agencies with control over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Because review and permitting process may be lengthy, take early action to pursue and submit for required approvals.
4. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.
5. Contractor shall install a sediment bag on the end of discharge piping.

1.08 – 1.09 NOT USED

1.10 DEFINITIONS

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

1. Dewatering includes lowering water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts, and disposing of removed water. 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 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 Work from any source of surface water.
- D. Equipment and instrumentation for monitoring and control of ground water control system includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

1.11 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Use optional equipment and materials as necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review of Project Manager through submittals required in Paragraph 1.04, Submittals.
- B. Eductors, well points, or deep wells, where used, must be furnished, installed and operated by experienced contractor regularly engaged in ground water control system design, installation, and operation.
- C. Equipment must be in good repair and operating order.
- D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Ground Water Control

1. Perform subsurface investigation by borings as necessary to identify water bearing layers, piezometric pressures, and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics of water bearing layers. Present results in Ground Water and Surface Water Control Plan (See Paragraph 1.04B.1).
2. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.
3. Install, operate, and maintain ground water control systems in accordance with Ground Water and Surface Water Control Plan. Notify Project Manager in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.
4. Provide for continuous system operation, including nights, weekends, and holidays. Arrange for appropriate backup if electrical power is primary energy source for dewatering system.
5. Monitor operations to verify system lowers ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for prosecution of subsequent operations.
6. Where hydrostatic pressures in confined water bearing layers exist below excavation, depressurize those zones to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in Ground Water and Surface Water Control Plan.
7. Remove ground water control installations.
  - a. Remove pumping system components and piping when ground water control is no longer required
  - b. Remove monitoring wells when directed by Project Manager.
  - c. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing as required in accordance with Part 3 of applicable specification.

- d. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.
  - 8. During backfilling, dewatering may be reduced to maintain water level minimum of 5 feet below prevailing level of backfill. However, do not allow that water level to result in uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement stabilized sand until at least 48 hour after placement.
  - 9. Provide uniform diameter for each pipe drain run constructed for dewatering. Remove pipe drain when it has served its purpose. If removal of pipe is impractical, provide grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout when pipe is removed from service.
  - 10. Extent of construction ground water control for structures with permanent perforated underground drainage system may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide means of draining affected portion of underground system, including standby equipment. Maintain drainage system during operations and remove it when no longer required.
  - 11. Remove system upon completion of construction or when dewatering and control of surface or ground water is no longer required.
  - 12. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.
  - 13. Foundation Beds: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.
- B. Requirements for Eductor, Well Points, or Deep Wells
- 1. For aboveground piping in ground water control system, include 12-inch minimum length of clear, transparent piping between every eductor well or well point and discharge header to visually monitor discharge from each installation.
  - 2. Install sufficient piezometers or monitoring wells to show trench or shaft excavations in water bearing materials are predrained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of Work.



3. Install piezometers or monitoring wells not less than 1 week in advance of beginning associated excavation.
4. Dewatering may be omitted for portions of under drains or other excavations, but only where auger borings and piezometers or monitoring wells show that soil is predrained by existing system and that criteria of ground water control plan are satisfied.
5. Replace installations that produce noticeable amounts of sediments after development.
6. Provide additional ground water control installations, or change methods, in event that installations according to ground water control plan do not provide satisfactory results based on performance criteria defined by plan and by specification. Submit revised plan according to Paragraph 1.07.B.2.

C. Excavation Drainage

May use excavation drainage methods if necessary to achieve well drained conditions. Excavation drainage may consist of 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.

D. Maintenance and Observation

1. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage are operating in area or seepage into tunnel is occurring. Keep system in good condition.
2. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedule.
3. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make observations, as specified.
4. Remove and grout piezometers inside or outside excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Project Manager.

E. Monitoring and Recording

1. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also monitor and record water level and ground water recovery. Obtain records daily until steady conditions are achieved and twice weekly thereafter.

2. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Project Manager determines more frequent monitoring and recording are required. Comply with Project Manager's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

F. Surface Water Control

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

3.04 – 3.10 NOT USED

END OF SECTION

Section 01580

PROJECT IDENTIFICATION SIGNS

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Project identification sign description
- B. Project sign installation
- C. Maintenance and removal of project sign

1.02 MEASUREMENT AND PAYMENT

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 component.

1.03 REFERENCES (NOT USED)

1.04 SUBMITTALS

- A. Submit shop drawings under provisions of Section 01330 – Submittal Procedures.
- B. Show content, layout, lettering style, lettering size, and colors. Make sign and lettering to scale, clearly indicating condensed lettering, if used.

1.05 RELATED REQUIREMENTS

Section 01330 – “Submittal Procedures”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

- A. Sign Construction: Construct project identification signs of new materials. Construct post-mounted signs as shown on the Plans – Project Sign Detail.
- B. Appearance: Project identification signs shall be maintained to present a clean and neat look throughout project duration.
- C. Sign Manufacturer/Maker: Experienced as a professional sign company.

- D. Sign Placement: Place signs at locations as directed by Project Manager. Project Manager will provide sign placement instructions at preconstruction meeting.
1. A linear project is one involving paving, overlay, sewer lines, storm drainage, or water mains that run in right-of-way over a distance. A linear project requires a project identification sign at each end of construction site.
  2. Single Site or Building Projects: Provide one project identification sign.
  3. Multiple Sites: Provide one project identification sign at each site.
  4. Sign Relocation: As work progresses at each site, it may be necessary to move and relocate project identification signs. Relocate signs as directed in writing by Project Manager.

1.08 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Sign Materials

1. Structure and Framing: Use new sign materials.
  - a. Sign Posts: Use 4-inch by 4-inch pressure treated wood posts, 9 feet long for skid mounting and 12 feet long minimum for in-ground mounting.
  - b. Fasteners:
    - 1) Use galvanized steel fasteners.
    - 2) Use ½-inch by 5½-inch button head carriage bolts to attach sign to posts. Secure with nuts and flat head washers at locations shown on the Plans – Project Sign Detail.
    - 3) Cover button heads with white reflective film or paint to match sign background.
2. Sign: Use ¾ inch thick marine plywood. Use full-size 4-foot by 8-foot sheet for sign and a single piece for header to minimize joints; do not piece wood to fabricate sign face.

3. Paint and Primers: White paint used to prime surfaces and to resist weathering shall be an industrial grade, fast-drying, oil-based paint with gloss finish. Paint structural and framing members white on all sides and edges to resist weathering. Paint sign and sign header material white on all sides and edges to resist weathering. Paint all sign surfaces with this weather-protective paint prior to adding any adhesive applications.
4. Colors:
  - a. Sign Background: Sign background shall be industrial grade, reflective white. Use 3M Scotchlite Engineer Grade, Pressure Sensitive Sheeting (White), or approved equal.
  - b. Border: Add ½ inch-wide red border around area which designates project name and project amount. For border, use industrial grade reflective red. Use 3M Scotchlite Engineer Grade, Pressure Sensitive Sheeting (Red), or approved equal.
  - c. Sign Film: Make legends, symbols, lettering, and artwork from 3M Scotchcal Pressure Sensitive Films, or approved equal. Match colors to following 3M Scotchcal Pressure Sensitive Films.
    - 1) Lettering Below Logo: Black
    - 2) Lettering Above Project Name: Vivid Blue
    - 3) Lettering on Blue Background: White
    - 4) Background Behind Project Name: Vivid Blue

**B. Sign Layout**

1. Lettering:
  - a. Style, Size, and Spacing: Prepare sign using uppercase Helvetica Regular lettering of height and spacing shown on the Plans – Project Sign Detail.
  - b. Condensed Style: Lettering for variable text may be condensed if needed to maintain sign composition.
2. Composition:
  - a. Lines with Standard Text
    - 1) The top line reads “THE WATER WE CONSERVE TODAY CAN SERVE US TOMORROW” on all construction signs.

- 2) The lower left of sign below Owner Logo is used to list names and titles for the General Manager and Board Members. These lines will be placed exactly as shown on Plans with same size and spacing as indicated.
  - b. Lines with Variable Text. On blue background is space for project name and dollar amount for project construction.
    - 1) Project Manager will provide project name to Contractor for preparation of sign. Project name is centered on one or two lines in area with blue background. Lettering may be condensed, if necessary.
    - 2) Project Manager will provide Contractor with project's dollar value rounded to nearest \$1,000 for preparation of sign. Dollar amount is centered on one line in area with blue background and immediately below project name.

C. Layout and Composition

Owner Logo:

1. A space approximately 36 inches by 14 inches is allowed for Owner Logo.
2. Owner will provide Contractor with logo.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Install project identification signs within 7 calendar days after Date of Commencement.
- B. Erect signs where designated by Project Manager at preconstruction meeting. Position sign in such a manner as to be fully visible and readable to general public.
- C. Erect sign level and plumb.
- D. If mounted on posts, sink posts 3 feet to 4 feet below grade. Stabilize posts to minimize lateral motion. Leave a minimum of 8 feet of post above existing grade for mounting of sign.
- E. Erect sign so that top edge of sign is at a nominal 8 feet above existing grade.

F. Maintenance and Removal

1. Keep signs and supports clean. Repair deterioration and damage.
2. Remove signs, framing, supports, and foundations to a depth of 2 feet upon completion of Project. Restore area to a condition equal to or better than before construction.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 01610

**BASIC PRODUCT REQUIREMENTS****PART 1 GENERAL****1.01 SUMMARY**

This Section includes requirements for transportation, delivery, handling, and storage of Products including materials and equipment.

**1.02 – 1.06 NOT USED****1.07 SYSTEM DESCRIPTION****A. Products**

1. Products include material, equipment, or systems forming work. This does not include machinery and equipment used for preparation, fabrication, conveying, and erection of work. Products may also include existing materials or components designated for reuse.
2. For material and equipment specifically indicated or specified to be reused in the work:
  - a. Use special care in removal, handling, storage and reinstallation, to assure proper function in completed work.
  - b. Arrange for transportation, storage and handling of products which require off site storage, restoration or renovation. Include costs for such work in Unit Price for related items.
3. When contract documents require that installation of work comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in installation, including two copies to Project Manager. Maintain one set of complete instructions at job site during installation until completion.
4. Provide equipment and components from fewest number of manufacturers as practical, in order to simplify spare parts inventory and allow for maximum interchangeability of components. For multiple components of same size, type, or application, use same make and model of component throughout the Project.

**1.08 DELIVERY, STORAGE, AND HANDLING****A. Transportation**



1. Make arrangements for transportation, delivery, and handling of equipment and materials required for timely completion of the Work.
2. Transport and handle products in accordance with manufacturers' instructions.
3. Consign and address shipping documents to proper party giving name of Project with complete street address. Shipments shall be delivered to Contractor.

**B. Delivery**

1. Arrange deliveries of Products to accommodate short term site completion schedules and in ample time to facilitate inspection prior to installation. Avoid deliveries that cause lengthy storage or overburden of limited storage space.
2. Coordinate deliveries to avoid conflict with Work and conditions at site and to accommodate following:
  - a. Work of other contractors
  - b. Limitations of storage space.
  - c. Availability of equipment and personnel for handling products.
3. Have products delivered to site in manufacturer's original, unopened, labeled containers.
4. Immediately upon delivery, inspect shipment to assure:
  - a. Product complies with requirements of Contract.
  - b. Quantities are correct.
  - c. Containers and packages are intact; labels are legible.
  - d. Products are properly protected and undamaged.

**C. Product Handling**

1. Coordinate off-loading of Products delivered to job site. If necessary to move stored materials and equipment during construction, relocate materials and equipment at no additional cost.
2. Provide equipment and personnel necessary to handle products by methods to prevent damage to products or packaging.

3. Provide additional protection during handling as necessary to prevent breaking, scraping, marring, or otherwise damaging products or surrounding areas.
4. Handle Products by methods to prevent over bending or over stressing.
5. Lift heavy components only at designated lifting points.
6. Handle Products in accordance with manufacturer's recommendations.
7. Do not drop, roll, or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

D. Storage of Products

1. Store and protect Products in accordance with manufacturer's recommendations and requirements of these Specifications.
2. Make necessary provisions for safe storage of Products. Place loose soil materials, and materials to be incorporated into work to prevent damage to any part of work or existing facilities and to maintain free access at all times to all parts of work and to utility service company installations in vicinity of work. Keep Products neatly and compactly stored in locations that will cause minimum inconvenience to other contractors, public travel, adjoining owners, tenants, and occupants. Arrange storage to provide easy access for inspection.
3. Restrict storage to areas available on construction site for storage of Products if shown on Plans or approved by Project Manager.
4. Provide off-site storage and protection when on-site storage is not adequate. Provide addresses of and access to off-site storage locations for inspection by Project Manager.
5. Do not use lawns, grass plots, or other private property for storage purposes without written permission of owner or other person in possession or control of premises.
6. Protect stored Products against loss or damage.
7. Store in manufacturers' containers.
8. Neatly, safely, and compactly stack materials delivered and stored along line of work to avoid inconvenience and damage to property owners and general public, and maintain at least 3 feet from fire hydrant. Keep public, private driveways, and street crossings open.

9. Total length which Products may be distributed along route of construction at one time is 1,000 linear feet, unless otherwise approved in writing by Project Manager.

1.09 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01725

**FIELD SURVEYING**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes requirements for field surveying and Project Record Documents.

**1.02 MEASUREMENT AND PAYMENT**

No separate payment will be made for field surveying. Include cost in unit price for related items.

**1.03 NOT USED**

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit to Project Manager the name, address, telephone number and registration number of Surveyor before starting survey work.
- C. Submit documentation verifying accuracy of survey work on request.
- D. Submit certificate signed by surveyor, that elevations and locations of Work are in conformance with Contract.

**1.05 RELATED REQUIREMENTS**

- A. Section 01330 – “Submittal Procedures”
- B. Section 01785 – “Project Record Documents”

**1.06 QUALITY ASSURANCE**

Conform to State of Texas laws for surveys requiring registered surveyors. Employ registered public surveyor acceptable to Owner.

**1.07 SYSTEM DESCRIPTION**

- A. Project Record Documents
  - 1. Maintain complete and accurate log of control and survey work as it progresses.

2. Prepare certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.
  3. Submit Record Documents under provisions of Section 01785 - Project Record Documents.
- B. Examination
1. Verify locations of survey control points prior to starting the Work.
  2. Notify Project Manager immediately of any discrepancies discovered.
- C. Survey Reference Points
1. Locate and protect survey control points prior to starting site work; preserve permanent survey monuments during construction.
  2. Notify Project Manager 48 hours in advance of need for relocation of reference points due to changes in grades or other reasons.
  3. Report promptly to Project Manager loss or destruction of reference point.
  4. Contractor to replace permanent survey monuments disturbed by operations, at no additional cost to the Owner.
- D. Survey Requirements
1. Utilize recognized engineering survey practices.
  2. Surveyor to stake line and grade at a minimum of 100 foot spacing for linear projects.
  3. Establish elevations, lines, and levels to provide quantities required for measurement and payment and to provide appropriate controls for Work. Locate and lay out by instrumentation and similar appropriate means:
    - a. Site improvements including pavements; stakes for grading; fill and topsoil placement; utility locations, slopes, and invert elevations.
    - b. Grid or axis for structures.
    - c. Building foundation, column locations, ground floor elevations.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01731

**CUTTING AND PATCHING**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes cutting, patching and fitting of Work, coordinating installation or connection of Work with existing facilities, or uncovering Work for access, inspection, or testing and related submittals.

**1.02 MEASUREMENT AND PAYMENT**

Unit Prices:

No separate payment will be made for cutting and patching. Include cost in unit price for related items.

**1.03 REFERENCES (NOT USED)**

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit written notice to Project Manager requesting consent to proceed prior to cutting which may affect structural integrity, design function, or Work of another contractor.
- C. Include the following in submittal:
  - 1. Identification of Project
  - 2. Description of affected Work
  - 3. Necessity for cutting
  - 4. Effect on other Work and on structural integrity
  - 5. Include description of proposed Work:
    - a. Scope of cutting and patching
    - b. Contractor, subcontractor or trade to execute Work
    - c. Proposed products
    - d. Extent of refinishing

- e. Schedule of operations
- 6. Alternatives to cutting and patching
- D. When conditions of Work or schedule indicate change of materials or methods, submit written recommendation to Project Manager including:
  - 1. Conditions indicating change
  - 2. Recommendations for alternative materials or methods
  - 3. Submittals as required for substitutions
- E. Submit written notice to Project Manager designating time Work shall be uncovered for observation. Do not begin cutting or patching operations until authorized by Project Manager.

#### 1.05 RELATED REQUIREMENTS

- A. Document 00700 – “General Conditions”
- B. Section 01330 – “Submittal Procedures”

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 SYSTEM DESCRIPTION

- A. Cutting and Patching
  - 1. Perform activities to avoid interference with facility operations and Work of others in accordance with Document 00700 – “General Conditions” of Contract.
  - 2. Execute cutting and patching, including excavation, backfill and fitting to:
    - a. Remove and replace defective Work or Work not conforming to Plans and Specifications.
    - b. Take samples of installed Work as required for testing.
    - c. Remove construction required to provide for specified alteration or addition to existing Work.
    - d. Uncover Work to provide for inspection or reinspection of covered Work by Project Manager or regulatory agencies having jurisdiction.



- e. Connect Work not accomplished in proper sequence to completed Work.
  - f. Remove or relocate existing utilities and pipes that obstruct Work.
  - g. Make connections or alterations to existing or new facilities.
  - h. When necessary, provide openings, channels, chases and flues and cut, patch, and finish.
  - i. Provide protection for other portions of Project.
- 3. Restore existing Work to state equal to or better than that prior to cutting and patching and to standards of these Specifications.
  - 4. Support, anchor, attach, match, trim, and seal materials to Work of others. Unless otherwise specified, furnish and install sleeves, inserts, hangers, required for execution of Work.
  - 5. Provide shoring, bracing and support as required to maintain structural integrity and protect adjacent Work from damage during cutting and patching. Engineer's written approval is required before cutting beams or other structural members, anchors, lintels or other supports. Follow approved submittals, as applicable.
  - 6. Fully integrate new materials with existing similar materials by bonding, lapping, mechanically tying, anchoring or other effective means that shall prevent cracks and minimize evidence of patching. Conceal effects of demolition and patching and provide new construction that blends with existing adjacent or abutting surfaces without obvious breaks, joints, or changes of surface appearance unless specifically shown otherwise on Plans or as authorized by Project Manager.

**B. Connections to Existing Facilities**

- 1. Perform construction necessary to complete connections and tie-ins to existing facilities. Keep all existing facilities in continuous operation unless otherwise specifically permitted in these Specifications or approved by Project Manager.
- 2. Coordinate interruption of service requiring connection into existing facilities with facility owner and Project Manager. Bypassing of wastewater or sludge to waterways is not permitted. Provide temporary pumping facilities to handle wastewater if necessary. Use temporary bulkheads to minimize disruption. Provide temporary power supply and piping to facilitate construction where necessary.

3. Submit detailed schedule of proposed connections, including shut-downs and tie-ins. Include proposed time and date as well as anticipated duration of Work. Submit detailed schedule coordinated with construction schedule.

Provide specific time and date information to Project Manager 48 hours in advance of proposed Work.

4. Procedures and Operations:
  - a. Operate existing pumps, valves, and gates required for sequencing procedures under supervision of facility owner, operator and Project Manager. Do not operate valve, gate or other item of equipment without Owner's knowledge.
  - b. Equipment shall be tested and in operating condition before final tie-ins are made to connect equipment to existing facility as required.
  - c. Carefully coordinate Work and schedules. Provide written notice to Project Manager at least 48 hours before shutdowns or bypasses are required.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 01740

RESTORATION OF SITE

PART 1 GENERAL

1.01 SUMMARY

This Section includes restoration of site affected by the Work in public or private property, including but not limited to pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.02 MEASUREMENT AND PAYMENT

- A. Measurement and payment for restoration of project site for linear construction projects is paid by linear foot measured along the baseline. Multiple utilities within same right-of-way will be paid on linear foot basis for only one utility.
- B. Measurement and payment for Water Receiving Facility(s) - will be made on a lump sum basis. No partial payment will be made.

1.03 REFERENCES

ANSI Z60.1. American Standard for Nursery Stock.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit qualifications of nursery or landscaping firm to be used.

1.05 RELATED REQUIREMENTS

- A. Document 00700 – “General Conditions”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01562 – “Tree and Plant Protection”
- D. Section 01576 – “Waste Material Disposal”
- E. Section 02921 – “Hydromulch Seeding”
- F. Section 02922 – “Sodding”
- G. Section 02951 – “Pavement Repair and Resurfacing”

1.06 QUALITY ASSURANCE

Have trees, landscape shrubs, and plantings performed by qualified personnel.

1.07 – 1.09 NOT USED

1.10 DEFINITIONS

- A. Site Restoration is 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 improvements restored to condition which is equal to, or better than, that which existed prior to construction operations.
- B. Site Improvement includes but is not limited to pavement, curb and gutter, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping and other improvements in existence at the project site before commencement of construction operations.

1.11 – 1.12 NOT USED

1.13 WARRANTY

Warranty shall be in accordance with Section 00700 – General Conditions.

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Pavement, Sidewalks, and Driveways. Use materials as specified in Section 02951 – “Pavement Repair and Resurfacing”.
- B. Seeding and Sodding. Provide sod as specified in Section 02922 – “Sodding”. For areas to be seeded, conform to Section 02921 – “Hydromulch Seeding”.
- C. Trees, Shrubs, and Plantings.

Conform to requirements of Section 01562 – “Tree and Plant Protection”.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Coordination

1. For linear construction projects, complete site restoration within 30 days from date construction is successfully tested, unless extended in writing by Project Manager.
2. For linear construction projects, construction cannot exceed the unrestored site by more than 2,000 linear feet or the distance between two successive valves, whichever is greater. Site restoration must proceed continuously and be sequentially completed in order of work progress. No intermediate areas can be skipped or left to be completed at a future date, unless otherwise approved by Project Manager.

B. Installation

1. Pavement, Sidewalk, and Driveway Restoration.
  - a. Replace pavement, curb and gutter, sidewalks, and driveways removed or damaged as result of construction operations. Reconstruct in accordance with Section 02951 – “Pavement Repair and Resurfacing”.
  - b. Where replacement sidewalks terminate at street curb radius, construct wheel chair ramp that meets current Texas Accessibility Standards.
2. Seeding and Sodding.
  - a. Clean up construction debris and level area with bank sand so that resulting surface of new grass matches level of 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.
  - b. Restore previously existing turfed areas with sod and fertilize in accordance with Section 02922 – “Sodding”. Sod to match existing turf.
  - c. Restore unpaved areas not requiring sodding with hydromulch methods conforming to Section 02921 – “Hydromulch Seeding”.
3. Trees, Shrubbery, and Plants.

Remove and replant trees, shrubs, and plants in accordance with requirements of Section 01562 – “Tree and Plant Protection”.
4. Fence Removal and Replacement.
  - a. Replace fencing removed or damaged to equal or better than what existed prior to construction, including concrete footings and mow

strips. Provide new wood posts, top and bottom railing and panels.  
Metal fencing material not damaged by Work may be reused.

- b. Remove and dispose of damaged or substandard material.

C. Cleaning

Remove debris and trash to maintain clean and orderly site as described in General Conditions and Section 01576 – “Waste Material Disposal”.

D. Maintenance

- 1. Maintain shrubs, plantings, sodded areas and seeded areas through warranty period.
- 2. Replace shrubs, plantings, and seeded or sodded areas that fail to become established through warranty period.
- 3. Maintain newly planted trees, shrubs, and plantings in accordance with the requirements of Section 01562 – “Tree and Plant Protection”.
- 4. Refer to Section 01562 – “Tree and Plant Protection”, Section 02921 – “Hydromulch Seeding” and Section 02922 – “Sodding” for additional maintenance requirements.

3.04 – 3.10 NOT USED

END OF SECTION

Section 01770

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Substantial Completion Procedures.
- B. Closeout procedures for final submittals, operation and maintenance data, warranties, spare parts, and maintenance materials.
- C. Texas Department of Licensing and Regulation (TDLR) inspection for ADA compliance.

1.02 – 1.04 NOT USED

1.05 RELATED REQUIREMENTS

- A. Document 00300 – “Bid”
- B. Document 00700 – “General Conditions”
- C. Section 01110 – “Summary of Work”
- D. Section 01321 – “Construction Photographs”
- E. Section 01330 – “Submittal Procedures”
- F. Section 01782 – “Operations and Maintenance Data”
- G. Section 01785 – “Project Record Documents”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

- A. Substantial Completion
  - 1. Comply with Document 00700 – “General Conditions” (Section 15.5 – 15.6) regarding substantial completion when Contractor considers the Work, or portion thereof designated by Project Manager, to be substantially complete.

2. Insure the following items have been completed when included in the Work, prior to presenting a list of items to be inspected by Project Manager for issuance of a Certificate of Substantial Completion:
  - a. Cutting, plugging, and abandoning of water, wastewater, and storm sewer lines, as required by specifications for each item;
  - b. Construction of, and repairs to, pavement, driveways, sidewalks, and curbs and gutters;
  - c. Sodding and hydromulch seeding, unless waived by the Owner in writing;
  - d. General clean up including pavement markings, transfer of services, successful testing and landscape;
  - e. Installation of all applicable bid items included in Document 00300 – “Bid”; and
  - f. Any additional requirements in Section 01110 – “Summary of Work”.
3. Assist Project Manager with inspection of Contractor’s list of items and complete or correct the items, including items added by Project Manager, within a time period of 30 days or as mutually agreed.
4. Should Project Manager’s inspection show failure of Contractor to comply with substantial completion requirements, including those items in Paragraph 1.07.A.2 of this specification, Contractor shall complete or correct the items, before requesting another inspection by Project Manager.

**B. Closeout Procedures**

1. Comply with Document 00700 – “General Conditions” (Section 15.7 -15.9) regarding Final Completion and Final Payment when Work is complete and ready for Project Manager’s final inspection.
2. Provide Project Record Documents in accordance with Section 01785 – “Project Record Documents”.
3. Complete or correct items identified in Paragraph 1.07.A.4, with no new items added. Address new items during warranty period.
4. Owner will occupy portions of Work as specified in other Sections.

**C. Final Acceptance**

1. Final Cleaning Execute final cleaning prior to final inspection.



2. 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.
  3. Clean equipment and fixtures to sanitary condition.
  4. Clean or replace filters of operating equipment.
  5. Clean debris from roofs, gutters, down spouts, and drainage systems.
  6. Clean site; sweep paved areas, rake landscaped surfaces clean.
  7. Remove waste and surplus materials, rubbish, and temporary construction facilities from site following final test of utilities and completion of Work.
2. Adjusting
- Adjust operating equipment to ensure smooth and unhindered operation.
3. Operation and Maintenance Data
8. Submit operations and maintenance data as noted in Section 01330 – “Submittal Procedures” and Section 01782 – “Operations and Maintenance Data”.
- D. SPARE PARTS AND MAINTENANCE MATERIALS
1. Provide products, spare parts, maintenance, and extra materials in quantities specified in individual Specification sections.
  2. Deliver to location as directed by Project Manager; obtain receipt prior to final Payment Application.
- E. TEXAS DEPARTMENT OF LICENSING AND REGULATION (TDLR) INSPECTION
1. Contact TDLR’s Houston Regional Office, 5425 Polk Street, Suite G80 Houston, Texas, 77023, telephone 713-924-6300, to schedule an inspection for ADA compliance prior to final completion.
  2. Provide results of TDLR’s inspection to Project Manager prior to final inspection.
- F. FINAL PHOTOS
- Provide per Specification Section 01321 – “Construction Photographs”.

1.13 WARRANTY

- A. Provide one original and two copies of each warranty from subcontractors, suppliers, and manufacturers.
- B. Provide Table of Contents and assemble warranties in three-ring/D binder with durable plastic cover.
- C. Submit warranties prior to final progress payment.
- D. Warranties shall commence in accordance with requirements in Document 00700 – “General Conditions”.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

## Section 01782

## OPERATIONS AND MAINTENANCE DATA

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes submittal requirements for equipment and facility operating and maintenance manuals.

## 1.02 MEASUREMENT AND PAYMENT

No separate payment will be made for this item under Unit Price contracts.

For Stipulated (Lump Sum) contracts, the value of approved equipment operations and maintenance manuals is 5 percent of individual equipment value as indicated in Schedule of Values.

## 1.03 REFERENCES (NOT USED)

## 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”. Submit list of operation and maintenance manuals and parts manuals to be provided.
- B. Submit two copies, bound in 8½- x 11-inch text pages, three-ring/D binders with durable plastic covers and one CD in PDF format for each manual.
- C. Prepare binder covers with printed title “OPERATION AND MAINTENANCE INSTRUCTIONS,” title of project and subject matter of binder when multiple binders are required.
- D. Internally subdivide binder contents with permanent page dividers, logically organized as described in Item E below; with tab titling clearly printed under reinforced laminated plastic tabs.
- E. Contents: Prepare 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 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 following:
    - a. Shop drawings and product data
    - b. Air and water balance reports
    - c. Certificates
    - d. Photocopies of warranties
  - F. Within 1 month prior to placing equipment or facility in service, submit operation and maintenance and parts manual for review.
- 1.05 RELATED REQUIREMENTS
- Section 01330 – “Submittal Procedures”
- Section 01770 – “Closeout Procedures”
- Section 11303 – “Chemical Analyzers”
- 1.06 QUALITY ASSURANCE (NOT USED)
- 1.07 SYSTEM DESCRIPTION
- A. Equipment Operation and Maintenance Data
- Furnish operation and maintenance manuals for equipment. Operation and maintenance manual must contain all information required for the Owner to operate, maintain, and repair equipment. Manual must be prepared by equipment manufacturer, furnished to Project Manager and, as a minimum, contain the following as applicable:

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. Maintenance instructions are to include detailed drawings giving location of each maintainable part and lubrication point and detailed instructions on disassembly and reassembly of equipment
5. Troubleshooting guide
6. Outline, cross-section, and assembly drawings; engineering data; wiring diagram
7. Test data and performance curves
8. Detailed drawings giving location of each maintainable part prepared by equipment manufacturer
9. 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.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

## Section 01785

## PROJECT RECORD DOCUMENTS

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes maintenance and Submittal of Record Documents and Samples.

## 1.02 – 1.03 NOT USED

## 1.04 SUBMITTALS

At Contract closeout, deliver Project Record Documents to Project Manager.

## 1.05 RELATED REQUIREMENTS

Document 00700 – “General Conditions”

Document 01770 – “Closeout Procedures” {Section

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 SYSTEM DESCRIPTION

## A. Maintenance of Documents and Samples

1. Maintain one record copy of documents at site in accordance with Document 00700 – “General Conditions” (Section 16.11).
2. Store Record Documents and samples in field office when field office is required by Contract, or in secure location.
3. Label each document “PROJECT RECORD” in neat, large, printed letters.
4. Maintain Record Documents in clean dry and legible condition. Do not use Record Documents for construction purposes.
5. Keep Record Documents and Samples available for inspection by Project Manager.
6. Bring Record Documents to progress review meetings for viewing by Project Manager.

## B. Recording

1. Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
2. Plans and Shop Drawings: Legibly mark each item to record actual construction, or “as built” conditions, including:
  - a. Measured depths of elements of foundation in relation to finish first floor datum
  - b. Measured horizontal locations and elevations of underground utilities and appurtenances, referenced to permanent surface improvements
  - c. Elevations of underground utilities referenced to bench mark utilized for Project
  - d. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction
  - e. Field changes of dimension and detail
  - f. Changes made by modifications
  - g. Details not on original Plans
  - h. References to related shop drawings and modifications
  - i. Water main invert elevation, including elevation top of manway and centerline horizontal location relative to baseline
3. Maintain on site at all times an instrument for accurately measuring elevations.
4. Record information with red felt-tip marking pen on set of Record Documents.
5. For water mains, legibly mark each sheet of Record Documents to record:
  - a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
  - b. Type of pipe material installed and pipe size.
  - c. Type of casing/tunnel linear installed, size and thickness.
  - d. Water meter model and serial number.
  - e. Type of valve installed, direction and number of turns to full open.

- f. Changes made by change order or field order.
  - g. Other matters not originally specified.
- 6. Legibly annotate shop drawings to record changes made after review.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



Section 02081

CAST-IN-PLACE CONCRETE MANHOLES

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Cast-in-place concrete manholes for sanitary sewers and storm sewers, including box sewers.
- B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Payment for manholes is on a unit price basis for each manhole installed.
  - 2. Payment for Type C manhole with inlet top is on a unit price basis for each.
  - 3. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.
  - 4. 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 REFERENCES

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength ASTM C270 REV A - Standard Specification for Mortar for Unit Masonry.
- C. ASTM C923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
- D. ASTM C1107/C1107M REV A - Standard Specification for Packaged Dry, Hydraulic - Cement Grout (Nonshrink).

- E. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup>).
- F. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe, and Fittings.
- G. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- H. ASTM D 2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- I. AWWA C 213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit proposed design mix and test data for each type and strength of concrete.
- C. Submit manufacturer’s data and details of following items for approval:
  - 1. Frames, grates, rings, and covers.
  - 2. Materials to be used in fabricating drop connections.
  - 3. Materials to be used for pipe connections at manhole walls.
  - 4. Materials to be used for stubs and stub plugs.
  - 5. Plugs to be used for sanitary sewer hydrostatic testing.
  - 6. Installation instruments for forms.
- D. If detailed design for cast-in-place manholes is not included in the construction documents, contractor shall submit detailed drawings for the cast-in-place manholes meeting the design requirements of Section 02082 – “Precast Concrete Manholes”. Seal submittal drawings by a Professional Engineer registered in the State of Texas. Include design details on the pipe to manhole connections.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02082 – “Precast Concrete Manholes”

- D. Section 02084 – “Frames, Grates, Rings, and Covers”
- E. Section 02317 – “Excavation and Backfill for Utilities”
- F. Section 02911 – “Topsoil”
- G. Section 02921 – “Hydro-Mulch Seeding”
- H. Section 02922 – “Sodding”
- I. Section 03315 – “Concrete for Utility Construction”

1.06 – 1.13 NOT USED

## PART 2 P R O D U C T S

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Concrete
  - 1. Conform to requirements of Section 03315 – “Concrete for Utility Construction”.
  - 2. Provide Class A concrete with minimum compressive strength of 4,000 psi unless otherwise indicated on Plans.
- B. Reinforcing Steel

Conform to requirements of Section 03315 - “Concrete for Utility Construction”.
- C. Mortar

Conform to requirements of ASTM C270 REV A, Type S using Portland cement.
- D. Miscellaneous Metals

Provide cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 - “Frames, Grates, Rings, and Covers”.
- E. Drop Connections and Stubs

Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Plans.
- F. Pipe Connections
  - 1. Sanitary Sewers:

- a. Provide resilient connectors conforming to requirements of ASTM C923. Use the following materials for metallic mechanical devices as defined in ASTM C923:
  - 1) External clamps: Type 304 stainless steel
  - 2) Internal, expandable clamps on Standard manholes: Type 304 stainless steel, 11 gauge minimum
  - 3) Internal, expandable clamps on corrosion-resistant manholes:
    - a) Type 316 stainless steel, 11 gauge minimum
    - b) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213
- b. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Plans, provide polyethylene-isoprene waterstop meeting physical property requirements of ASTM C923, such as Pres-Seal WS Series, or approved equal.
2. Storm Sewers: Use non-shrink grout for storm sewer pipe connections to concrete manholes, unless otherwise shown on Plans. Grout pipe penetration in place on both inside and outside of manhole.

**G. Sealant Materials**

1. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P 201, or approved equal.
2. Provide external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.
3. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

**H. Corrosion-Resistant Manhole Materials**

Where corrosion-resistant manholes or PVC-lined manholes are indicated on the Plans, provide one of the following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections
2. Precast base sections lined with PVC and fiberglass manhole sections and cone sections.

**I. Backfill Materials**

Conform to the requirements of Section 02317 - "Excavation and Backfill for Utilities".

J. Non-Shrink Grout

1. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based non-shrink grout requiring only addition of water.
2. Provide grout meeting requirements of ASTM C1107/C1107 M REV A and having minimum 28-day compressive strength of 7,000 psi.

K. Vent Pipes for Sanitary Manholes

1. Provide external vent pipes for manholes where indicated on Plans.
2. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.
3. Vent Outlet Assembly: Provide vent outlet assembly as shown on Plans, constructed of following specified materials.
  - a. FRP Pipe: Provide filament-wound FRP conforming to ASTM D2996 or centrifugally cast FRP conforming to ASTM D2997. Seal cut ends in accordance with manufacturer's recommendations.
  - b. Joints and Fittings: Provide epoxy- bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.
  - c. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Plans. Meet bolt pattern and dimensions for ASME B16.1, 125-pound flanges. Use Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A307, Class A or B flange bolts.
  - d. Coating: Provide 2-component, aliphatic polyurethane coating, using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Provide Amershield, Tnemec 74, or approved equal. Project Manager selects color from manufacturer's standard colors.

L. Prohibited Materials

Do not use brick masonry for construction of sanitary sewer manhole, including adjustment of manholes to grade. Use only specified materials listed above.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Verify lines and grades are correct.
- B. Determine if subgrade, when scarified and recompact, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D698 prior to placement of foundation material and base section. When proper density cannot be reached, moisture condition subgrade until that density is reached or treat as an unstable subgrade.
- C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Manholes
  - 1. Construct manholes to dimensions shown on Plans. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.
  - 2. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Plans, under manhole base.
  - 3. Cast manhole foundations and walls monolithically. Use cold joint with approved waterstop when manhole flow line depth exceeds 12 feet. No other joints shall be allowed unless shown on Plans. Wrap cold joints with external sealing material, minimum 6-inch width.
  - 4. For concrete containing micro silica admixtures, place, finish, and cure concrete for manholes following procedures in Section 03315 - "Concrete for Utility Construction".
  - 5. Top of manhole elevations shown on Plans are approximate, based on current pavement and natural ground conditions as determined from elevations measured on 50-foot spacings. No additional payment shall be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

**B. Pipe Connections**

1. Install approved resilient connectors at each pipe entering and exiting sanitary sewer manholes in accordance with manufacturer's instructions.
2. Grout storm sewer connections to manhole unless otherwise shown on Plans. Grout pipe penetrations both inside and outside of manhole.
3. Ensure no concrete, cement stabilized sand, fill, or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on interior or exterior of manhole. When necessary, fill space with compressible material to ensure resilient connector will maintain full flexibility where evidence of reduced flexibility is encountered.
4. Where new manhole is to be constructed on existing sewer, a rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe spring line using adhesive recommended and supplied by waterstop manufacturer.
5. Do not construct joints on sanitary sewer pipe within wall sections of manholes. Use approved connection material.
6. Construct pipe stubs with resilient connectors for future connections at locations and with material indicated on Plans. Install approved stub plugs at interior of manhole.
7. Test connection for watertight seal before backfilling.

**C. Inverts for Sanitary Sewers**

1. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
  - a. Slope of invert bench: 1 inch per foot minimum; 1½ inch per foot maximum.
  - b. Depth of bench to invert:
    - 1) Pipes smaller than 15 inches: one-half of largest pipe diameter
    - 2) Pipes 15 to 24 inches: three-fourths of largest pipe diameter
    - 3) Pipes larger than 24 inches: equal to largest pipe diameter
  - c. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole and at pipe-manhole connections, unless otherwise indicated on Plans.

2. Form invert channels with Class A concrete if not integral with manhole base. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

D. Drop Connections for Sanitary Sewers

1. Backfill drop assembly with crushed stone wrapped in filter fabric, cement-stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.
2. Install connection when sewer line enters manhole higher than 24 inches above invert of manhole.

E. Stubs for Future Connections

In manholes where future connections are indicated on Plans, install resilient connectors and pipe stubs with approved watertight plugs.

F. Adjustment Rings and Frame

1. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces to be joined with non-shrink grout. Set cast iron frame on adjustment ring in a bed of approved sealant material. Install a sealant bed consisting of two beads of sealant, each bead having minimum dimensions of ½-inch high and ½-inch wide.
2. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame, and ring and precast section.
3. For manholes in unpaved areas, set top of frame a minimum of 6 inches above existing ground line unless otherwise indicated on Plans. Encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter.

G. Backfill

1. After concrete obtains adequate strength, place, and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - "Excavation and Backfill for Utilities". Use embedment zone backfill material for adjacent utilities, as shown in details over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.



2. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to spring line of pipe with Class B concrete or flowable fill.
3. In unpaved areas, grade surface at uniform slope of 5 to 1 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 – “Topsoil”. Seed in accordance with Section 02921 - “Hydro-Mulch Seeding”, or sod disturbed areas in accordance with Section 02922 - “Sodding”.

3.04 – 3.08 NOT USED

3.09 PROTECTION

Protect manholes from damage until subsequent work has been accepted. Repair or replace damaged elements of manholes at no additional cost.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02082

**PRECAST CONCRETE MANHOLES**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes:

- A. Precast concrete manholes for sanitary sewers, storm sewers and water lines.
- B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in Plans.
- C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices.
  - 1. Payment for normal depth manholes, up to 8 feet deep, is on a unit price basis for each manhole installed. Manhole depth is measured from top of cover to sewer invert. Manholes for water lines are measured from top of cover to inside base.
  - 2. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than 8 feet. Sewer manhole depth is measured from top of cover to sewer invert. Manholes for water lines are measured from top of cover to inside base.
  - 3. Payment for corrosion resistant manholes is on a unit price basis for each manhole installed.
  - 4. Payment for standard manhole drops is on a unit price basis for each drop installed. Standard manhole drops include both internal and external drops.
  - 5. Payment for watertight sanitary sewer manholes, including external vent pipe is on a unit price basis for each.
  - 6. Payment for air release and vacuum relief manholes with valves and fittings is on a unit price basis for each manhole including the air release and vacuum relief valves, fittings, vent piping and bollards installed.
  - 7. Payment for butterfly valve manholes with valves and fittings is on a unit price basis for each manhole including the butterfly valves and fittings installed.

8. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.
  9. Pay estimates for partial payments shall be made as measured above according to the following schedule for sanitary sewer manholes:
    - a. Estimate for 90 percent payment shall be authorized when the manhole is completely installed and surrounding soil backfilled
    - b. Estimate for 100 percent payment shall be authorized when manhole has been tested and accepted.
  10. 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 REFERENCES

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
- C. ASTM A615/A615M REV A - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- D. ASTM C270 REV A- Standard Specification for Mortar for Unit Masonry.
- E. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- F. ASTM C478 REV A - Standard Specification for Precast Reinforced Concrete Manhole Sections.
- G. ASTM C923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
- H. ASTM C1107/C1107M REV A - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
- I. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup>).
- J. ASTM D2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

- K. ASTM D2996 - Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- L. ASTM D2997 - Standard Specification for Centrifugally Cast “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
- M. AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and fittings
- N. American Association of State Highway and Transportation Officials (AASHTO).

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - “Submittal Procedures”.

Submit manufacturer’s data and details of following items for approval:

- 1. Shop Drawings of manhole sections, base units, and construction details, including reinforcement, jointing methods, materials, and dimensions.
  - 2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C478 REV A and design criteria as established in Paragraph 2.01 E of this Specification.
  - 3. Frames, grates, rings, and covers.
  - 4. Materials to be used in fabricating drop connections.
  - 5. Materials to be used for pipe connections at manhole walls.
  - 6. Materials to be used for stubs and stub plugs, if required.
  - 7. Materials and procedures for corrosion-resistant liner and coatings, if required.
  - 8. Plugs to be used for sanitary sewer hydrostatic testing.
  - 9. Manufacturer’s data for pre-mix (bag) concrete, if used for channel inverts and benches.
- B. Seal submittal drawings by Professional Engineer registered in the State of Texas.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02084 – “Frames, Grates, Rings and Covers”
- D. Section 02317 – “Excavation and Backfill for Utilities”
- E. Section 02321 – “Cement Stabilized Sand”
- F. Section 02911 – “Topsoil”
- G. Section 02921 – “Hydromulch Seeding”
- H. Section 02922 – “Sodding”
- I. Section 03315 – “Concrete for Utility Construction”
- J. Section 04061 – “Mortar”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Precast Concrete Manholes
  - 1. Provide manhole sections, base sections, and related components conforming to ASTM C478 REV A. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.
  - 2. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Plans. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.
  - 3. Provide tops to support cast iron castings meeting AASHTO M-306 Section 5 loading, and receive manhole frame & covers, as indicated on Plans.

4. Where manholes larger than 48-inch diameter are indicated on Plans, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Plans. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Project Manager.
5. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C478 REV A for depth as shown on Plans and to resist following loads.
  - a. AASHTO HS-20 design live loading applied to manhole cover and transmitted down to transition and base slabs.
  - b. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
  - c. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.
  - d. Internal liquid pressure based on unit weight of 63 pcf.
  - e. Dead load of manhole sections fully supported by transition and base slabs.
6. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C478 REV A and following:
  - a. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Plans.
  - b. Wall loading conditions:
    - 1) Saturated soil pressure acting on empty manhole.
    - 2) Manhole filled with liquid to mid-height from invert to cover, with no balancing external soil pressure.
  - c. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater.
7. Provide joints between sections with o-ring gaskets conforming to ASTM C443.
8. Place at least two precast concrete grade rings with thickness of 12 inches, under casting.

9. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.
10. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

**B. Concrete**

1. Conform to requirements of Section 03315 - "Concrete for Utility Construction".
2. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4,000 psi.
3. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Plans, conforming to requirements of Section 02321 - "Cement Stabilized Sand".
4. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4,000 psi for concrete foundation slab under manhole base section where indicated on Plans.

**C. Reinforcing Steel**

Conform to requirements of Section 03315 - "Concrete for Utility Construction".

**D. Mortar**

Conform to requirements of Section 04061 - "Mortar".

**E. Miscellaneous Metals**

Provide cast-iron frames, rings, and covers conforming to requirements of Section 02084 - "Frames, Grates, Rings and Covers".

**F. Drop Connections and Stubs**

Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Plans.

**G. Pipe Connections to Manhole**

1. Sanitary Sewers.

- a. Provide resilient connectors conforming to requirements of ASTM C923. Use the following materials for metallic mechanical devices as defined in ASTM C923:
    - 1) External clamps: Type 304 stainless steel
    - 2) Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.
    - 3) Internal, expandable clamps on corrosion-resistant manholes:
      - a) Type 316 stainless steel, 11 gauge minimum
      - b) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C213
  - b. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Plans, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C923, such as Press-Seal WS Series, or approved equal.
2. Storm Sewer Connections:
- Provide watertight connections. Grout storm sewer connections to manhole unless otherwise shown on Plans. Grout pipe penetration in place on both inside and outside of manhole.
3. Water Lines
- a. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press -Seal, Thunderline Link-Seal, or approved equal. See Plans for placement of assembly in manhole sections.
  - b. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

H. Sealant Materials



1. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.
2. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.
3. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

**I. Corrosion Resistant Manhole Materials**

When corrosion-resistant manholes are indicated on the Plans provide PVC liner for precast cylindrical manhole section.

**J. Backfill Materials**

Conform to requirements of Section 02317 - "Excavation and Backfill for Utilities".

**K. Non-Shrink Grout**

1. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.
2. Meet requirements of ASTM C1107/C1107M REV A and have minimum 28-day compressive strength of 7,000 psi.

**L. Vent Pipes for Sanitary Manholes**

1. Provide external vent pipes for manholes where indicated on Plans.
2. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.
3. Vent Outlet Assembly: Provide vent outlet assembly as shown on Plans, constructed of following specified materials:
  - a. FRP Pipe: Provide filament wound FRP conforming to ASTM D2996 or centrifugally cast FRP conforming to ASTM D2997. Seal cut ends in accordance with manufacturer's recommendations.
  - b. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive
  - c. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Plans. Meet bolt pattern and dimensions for ASME B16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A307, Class A or B.

- d. Coating: Provide 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Provide Amershield, Tnemec 74, or approved equal. Color shall be selected by Project Manager from manufacturer's standard colors.

**M. Vent Pipes for Water Line Manholes**

Provide vent pipes for air release and vacuum relief valves in accordance with the Plans. Vent pipe and fittings shall be Schedule 80 galvanized steel.

**N. Prohibited Materials**

Do not use brick masonry for construction of sanitary sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

**O. Manhole Ladder for Waterline Manholes**

- 1. Manhole Ladder: Fiberglass with 300-pound rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Plans.
  - a. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
  - b. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Plans.
  - c. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.
- 2. Provide approved petroleum-based tape encapsulating bolts in access manhole.

2.03 – 2.04 NOT USED

**PART 3 EXECUTION**

**3.01 GENERAL / MANUFACTURER(S) (NOT USED)**

**3.02 PREPARATION**

**A. Examination**

- 1. Verify that lines and grades are correct.

2. Determine if subgrade, when scarified and recompact, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.
3. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. Placement

1. Install precast manholes to conform to locations and dimensions shown on Plans.
2. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Plans.

#### B. Manhole Base Sections and Foundations

1. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Section 02321 - "Cement Stabilized Sand".
2. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Plans, under manhole base.
3. For manholes located over large diameter water lines, place precast base on a foundation of cement stabilized sand extending from bottom of manhole to bottom of trench. Manhole base is to be a minimum of 12-inches above water line.

#### C. Precast Manhole Sections

1. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.
2. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.
3. Seal any lifting holes with non-shrink grout.

4. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.
5. Place at least two precast concrete grade rings with thickness of 12 inches, under casting.

**D. Pipe Connections at Manholes**

1. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.
2. Grout storm sewer connections to manhole unless otherwise shown on Plans. Grout pipe penetration in place on both inside and outside of manhole.
3. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.
4. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.
5. Test connection for watertight seal before backfilling.

**E. Inverts for Sanitary**

1. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:
  - a. Slope of invert bench: 1 inch per foot minimum; 1½ inches per foot maximum
  - b. Depth of bench to invert:
    - 1) Pipes smaller than 15 inches: one-half of largest pipe diameter
    - 2) Pipes 15 to 24 inches: three-fourths of largest pipe diameter
    - 3) Pipes larger than 24 inches: equal to largest pipe diameter
  - c. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole and at pipe-manhole connection, unless otherwise indicated on Plans.

2. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

F. Drop Connections for Sanitary Sewers

1. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of 4 inches outside bells.
2. Install drop connection when sewer line enters manhole higher than 24 inches above invert of manhole.

G. Stubs for Future Connections

In manholes, where future connections are indicated on Plans, install resilient connectors and pipe stubs with approved watertight plugs.

H. Manhole Frame and Adjustment Rings

1. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of ½-inch high and ½-inch wide.
2. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and ring and precast section.
3. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Plans. In unpaved areas, encase storm and sanitary manhole frames in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded corner around perimeter. Encase water line manhole frames with a 6 foot square Class A concrete collar, 12 inches thick as shown in the standard details.

I. Backfill

1. Place and compact backfill materials in area of excavation surrounding manholes in accordance with the requirements of Section 02317 - "Excavation and Backfill for Utilities".

2. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.
3. In unpaved areas, provide positive drainage away from manhole frame to natural grade surface at uniform slope of 5 to 1 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 – “Topsoil”. Seed in accordance with Section 02921 - “Hydromulch Seeding”, or sod disturbed areas in accordance with Section 02922 - “Sodding”.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 – 3.08 NOT USED

3.09 PROTECTION

Protect manholes from damage until Work has been accepted. Repair damage to manholes at no additional cost.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02084

FRAMES, GRATES, RINGS, AND COVERS

PART 1 GENERAL

1.01 SUMMARY

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 frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.
2. Payment to rack over existing manhole is on a unit price basis for each manhole.
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.

1.03 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials

1. Standard Specification for Highway Bridges
2. M306: Standard Specification for Drainage, Sewer, Utility, and Related Castings
3. M105: Standard Specification for Gray Iron Castings

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings

C. ASTM A615/A615M REV A - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

1.04 SUBMITTALS

A. Conform to requirements of 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. Include plans, elevations, sections, and connection details. Show anchorage and accessory

items. Include setting drawings for location and installation of castings and anchorage devices.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02081 – “Cast-In-Place Concrete Manholes”
- D. Section 02082 – “Precast Concrete Manholes”
- E. Section 02085 – “Valve Boxes, Meter Boxes, and Meter Vaults”
- F. Section 02087 – “Brick Manholes”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Castings
  - 1. All castings shall be made from gray cast iron conforming to the requirements of AASHTO M105 class 35b.
  - 2. Castings intended for traffic service shall be clean castings capable of withstanding an application of 40,000 pound proof load as described in Section 5 of AASHTO M306 (includes items such as frames, grates, rings, covers, trench drainage, etc.)
  - 3. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Plans.
  - 4. All castings shall be manufactured in accordance with the requirement of Section 4 of AASHTO M306.
  - 5. Unless otherwise indicated, all castings shall be provided uncoated.
  - 6. Each individual casting shall include all markings as shown on the Plans and in accordance with the applicable specifications and shall be identified by the producing foundry showing the following: Name of producing foundry; country of manufacturer preceded by the words “Made in,” such as “Made in USA”; material designation, heat identification and cast date (MM/DD/YY),



casting lettering as required by the purchaser. If a casting is melted and poured at one foundry and labeled with the name of another organization, manufacturer, or foundry the casting shall include the name of the producing foundry and the organization the casting is produced for. The name of the producing foundry and the organization the product is made for shall have lettering of equal size, be in close proximity to each other, and be easily identified from the same side of the casting. The casting shall also include any additional markings as required in Section 9 of AASHTO M306 and Section 17 of AASHTO M105.

**B. Special Frames and Covers**

1. Where indicated on Plans, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.
2. Where shown on Plans, provide manhole frames and covers with 48 inch diameter clear opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Plans.

**C. Adjustment Rings for Asphalt Overlays**

1. Use castings conforming to Section 2.02.A.
2. One piece casting with dimensions to fit frame and cover.

**2.03 FABRICATION (NOT USED)**

**2.04 SOURCE QUALITY CONTROL**

**A. Testing Requirements**

1. Testing shall be performed in accordance with the following inspection criteria unless otherwise specified in the contract or purchase order. The manufacturer/supplier shall be responsible for carrying out all of the required tests and inspections. All testing shall be conducted in the United States using purchaser approved reliable facilities. The manufacturer/supplier shall maintain complete records of all such tests and inspections. All testing shall be paid for by the manufacturer/supplier.
2. The manufacturer shall report and certify material information obtained from separately cast test bars. If there are more than three test bar failures in a calendar year the manufacturer shall report this to the purchaser and shall discontinue supplying product. In order to resume supplying product, documentation that a new Quality System is in place to ensure material compliance must be submitted to and accepted by the purchaser. The manufacturer may also supply under subsection C.

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Install castings according to approved Shop Drawings, instructions in related specifications, and applicable directions from 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 form work until permanently set.
- C. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.
- D. Provide rounded or square concrete collars for manholes and valve boxes in unpaved areas as shown on the Plans and in accordance with the applicable specification sections: 02081 "Cast-in-Place Concrete Manholes", 02082 - "Precast Concrete Manholes", 02085 - "Valve Boxes, Meter Boxes and Meter Vaults", and 02087 - "Brick Manholes".

3.04 – 3.10 (NOT USED)

END OF SECTION

Section 02085

VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 GENERAL

1.01 SUMMARY

This 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 02521 - "Gate Valves".
  - 2. Payment for each size of meter vaults is on unit price basis per vault. Payment will be made for each vault installed, regardless of depth.
  - 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.

1.03 REFERENCES

- A. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
- C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.
- D. ASTM D648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
- E. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

- F. SECTION 0512 - Water Tap and Service Line Installation [City of Houston Standard Specification]

1.04 SUBMITTALS

- A. 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 State of Texas.
- D. Submit Shop Drawings for cast-in-place meter vaults for approval if proposed construction varies from Plans.
- E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.02.E, Plastic Meter Boxes.

1.05 RELATED REQUIREMENTS

- A. Section 01270 - "Measurement and Payment"
- B. Section 01330 - "Submittal Procedures"
- C. Section 02082 - "Precast Concrete Manholes"
- D. Section 02084 - "Frames, Grates, Rings and Covers"
- E. Section 02317 - "Excavation and Backfill for Utilities"
- F. Section 02320 - "Utility Backfill Materials"
- G. Section 02501 - "Ductile Iron Pipe and Fittings"
- H. Section 02506 - "Polyvinyl Chloride Pipe"
- I. Section 02511 - "Water Lines"
- J. Section 02775 - "Concrete Sidewalks"
- K. Section 02911 - "Topsoil"
- L. Section 02921 - "Hydromulch Seeding"

M. Section 02922 – “Sodding”

N. Section 03315 – “Concrete for Utility Construction”

1.06 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

### A. Valve Boxes

1. Provide Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.
2. Cast letter “W” into lid, ½ inch in height and raised 3/32 inch, for valves serving potable water lines.
3. Unless otherwise specified, uncoated cast iron.
4. Riser Pipe.
  - a. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Section 02506 – “Polyvinyl Chloride Pipe” or
  - b. Provide 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Section 02501 – “Ductile Iron Pipe and Fittings”.
  - c. Provide single section of pipe.
5. Concrete for valve box placement:
  - a. For locations in new concrete pavement, provide strength and mix design of new pavement.
  - b. For other locations, provide concrete conforming to requirements of Section 02775 - “Concrete Sidewalk”.

### B. Meter Boxes

1. Provide meter boxes for 5/8-inch through 1-inch meters of the following materials:
  - a. Non-traffic bearing locations: Cast iron, concrete or plastic.
  - b. Traffic bearing locations: Cast iron.

2. Provide meter boxes for 1½-inch and 2-inch meters of cast iron.
3. Provide meter box with reading lid. Provide lids with spring-type latching devices. Lids shall contain sufficient metal that meter box can be easily located with metal detector. Cast words “WATER METER” into lid with letters of ½-inch height and raised 3/32 inch.
4. Meter box dimensions shall conform to the following approximate dimensions:
  - a. Length: At top - 15½ inches; at bottom 20 inches
  - b. Width: At top - 12½ inches; at bottom 14¾ inches
  - c. Height: 12 inches
5. Extensions: Meter box extensions 3 inches and 6 inches in height shall be available from manufacturer as standard item.

C. Cast-Iron Meter Boxes

1. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A48/A48M, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.
2. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.
3. Provide lock-type meter boxes when required by Plans. Lock mechanisms shall work with ease.

D. Concrete Meter Boxes

1. Concrete Meter Boxes: Made of Class A concrete, with minimum 4,000 psi compressive strength, conforming to requirements of Section 03315 - “Concrete for Utility Construction”. Construct to dimensions shown on Plans.
2. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

E. Plastic Meter Boxes

1. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:

<b>ASTM</b>	<b>REQUIREMENT</b>
D256	Impact Strength = 1.9 ft.-lb./inch (Izod, Notched)
D256	Impact Strength = 6.4 ft.-lb./inch (Izod, Un-Notched)
D638	Tensile Strength (2.0 min.) = 3,400 psi
D648	Deflection Temperature = 170 degrees F
D 2240	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160 inch-lb.
D790	Flexural Modulus = 90,000 psi

2. Meter boxes shall meet the following test requirements:
  - a. Static Load: Not less than 2,500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.
  - b. Deflection: Not less than 1,000 pounds load required to deflect top edge of meter box 1/8-inch.
3. Meter box body, without lid, shall weigh approximately 7 pounds.

**F. Meter Vaults**

1. Meter vaults may be constructed of precast concrete or cast-in-place concrete unless a specific type of construction is required by Plans.
2. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 03315 - "Concrete for Utility Construction" with minimum compressive strength of 4,000 psi at 28 days.
3. Reinforcing steel for meter vaults: Conform to requirements of Section 03315 Concrete for Utility Construction.
4. Grates and Covers: Conform to requirements of Section 02084 - "Frames, Grates, Rings, and Covers".

**PART 3 EXECUTION**

**3.01 GENERAL / MANUFACTURER(S) (NOT USED)**

**3.02 PREPARATION**

**A. Examination**

1. Obtain approval from Project Manager for location of meter vault.
2. Verify lines and grade are correct.

3. Verify compacted subgrade will support loads imposed by vaults.

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. Valve Boxes

1. Install riser pipe with suitable length for depth of cover indicated on Plans or to accommodate actual finish grade.
  - a. Install with bell on top of valve
  - b. Place riser pipe in plumb, vertical position
2. 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. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.
3. Set, align, and adjust valve box so that lid is level with final grade.
4. In unpaved areas, set valve box 2 to 3 inches above natural grade and pour 30 inch by 30 inch by 8 inch thick concrete pad around valve box. Center valve box horizontally within concrete pad and stamp "NHCRWA" in the concrete as shown in the Plans.

#### B. Meter Boxes

1. Install cast iron or plastic boxes in accordance with manufacturers' instructions.
2. Construct concrete meter boxes to dimensions shown on Plans.
3. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.03.D, Frame and Cover for Meter Vaults.
4. Do not locate under paved areas unless approved by Project Manager. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

#### C. Meter Vaults

1. Construct concrete meter vaults to dimensions shown on Plans. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults. Vaults shall be designed to the same loading criteria and conditions of Section 02082 - "Precast Concrete Manholes", paragraph E. and F.



2. Precast Meter Vaults:
  - a. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to requirements of Section 02320 - "Utility Backfill Materials".
  - b. Seal lifting holes with cement-sand mortar or non-shrink grout.
3. Meter Vault Floor Slab:
  - a. Construct floor slabs minimum of 6-inch-thick reinforced concrete. Slope floor  $\frac{1}{4}$  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 Plans. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.
  - b. Precast floor slab elements may be used for precast vault construction
4. Cast-in-Place Meter Vault Walls:
  - a. Key walls to floor slab and form to dimensions shown on Plans. Minimum wall thickness shall be 4 inches.
  - b. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
  - c. Set frame for cover in concrete

D. Frame and Cover for Meter Vaults

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.

E. Backfill

1. 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".
2. In unpaved areas, grade surface at uniform slope of 5 to 1 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - "Topsoil". Provide seeding in accordance

**NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY VALVE BOXES, METER  
STANDARD SPECIFICATION BOXES, AND METER VAULTS**

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with Section 02921 - “Hydro-mulch Seeding”, or if sodding in accordance with Section 02922 - “Sodding”.

END OF SECTION

Section 02086

ADJUSTING MANHOLES, INLETS, AND VALVE BOXES TO GRADE

PART 1 GENERAL

1.01 SUMMARY

This Section includes adjusting elevation of manholes, inlets, and valve boxes to new grades.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for adjusting proposed manhole frames and covers, inlets, valve boxes, and meter boxes to grade for new construction under this Section. Include payment in unit price for related item.
2. Payment for adjusting existing manholes, frame and cover, inlets, valve boxes, and meter boxes to a new grade is on a unit price basis for each.
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.

1.03 – 1.04 NOT USED

1.05 RELATED REQUIREMENTS

- A. Section 01270 – "Measurement and Payment"
- B. Section 02081 – "Cast-In-Place Concrete Manholes"
- C. Section 02082 – "Precast Concrete Manholes"
- D. Section 02084 – "Frames, Grates, Rings and Covers"
- E. Section 02085 – "Valve Boxes, Meter Boxes, and Meter Vaults"
- F. Section 02087 – "Brick Manholes"
- G. Section 02316 – "Excavation and Backfill for Structures"
- H. Section 02501 – "Ductile Iron Pipe and Fittings"
- I. Section 02506 – "Polyvinyl Chloride Pipe"

**NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY ADJUSTING MANHOLES,  
STANDARD SPECIFICATION INLETS, AND VALVE BOXES TO GRADE**

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- J. Section 02632 – “Cast-in-Place Inlets, Headwalls and Wingwalls”
- K. Section 02633 – “Precast Concrete, Inlets, Headwalls and Wingwalls”
- L. Section 02911 – “Topsoil”
- M. Section 02921 – “Hydromulch Seeding”
- N. Section 02922 – “Sodding”
- O. Section 03315 – “Concrete for Utility Construction”
- P. Section 04061 – “Mortar”
- Q. Section 04210 – “Brick Masonry for Utility Construction”

1.06 – 1.13 NOT USED

**PART 2 PRODUCTS**

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR CONSTRUCTION

**A. Concrete Materials**

- 1. Provide concrete, conforming to requirements of Section 03315 – “Concrete for Utility Construction”.
- 2. Provide precast concrete manhole sections and adjustment rings conforming to requirements of Section 02082 - “Precast Concrete Manholes”.
- 3. Provide mortar conforming to requirements of Section 04061 - “Mortar”.

**B. Cast-Iron Materials**

Provide cast-iron materials conforming to requirements of Section 02084 - Frames, Grates, Rings, and Covers.

**C. Riser Piping Materials**

- 1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Section 02506 – “Polyvinyl Chloride Pipe” or provide 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Section 02501 – “Ductile Iron Pipe and Fittings”.
- 2. Provide single section of pipe.

D. Masonry Materials for Storm Sewer Manholes and Inlets

Provide brick masonry units conforming to the requirements of Section 04210 - "Brick Masonry for Utility Construction".

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

A. Examination

Examine existing structure, valve box, frame and cover or inlet box, frame and cover or inlet, piping and connections for damage or defects affecting adjustment to grade. Report damage or defects to Project Manager.

B. Establishing Grade

Coordinate grade related items with existing grade and finished grade or paving, and relate to established benchmark or reference line.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Adjusting Manholes and Inlets

1. Rebuild adjustment portion of manhole or inlet by adding or removing Adjustments. Follow procedures for the type of structure being adjusted detailed in the following Sections:
  - a. Section 02081 – "Cast-In-Place Concrete Manholes"
  - b. Section 02082 – "Precast Concrete Manholes"
  - c. Section 02087 – "Brick Manholes"
  - d. Section 02632 – "Cast-In-Place Inlets, Headwalls and Wingwalls"
  - e. Section 02633 – "Precast Concrete Inlets, Headwalls and Wingwalls"
2. Salvage and reuse cast-iron frame and cover or grate.
3. Protect or block off manhole or inlet bottom using wood forms shaped to fit so that no debris or soil falls to bottom during adjustment.
4. Verify that manholes and inlets are free of visible leaks as result of reconstruction. Repair leaks in manner subject to Project Manager's approval.

B. Adjusting Valve Boxes

1. Salvage and reuse valve box and surrounding concrete block as approved by Project Manager. No separate pay.
2. Remove and replace 6 inch riser pipe with suitable length for depth of cover required to establish adjusted elevation to accommodate actual finish grade. Provide riser pipe with material in accordance with Section 02085 – “Valve Boxes, Meter Boxes, and Meter Vaults”.
3. Reinstall valve box and riser piping plumbed in vertical position. Provide minimum 6 inches telescoping freeboard space between riser pipe top butt end and interior contact flange of valve box for vertical movement damping.
4. After valve box has been set, aligned, and adjusted, pour 30 inch by 30 inch by 8 inch thick concrete pad around valve box. Center valve box horizontally within concrete pad and stamp “NHCRWA” in the concrete as shown in the Plans.

C. Backfill and Grading

1. Backfill area of excavation surrounding each adjusted manhole, inlet, and valve box and compact according to requirements of Section 02316 - “Excavation and Backfill for Structures”.
2. Grade ground surface to drain away from each manhole and valve box. Place earth fill around manholes to level of upper rim of manhole frame. Place earth fill around valve box concrete slab.
3. In unpaved areas, grade surface at uniform slope of 1 to 5 from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 02911 - “Topsoil”. Provide seeding in accordance with Section 02921 - “Hydro-mulch Seeding”, or if sodding in accordance with Section 02922 - “Sodding”.

3.04 – 3.10 NOT USED

END OF SECTION

Section 02221

REMOVING EXISTING PAVEMENTS, STRUCTURES AND BURIED UTILITIES

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Removing concrete paving, asphaltic concrete pavement, brick pavement, and base courses.
- B. Removing concrete curbs, concrete curbs and gutters, sidewalks, and driveways.
- C. Removing pipe culverts, sewers, and sewer leads.
- D. Removing waterlines and water services lines including asbestos cement pipe per OSHA guidelines.
- E. Removing existing inlets and manholes.
- F. Removing and disposing of pre-stressed concrete beams and drill shafts.
- G. Removing miscellaneous structures of concrete or masonry.
- H. Removing existing bridge.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Payment for removing and disposing of asphaltic surfacing including base, regardless of thickness encountered, is on square yard basis measured between lips of gutters.
  - 2. Payment for removing and disposing of reinforced concrete pavement, with or without asphalt overlay, regardless of its thickness, is on square yard basis measured from back-to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.
  - 3. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on square yard basis.
  - 4. Payment for removing and disposing of concrete sidewalks and driveways is on square yard basis.

5. Payment for removing asphaltic surface course only is on a square yard basis paid under item description "Asphalt Surface Mill." This includes removal of existing surface to pavement base.
6. Payment for removing and disposing of miscellaneous concrete and masonry is on cubic yard basis of structure in place.
7. Payment for removing and disposing of pipe culverts, sewers, and sewer leads is on linear foot basis for each diameter and each material type of pipe removed.
8. Payment for removing and disposing of waterline and water service lines including asbestos cement pipe is on linear foot basis for each diameter pipe and each material type of pipe removed.
9. Payment for removing and disposing of existing inlets is on unit price basis for each inlet removed.
10. Payment for removing and disposing of prestressed concrete piles and drill shafts is on linear foot basis.
11. Payment for removing and disposing of existing bridge, including piles and abutments to minimum of 4 feet below ground level, is on a lump sum basis.
12. Payment for removing and disposing of existing manholes is on unit price basis for each manhole removed.
13. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Include cost of such Work in unit prices for items listed in bid form requiring saw cutting.
14. No payment will be made for Work outside maximum payment limits indicated on the Plans, or for pavements or structures removed for Contractor's convenience.

For utility installations: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on the Plans. Limits of measurement will be shown on Street Cut Pavement Replacement Rules.

15. 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 REFERENCES

- A. Conform to applicable codes for disposal of debris.
- B. Coordinate removal work with utility companies.

1.04 SUBMITTALS (NOT USED)

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01576 – “Waste Material Disposal”
- C. Section 02316 – “Excavation and Backfill for Structures”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Obtain advance approval from Project Manager for dimensions and limits of removal work.
- B. Identify known utilities below grade. Stake and flag locations.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Removals

- 1. Remove pavements and structures by methods that shall not damage underground utilities. Do not use drop hammer near existing underground utilities.
- 2. Minimize amount of earth loaded during removal operations.
- 3. 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 the full depth of the pavement or base. The use of a drop hammer shall only be allowed with the written approval of the Engineer.

4. When street and driveway saw cut location is greater than one-half of pavement lane width, remove pavement for full lane width or to nearest longitudinal joint as directed by Project Manager.
5. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.
6. Where indicated on the plans or directed by the Project Manager, remove waterlines and water services lines. Remove asbestos cement pipe per OSHA guidelines. Provide plug and clamp for pipe ends if required in accordance with Section 02516 - Cut, Plug, and Abandonment of Waterlines [City of Houston Standard Specification].
7. Where existing end of pipe culvert or end of sewer is to remain, install 8-inch-thick masonry plug in pipe end prior to backfill in accordance with requirements of Section 02316 – “Excavation and Backfill for Structures”.

**B. Backfill**

Backfill of removal areas shall be in accordance with requirements of Section 02316 – “Excavation and Backfill for Structures”.

**C. Disposal**

1. Disposal shall be in accordance with requirements of Section 01576 – “Waste Material Disposal”.
2. Remove from site, debris resulting from Work under this section in accordance with requirements of Section 01576 – “Waste Material Disposal”.

**3.04 – 3.08 NOT USED**

**3.09 PROTECTION**

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. Pavement and utility structures designated to remain.
5. Bench marks, monuments, and existing structures designated to remain.

**3.10 SCHEDULES (NOT USED)**

END OF SECTION

Section 02233

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SUMMARY

- 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. Removal of fences.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Payment for clearing and grubbing is on per acre basis.
  - 2. Payment for fence removal is on per linear foot basis by type of fence.
  - 3. No separate pay will be made for removing surface debris and rubbish under Section 01576 – “Waste Material Disposal”.
  - 4. 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 REFERENCES

- A. Conform to applicable codes for disposal of debris.
- B. Coordinate clearing Work with utility companies.

1.04 SUBMITTALS (NOT USED)

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01576 – “Waste Material Disposal”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

Verify that existing plant life and features designated to remain are identified and tagged.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. CLEARING

1. Remove stumps, main root ball, and root system to:
  - a. Depth of 24 inches below finished subgrade elevation in area bounded by lines 2 feet behind back of curbs.
  - b. Depth of 24 inches below finished surface of required cross section for other areas.
2. Clear undergrowth and deadwood without disturbing subsoil.
3. Remove vegetation from top soil scheduled for reuse.

B. REMOVAL

1. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Section 01576 – “Waste Material Disposal”.
2. 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.

3.04 – 3.08 NOT USED

3.09 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.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02260

**TRENCH SAFETY SYSTEM**

**PART 1 GENERAL**

**1.01 SUMMARY**

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

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices:
  - 1. Measurement for trench safety systems used on trench excavations is on a linear foot basis measured along centerline of trench, including manholes and other line structures.
  - 2. No payment will be made for Trench Safety Systems for structural excavations, tunnel shafts, auger pits, or excavation for trenchless installations under this section. Include payment for Trench Safety Systems in applicable structural or utility installation sections.
  - 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. Install and maintain trench safety systems in accordance with detail specifications set out in provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29CFR, Part 1926, Subpart P, as amended, including Final Rule, published in Federal Register Vol. 54, No. 209 on October 31, 1989. Sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.
- B. Reproduction of OSHA standards included in "Subpart P - Excavations" from Federal Register Vol. 54, No. 209 is available upon request to Contractors bidding on projects. The Owner assumes no responsibility for accuracy of reproduction. The Contractor is responsible for obtaining a copy of this section of the Federal Register.

- C. Legislation enacted by Texas Legislature with regard to Trench Safety Systems, is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., §756.021 (Vernon 1991).

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - "Submittal Procedures".
- B. Submit trench safety program specifically for construction of trench excavation. Design the trench safety program to be in accordance with OSHA 29 CFR 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 registered in the State of Texas retained and paid by Contractor.
- D. Review of trench safety system by Project Manager shall only be in regards to compliance with this specification and shall not constitute approval by Project Manager nor relieve Contractor of obligations under State and Federal trench safety laws.
- E. Submit certification that trench safety system shall not be subjected to loads exceeding those which the system was designed to withstand according to the available construction and geotechnical information.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – "Measurement and Payment"
- B. Section 01330 – "Submittal Procedures"

#### 1.06 QUALITY ASSURANCE

- A. Indemnification
  - 1. Contractor to indemnify and hold harmless the Owner and the Project Manager, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and cost of investigation), judgments or claims by anyone for injury or death of persons resulting from collapse or failure of trenches constructed under this Contract.
  - 2. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner and the Project Manager, its employees and agents, in case the Owner and the Project Manager is 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 hiring of the Contractor.



## 1.07 – 1.09 NOT USED

## 1.10 DEFINITIONS

- A. Trench. Narrow excavation (in relation to its depth) made below surface of ground. In general, depth is greater than width, but width of trench (measured at bottom) is not greater than 15 feet.
- B. Trench safety system requirements shall apply to larger open excavations if erection of structures or other installations limits space between excavation slope and 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. Trench safety system is Contractor's methods and means of construction.
- D. Trench Safety Program is the safety procedures governing the presence and activities of individuals working in and around trench excavations.

## 1.11 – 1.13 NOT USED

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

## 3.01 – 3.02 NOT USED

## 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Install and maintain trench safety systems in accordance with provisions of OSHA 29 CFR.
- B. Install specially designed trench safety systems in accordance with Contractor's trench excavation safety program for locations and conditions identified in the program.
- C. A competent person, as identified in Contractor's Trench Safety Program, shall verify that trench boxes and other pre-manufactured systems are certified for actual installation conditions.

## 3.04 REPAIR/RESTORATION (NOT USED)

## 3.05 FIELD QUALITY CONTROL

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

## 3.06 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

- A. Contractor, or Contractor's independently retained consultant, to make daily inspections of trench safety systems to ensure that installed systems and operations meet OSHA 29 CFR and other personnel protection regulation requirements.
- B. If evidence of possible cave-ins or slides is apparent, immediately stop work in trench and move personnel to safe locations until necessary precautions have been taken to safeguard personnel entering trench.
- C. Maintain permanent record of daily inspections. Daily inspection reports shall be retained by the Contractor and made available at the request of the Project Manager or Engineer.

3.09 -3.10 NOT USED

END OF SECTION

Section 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

This Section includes 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 payment in unit price or lump sum for construction of 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 REFERENCES

- A. ASTM D698 - Standard Test Methods for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lb/ft<sup>3</sup> (600kN-m/m<sup>3</sup>)).
- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- C. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depths).
- D. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- E. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.
- F. TxDOT Tex-110-E - Particle Size Analysis of Soils.
- G. Federal Regulations, 29 CFR, Part 1926, Standards - Excavation, Occupational Safety and Health Administration (OSHA).
- H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - “Submittal Procedures”.
- B. Submit Work plan for excavation and backfill for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to excavation and backfill activities. Use descriptions, with supporting illustrations, sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Plans.
- C. Submit excavation safety system plan.
  - 1. Submit excavation safety system plan in accordance with applicable OSHA requirements for excavations.
  - 2. Submit excavation safety system plan in accordance with requirements of Section 02260 - “Trench Safety System”, for excavations that fall under State and Federal trench safety laws.
- D. Submit 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.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 01555 – “Traffic Control and Regulation”
- E. Section 01562 – “Tree and Plant Protection”
- F. Section 01576 – “Waste Material Disposal”
- G. Section 01578 – “Control of Ground Water and Surface Water”
- H. Section 01785 – “Project Record Documents”

- I. Section 02221 – “Removing Existing Pavements and Structures”
  - J. Section 02260 – “Trench Safety System”
  - K. Section 02319 – “Borrow”
  - L. Section 02320 – “Utility Backfill Materials”
  - M. Section 02321 – “Cement Stabilized Sand”
  - N. Section 02621 – “Geotextile”
- 1.06 QUALITY ASSURANCE
- A. Tests
    - 1. Testing and analysis of backfill materials for soil classification and compaction during construction shall be performed by an independent laboratory in accordance with requirements of Section 01454 - “Testing Laboratory Services” and as specified in this Section.
    - 2. Perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- “Utility Backfill Materials”.
- 1.07 – 1.09 NOT USED
- 1.10 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 D2487.
    - 2. Materials that cannot be compacted to required density due to 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 are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.
  - C. Select Material: Material as defined in Section 02320 - “Utility Backfill Materials”.

- D. Backfill: 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 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. Foundation base provides smooth, level working surface for construction of concrete foundation.
- G. Foundation Subgrade: Foundation subgrade is surface of natural soil which has been excavated and prepared to support foundation base or foundation backfill, where needed.
- H. Ground Water Control Systems: Installations external to excavation 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 excavation, and depressurization to prevent failure or heaving of 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 excavation. Remove rain water and surface water which accidentally enters excavation as part of excavation drainage.
- J. Excavation Drainage: Removal of surface and seepage water in excavation by sump pumping and using French drains surrounding foundation to intercept water.
- K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below foundation as shown on Plans, and backfilled with foundation backfill material.
- L. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.11 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Perform excavation with equipment suitable for achieving requirements of this Specification.

- B. Use equipment which shall produce degree of compaction specified. Compact backfill within 3 feet of walls with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to depth of fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.03 FABRICATION (NOT USED)

2.04 SOURCE QUALITY CONTROL

- A. Material Classifications

Use backfill materials conforming to classifications and product descriptions of Section 02320 - "Utility Backfill Materials". Use classification or product description for backfill applications as shown on Plans and as specified.

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Conduct an inspection to determine condition of existing structures and other permanent installations.
- B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - "Traffic Control and Regulation". Maintain barricades and warning devices at all times for streets and intersections where Work is in progress, or where affected by 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 02260 - "Trench Safety Systems".
- D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - "Removing Existing Pavements and Structures".
- E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - "Control of Ground Water and Surface Water".

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Excavation

- 1. Perform excavation Work so that underground structure can be installed to depths and alignments shown on Plans. Use caution during excavation work to

- avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to absolute minimum necessary. No additional payment shall be made for excess excavation not authorized by Project Manager.
2. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue Work at that location. Notify Project Manager and obtain instructions before proceeding in such areas.
  3. Immediately notify agency or company owning any line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.
  4. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.
  5. 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.
  6. Conduct hauling operations so that trucks and other vehicles do not create dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner such that objectionable materials shall not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.
  7. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by Work.
  8. Provide sheeting, shoring, and bracing where required to safely complete Work, to prevent excavation from extending beyond limits indicated on Plans, and to protect Work and adjacent structures or improvements. Use sheeting, shoring, and bracing to protect workmen and public conforming to requirements of Section 02260 - "Trench Safety Systems".
  9. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, cement stabilized sand, or other material approved by Project Manager and compact to 95 percent standard density.
  10. After completion of structure, remove sheeting, shoring, and bracing unless shown on Plans to remain in place or directed by Project Manager 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 Work and adjacent structures or improvements.



11. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or other material approved by Project Manager and compact to 95 percent standard density.

**B. Handling Excavated Materials**

1. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at sufficient distance from excavation to prevent slides or cave-ins.
2. Provide additional backfill material in accordance with requirements of Section 02319 - "Borrow", if adequate quantities of suitable material are not available from excavation and trenching operations at site.

**C. Dewatering**

1. Provide ground water control per Section 01578 - "Control of Ground Water and Surface Water".
2. Keep ground water surface elevation minimum of 2 feet below bottom of foundation base.
3. Maintain ground water control as directed by Section 01578 - "Control of Ground Water and Surface Water" and until structure is sufficiently complete to provide required weight to resist hydrostatic uplift with minimum safety factor of 1.2.

**D. Foundation Excavation**

1. Notify Project Manager at least 48 hours prior to planned completion of foundation excavations. Do not place foundation base until excavation is accepted by Project Manager.
2. Excavate to elevations shown on Plans, as needed to provide space for foundation base, forming level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or material as directed by Project Manager. Prior to placing material over it, recompact sub grade where indicated on Plans, scarifying as needed, to 95 percent of maximum Standard Dry Density according to ASTM D 698. If specified level of compaction cannot be achieved, moisture condition subgrade and recompact until 95 percent is achieved, over-excavate to provide minimum layer of 24 inches of foundation backfill material, or other means acceptable to Project Manager.
3. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by Project Manager.

4. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.
5. Remove soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to required subgrade, and replace with foundation backfill material, as directed by Project Manager, at no additional cost.
6. Place foundation base, or foundation backfill material where needed, over subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with seal slab or cement-stabilized sand.
7. Use filter fabric as specified in Section 02621 - "Geotextile" to separate crushed aggregate, and other free draining Class I materials from native soils or select material backfill. Overlap fabric minimum of 12 inches beyond where another material stops contact with soil.
8. Place crushed aggregate, and other Class I materials, in uniform layers of 8-inch maximum thickness. Perform compaction by means of at least two passes of vibratory compactor.

E. Foundation Base

1. Place foundation base after sub grade is properly prepared, including placement of foundation backfill where needed. Use foundation base consisting of 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, seal slab with minimum thickness of 4 inches may be placed. Extend foundation base minimum of 12 inches beyond edge of structure foundation, unless shown otherwise on Plans.
2. Where foundation base and foundation backfill are of same material, both can be placed in one operation.

F. Backfill

1. Complete backfill to surface of natural ground or to lines and grades shown on Plans. Remove forms, lumber, trash and debris from structures.
  - a. Unless otherwise shown on Plans, for structures under pavement or within one foot back of curb, use cement stabilized sand up to pavement base or subgrade.

- b. Unless otherwise shown on Plans, for structures not under pavement, use cement stabilized sand to within 2 feet of final grade. Use random backfill of suitable material for top two feet.
  2. Do not place backfill against concrete walls or similar structures, until laboratory test breaks indicate that concrete has reached minimum of 85 percent of specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until slab or intermediate walls have been placed and concrete has attained sufficient strength.
  3. Remove concrete forms before starting backfill and remove shoring and bracing as Work progresses.
  4. Maintain backfill material at no less than 2 percent below nor more than 2 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D698 below paved areas. Compact fill to at least 95 percent around structures below unpaved areas.
  5. Where backfill is placed against sloped excavation surface, run compaction equipment across boundary of cut slope and backfill to form compacted slope surface for placement of next layer of backfill.
  6. Place backfill using cement stabilized sand in accordance with Section 02321 - "Cement Stabilized Sand".
- G. Disposal of Excess Material

Dispose of excess materials in accordance with requirements of Section 01576 - "Waste Material Disposal".
- 3.04 REPAIR/RESTORATION (NOT USED)
- 3.05 FIELD QUALITY CONTROL
  - A. Testing shall be performed under provisions of Section 01454 - "Testing Laboratory Services".
  - B. Tests shall be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests shall be performed whenever there is noticeable change in material gradation or plasticity.

- C. In-place density tests of compacted sub grade and backfill shall be performed according to ASTM D1556/D1556M, or ASTM D6938, and at following frequencies and conditions:
  - 1. Minimum of one test for every 50 to 100 cubic yards of compacted backfill material as directed by Project Manager.
  - 2. A minimum of three density tests for each full work shift.
  - 3. Density tests shall be performed in all placement areas.
  - 4. Number of tests will be increased when inspection determines that soil types or moisture contents are not uniform or when compacting effort is variable and not considered sufficient to attain uniform density.
  - 5. Identify elevation of test with respect to natural ground.
  - 6. Record approximate depth of lift tested.
- D. At least one test for moisture-density relationships shall be initially performed for each type of backfill material in accordance with ASTM D698. Perform additional moisture-density relationship test once a month or whenever there is noticeable change in material gradation or plasticity.
- E. When tests indicate Work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

### 3.06 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Plans, 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 is indicated on Plans.
- 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.

END OF SECTION

Section 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

This Section includes 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 unit price for installed underground piping, sewer, conduit, or duct work.
2. When Project Manager directs Contractor to overexcavate trench bottom, Contractor shall be paid by unit price bid per linear foot under bid item – 6-Inch Overexcavation of Trench Bottom.
  - a. No payment will be made if Project Manager does not direct Contractor to overexcavate trench bottom.
  - b. No overexcavation shall be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 – “Control of Ground Water and Surface Water”.
3. No additional payment shall be made for performing Critical Location exploratory excavation. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.
4. 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 REFERENCES

- A. ASTM C12 – Standard Practice for Installing Vitrified Clay Pipe Lines.
- B. ASTM D558 – Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

- C. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).
- D. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- E. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
- F. ASTM D2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- G. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- H. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- I. TxDOT Tex-101-E – Preparing Soil and Flexible Base Materials for Testing.
- J. TxDOT Tex-110-E – Particle Size Analysis of Soils.
- K. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).
- L. ASTM C76 REV A – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit proposed vacuum excavation method and qualifications of proposed subcontractor for approval by Project Manager.
- C. Submit planned typical method of excavation, backfill placement, and compaction including:
  - 1. Trench widths.
  - 2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.
  - 3. Procedures for assuring compaction against undisturbed soil when premanufactured trench safety systems are proposed.
- D. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 – “Utility Backfill Materials”.

- E. Submit trench excavation safety program in accordance with requirements of Section 02260 – “Trench Safety System”. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.
- 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.
- G. Submit 11 inch by 17 inch copy of Plans with plotted utility or obstruction location titled “Critical Location Report” to Project Manager. The Critical Location Report shall be a prerequisite for the approval of any proposed lay schedules for water line projects utilizing the following pipe materials: Ductile Iron Pipe (Section 02501 – for pipelines 30” and larger), Prestressed Concrete Cylinder Pipe (Section 02507), Large Diameter Steel Pipe (Section 02518), or Bar Wrapped Steel Cylinder Pipe (Section 02613). See also paragraph 3.03, Critical Location investigation.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 01504 – “Temporary Facilities and Controls”
- E. Section 01555 – “Traffic Control and Regulation”
- F. Section 01562 – “Tree and Plant Protection”
- G. Section 01576 – “Waste Material Disposal”
- H. Section 01578 – “Control of Ground Water and Surface Water”
- I. Section 01725 – “Field Surveying”
- J. Section 02221 – “Removing Existing Pavements and Structures”
- K. Section 02260 – “Trench Safety System”
- L. Section 02320 – “Utility Backfill Materials”
- M. Section 02321 – “Cement Stabilized Sand”
- N. Section 02501 – “Ductile Iron Pipe and Fittings”
- O. Section 02506 – “Polyvinyl Chloride Pipe”

- P. Section 02507 – “Prestressed Concrete Cylinder Pipe”
- Q. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”
- R. Section 02613 – “Bar Wrapped Steel Cylinder Pipe”
- S. Section 02621 – “Geotextile”
- T. Section 03315 – “Concrete for Utility Construction”
- U. Special Shoring Design Requirements

Have special shoring designed or selected by Contractor’s Professional Engineer to provide support for sides of 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 premanufactured system selected by Contractor’s Professional Engineer to meet project site requirements based on manufacturer’s standard design.

#### 1.06 QUALITY ASSURANCE

- A. Tests
  - 1. Testing and analysis of backfill materials for soil classification and compaction during construction shall be performed by an independent laboratory provided by the Owner in accordance with requirements of Section 01454 – “Testing Laboratory Services” and as specified in this Section.
  - 2. Perform backfill material source qualification testing in accordance with requirements of Section 02320 – “Utility Backfill Materials”.

#### 1.07 – 1.09 NOT USED

#### 1.10 DEFINITIONS

- A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Plans, or foundation backfill material placed and compacted in over-excavations.
- B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.
- C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.



- D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.
- E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching, and initial backfill.
- F. Trench Zone: 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 D2487.
  - 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. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, 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 rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.
- L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.
- M. Trench Conditions are defined with regard to 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 as result 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 embedment zone in combination with ground water control in predominately sandy or silty soils.
  3. Unstable Trench: Unstable trench conditions exist in 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 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. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.
- O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along 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 Plans, 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 02260 – “Trench Safety Systems”.

- S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as Work proceeds, used as protective system and designed to withstand forces imposed on it by cave-in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.
- T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.
- U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements.
- V. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jets are used to slough off and vacuum away soil.

1.11 SEQUENCING (NOT USED)

1.12 SCHEDULING

Schedule Work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

1.13 WARRANTY (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.
- B. Use only hand-operated tamping equipment until 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 1.08, Special Shoring Design Requirements.

2.03 FABRICATION (NOT USED)

2.04 SOURCE QUALITY CONTROL

A. Material Classifications

1. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - "Utility Backfill Materials" and Section 02321 - "Cement Stabilized Sand".
2. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - "Concrete for Utility Construction".
3. Geotextile (Filter Fabric): Conform to requirements of Section 02621 - "Geotextile".
4. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

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 Work, and are considered hazardous to traffic movements.
- B. Perform Work to conform with applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - "Trench Safety Systems".
- C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager 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 to Section 01578 - "Control of Ground Water and Surface Water". Provide stable trench to allow installation in accordance with Specifications.
- 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".
- G. Limit concrete removal, pavement removal, and dewatering to less than five pipe laying days in advance of pipe laying.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Standard Practice

1. Install flexible pipe, including “semi-rigid” pipe, to conform to standard practice described in ASTM D2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.
2. Install rigid pipe to conform with standard practice described in ASTM C12 or C76 REV A as applicable, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Critical Location Investigation

1. The contractor shall properly locate and identify all critical locates shown on the Plans. Prior to manufacturing pipe of types and sizes listed in paragraph 1.06.G all critical locate activities shall be complete. The contractor shall confirm critical utilities using vacuum excavation or other suitable excavation method and provide a submittal to the Owner with their findings and proof of completion, in accordance with the requirements of paragraph 1.06. Field verify horizontal and vertical locations of such lines within a zone of 2 feet vertically above and below, and 4 feet horizontally on each side of proposed Work. Exclude water jetting at PCCP water lines. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 11 inch by 17 inch copy of Plans. In addition, include horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline. Use extreme caution and care when uncovering utilities designated by Critical Locate.
2. Notify involved utility companies of date and time that investigation excavation shall occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours’ notice prior to field excavation or related Work.

C. Existing Utility Investigation

1. Horizontal and vertical location of various underground lines shown on Plans, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations.
2. The Contractor shall verify location of existing utilities in proximity to the water line corridor. Verify location of existing utilities a minimum of 7

working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Notify Project Manager in writing immediately upon identification of obstruction.

3. In event of failure to identify obstruction a minimum of 7 days in advance of pipe laying, Contractor shall not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager is notified of obstruction.
4. Notify involved utility companies of date and time that investigation excavation shall occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours' notice prior to field excavation or related Work.

D. Excavation

1. Except as otherwise specified or shown on Plans, install underground utilities in open cut trenches with vertical sides.
2. Perform excavation Work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Plans. Avoid disturbing surrounding ground and existing facilities and improvements.
3. Trench excavation widths shall meet the following requirements:
  - a. Minimum Allowable Trench Width: O.D. + 36 inches.
  - b. Maximum Allowable Trench Width: O.D. + 48 inches.

Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

4. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment, and backfill, and other materials.
5. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue Work at that location. Notify Project Manager and obtain instructions before proceeding.

6. Shoring of Trench Walls.
  - a. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls shall remain laterally supported at all times.
  - b. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.
  - c. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.
  - d. Employ special methods for maintaining 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.
  - e. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.
7. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:
  - a. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.
  - b. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Recompact after shield is moved if soil is disturbed.
  - c. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.
  - d. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.

- e. Conform to applicable Government regulations.
  - 8. Voids under paving area outside shield caused by Contractor's Work shall require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.
  - 9. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.
  - 10. Coordinate excavation within 15 feet of pipeline with Company's representative. Support pipeline with methods agreed to by Pipeline Company's representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company's line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company's representative.
  - 11. When, during excavation to uncover Pipeline Company's pipelines, screwed collar or an oxyacetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.
- E. Handling Excavated Materials
- 1. 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 distance from trench to prevent slides or cave-ins.
  - 2. When required, provide additional backfill material conforming to requirements of Section 02320 – "Utility Backfill Materials".
  - 3. Do not place stockpiles of excess excavated materials on streets or adjacent properties. Protect excess stockpiles for use on site. Maintain site conditions in accordance with Section 01504 – "Temporary Facilities and Controls". Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.



F. Trench Foundation

1. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.
2. When wet soil is encountered on trench bottom and dewatering system is not required, overexcavate an additional 6 inches with approval by Project Manager. Place nonwoven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.
3. Perform over excavation, when directed by Project Manager, in accordance with Paragraph 3.07B above.
  - a. Even though Contractor has not determined material to be unsuitable, or
  - b. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 – Control of Ground Water and Surface Water.
4. 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.

G. Pipe Embedment, Placement, and Compaction

1. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.
2. Place embedment including bedding, haunching, and initial backfill as shown on Plans.
3. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.
4. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

5. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.
6. 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.
7. Place haunching material manually around 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 pipe with sand bags or other suitable means.
8. Place electrical conduit, if used, directly on foundation without bedding.
9. 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. Water tamping is not allowed.
10. For water lines construction embedment, use bank run sand or concrete sand as specified in Section 02320 – “Utility Backfill Material”. Adhere to the following subparagraph numbers a and b.
  - a. Class I, II, and III Embedment Materials:
    - 1) Maximum 6 inch compacted lift thickness.
    - 2) Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D698.
    - 3) Moisture content to be within –3 percent to +5 percent of optimum as determined according to ASTM D698, unless otherwise approved by Project Manager.
  - b. Cement Stabilized Sand (where required for special installations):
    - 1) Maximum 6 inch compacted thickness.
    - 2) Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D698.
    - 3) Moisture content to be on dry side of optimum as determined according to ASTM D698 but sufficient for effective hydration.
11. For storm sewers and sanitary sewers other than force mains, provide cement stabilized sand per subparagraph b below. For Sanitary Sewer force mains adhere to the following subparagraph numbers a and b, and the embedment requirements shown on the Plans. Embedment materials for storm sewers and

sanitary sewers including force mains shall meet the requirements of Section 02320 – “Utility Backfill Material”.

- a. Class I Embedment Materials.
    - 1) Maximum 6 inch compacted lift thickness.
    - 2) Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.
    - 3) Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation, or trench walls.
  - b. Class II Embedment and Cement Stabilized Sand.
    - 1) Maximum 6 inch compacted thickness.
    - 2) Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D698 for Class II materials and according to ASTM D558 for cement stabilized materials.
    - 3) Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D558 but sufficient for effective hydration.
12. Place trench dams in Class I embedment 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.

**H. Trench Zone Backfill Placement and Compaction**

- 1. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.
- 2. For water lines, under pavement and to within one foot back of curb, use backfill materials described by trench limits.
  - a. For water lines 20 inches in diameter and smaller, use bank run sand or select backfill materials up to pavement base or subgrade.
  - b. For water lines 24 inches in diameter and larger, backfill with suitable on-site material up to 12 inches below pavement base or subgrade.

Place minimum of 12 inches of select backfill below pavement base or subgrade.

3. For sewer pipes under pavement and to within one foot back of curb, use backfill materials described by trench limits.
  - a. For sewer pipes 36 inches in diameter and smaller use cement stabilized sand up to pavement base or subgrade.
  - b. For sewer pipes 42 inches in diameter and larger, backfill with suitable on-site material or select backfill up to 12 inches below pavement base or subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.
4. Where damage to completed pipe installation Work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.
5. If unsuitable materials are discovered notify Engineer, remove unsuitable material from the site, and backfill with suitable material.
6. Unless otherwise shown on Plans. Use one of the following trench zone backfills under pavement and to within one foot of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.
  - a. Class I, II, or III or combination thereof:
    - 1) Place in maximum 12-inch thick loose layers.
    - 2) Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D698.
    - 3) Moisture content within zero percent to +5 percent of optimum determined according to ASTM D698, unless otherwise approved by Project Manager.
  - b. Cement-Stabilized Sand:
    - 1) Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.
    - 2) Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D538.

- 3) Moisture content on dry side of optimum determined according to ASTM D558 but sufficient for cement hydration.
  - c. Class IVA and IVB (Clay Soils):
    - 1) Place in maximum 8-inch thick loose lifts.
    - 2) Compact by vibratory Sheepfoot Roller to minimum of 95 percent of maximum dry density determined according to ASTM D698.
    - 3) Moisture content within zero percent to +5 percent above optimum determined according to ASTM D698, unless approved by Project Manager.
7. Unless otherwise shown on Plans, for trench excavations not under pavement, backfill of suitable material may be used in trench zone.
  - a. Class IVA and IVB (Clay Soils) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at no additional cost to the Owner, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements or use different suitable material.
  - b. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.
  - c. Compaction by appropriate equipment to minimum of 95 percent of maximum dry density determined according to ASTM D698.
  - d. Moisture content as necessary to achieve density.
8. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.
9. Buried warning and identification tape for non-metallic pipe.

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 4 inch minimum width, blue color for water line with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED WATER LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil. Warning and identification tape shall be centered above water main and buried 36-inches below finished grade.

10. Tracer wire for non-metallic pipe: provide trace wire and test stations as shown on plans and per Section 02506 Polyvinyl Chloride (PVC) Pipe. Tracer wire shall be AWG #8 solid strung soft drawn copper insulated with high molecular weight HDPE, suitable for direct bury application.

I. Manholes, Junction Boxes, and Other Pipeline Structures

Encapsulate manhole, junction box and other pipeline structures with cement stabilized sand; minimum of 1 foot below base, minimum 1 foot around walls, up to within 12 inches of pavement subgrade or finished grade. Compact in accordance with Paragraph 3.09.F.2 of this Section.

J. Disposal of Excess Material

Dispose of excess materials in accordance with requirements of Section 01576 – “Waste Material Disposal”.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 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.
- C. Tests shall be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests shall be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Project Manager.
- D. At least three tests for moisture-density relationships shall be performed initially for backfill materials in accordance with ASTM D698, and for cement-stabilized sand in accordance with ASTM D558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.
- E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials shall be performed according to ASTM D1556, or ASTM D6938, and at following frequencies and conditions.
  1. For open cut construction projects: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material.

2. For construction within auger pits: Unless otherwise approved by Project Manager, successful compaction to be measure by one test per 40 linear feet measured along pipe for compacted embedment zone (minimum one test per auger pit) and two tests per 40 linear feet measured along pipe for compaction of trench zone backfill material (minimum two test per auger pit).
  3. A minimum of three density tests for each full shift of Work.
  4. Density tests shall be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill, and trench zone.
  5. The number of tests shall 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.
  6. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.
  7. Two verification tests shall be performed adjacent to in-place tests showing density less than acceptance criteria. Placement shall be rejected unless both verification tests show acceptable results.
  8. Recompacted placement shall be retested at same frequency as first test series, including verification tests.
  9. Identify elevation of test with respect to natural ground or pavement.
- F. Recondition, recompact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.
- G. Acceptability of crushed rock compaction shall be determined by inspection.

3.06 – 3.08 NOT USED

3.09 PROTECTION

- A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Plans, 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 is indicated on Plans.

- 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.

3.10 SCHEDULES (NOT USED)

END OF SECTION



Section 02318

EXTRA UNIT PRICE WORK FOR EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Measurement and payment applicable to extra unit price Work items for excavation and backfill made necessary by unusual or unforeseen circumstances encountered during utility installations.
- B. Extra unit price Work for excavation and backfill is paid only when authorized in advance by Project Manager.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

- 1. Excavation Around Obstructions: Payment for excavation around obstructions is on cubic yard basis, measured in place, without deduction for volume occupied by portions of pipes, ducts, or other structures left in place across trenches excavated under this item.
- 2. Extra Hand Excavation: Payment for extra hand excavation is on cubic yard basis, measured in place.
- 3. Extra Machine Excavation: Payment for extra machine excavation is on cubic yard basis, measured in place.
- 4. Extra Placement of Backfill Material: Payment for extra placement of backfill material is on cubic yard basis, measured in place, for material installed as part of Work. At discretion of Project Manager, measurement of cubic yards may be calculated from volume of Extra Hand Excavation or Extra Machine Excavation for which replacement is made, minus volume of any Extra Placement of Granular Backfill authorized in conjunction with Work.
- 5. Extra Placement of Granular Backfill: Payment for extra placement of granular backfill material is on cubic yard basis, measured in place.
- 6. Extra Select Backfill: Payment for extra select backfill is on cubic yard basis, measured in place for a theoretical minimum trench width. The Project Manager may authorize extra select backfill when soil from the excavation Work does not include adequate quantities for placement of suitable on-site material (random backfill).

7.      Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

1.03 – 1.04 NOT USED

1.05      RELATED REQUIREMENTS

- A.      Section 01270 – “Measurement and Payment”
- B.      Section 02316 – “Excavation and Backfill for Structures”
- C.      Section 02317 – “Excavation and Backfill for Utilities”
- D.      Section 02320 – “Utility Backfill Materials”

1.06 – 1.09 NOT USED

1.10      DEFINITIONS

- A.      Excavation Around Obstructions: Excavation necessitated by obstruction of pipes (other than service connections 3 inches in diameter or less), ducts, or other structures, not shown on Plans, and of an unusual or unforeseen nature which interfere with installation of utility piping by normal methods of excavation or auguring.
- B.      Extra Hand Excavation: Excavation by manual labor made necessary by unusual or unforeseen circumstances at locations approved in advance by Project Manager.
- C.      Extra Machine Excavation: Excavation by machine at or near project site to perform related Work not included in original project scope but added for convenience of the Owner, as approved in advance by Project Manager.
- D.      Extra Replacement of Backfill Material: Handling, backfill, and compaction of excavated material authorized under extra Work bid items for Extra Hand Excavation or Extra Machine Excavation. Placement and compaction shall conform to requirements specified for excavation and backfill in Sections 02316 – “Excavation and Backfill for Structures” and 02317 – “Excavation and Backfill for Utilities”.
- E.      Extra Placement of Granular Backfill: Hauling, placing, and compacting granular backfill materials as approved by Project Manager in conjunction with Extra Replacement of Backfill Material. Materials placed under this item shall conform to requirements for Bank Run Sand, Cement Stabilized Sand, Concrete Sand, Gem Sand, Crushed Stone, or Crushed Concrete specified for backfill material in Sections 02316 – Excavation and Backfill for Structures and 02317 – “Excavation and Backfill for Utilities”.
- F.      Extra Select Backfill: Unsuitable material removed from the project and select backfill material hauled to the project, or conditioning unsuitable material on the site to make it select backfill. Provide select backfill material as specified in Section 02320 – “Utility

Backfill Material”.

1.11 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

Section 02319

**BORROW**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes soil materials for embankment.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices.**

1. Payment for borrow is on cubic yard basis calculated by theoretical quantities using average end area method based on Plans.
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 REFERENCES**

- A.** ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
- B.** ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

**1.04 SUBMITTALS**

- A.** Conform to requirements of Section 01330 - "Submittal Procedures".
- B.** Submit location and description of proposed borrow area for approval.
- C.** Submit material samples for testing.

**1.05 RELATED REQUIREMENTS**

- A.** Section 01270 – "Measurement and Payment"
- B.** Section 01330 – "Submittal Procedures"
- C.** Section 01454 – "Testing Laboratory Services"
- D.** Section 01555 – "Traffic Control and Regulation"

E. Section 02330 – “Embankment”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Soil Material

1. Grade borrow material used for embankment free of lumps greater than 6 inches, rocks larger than 3 inches, organic material, chemical waste or other contamination, and debris. Take borrow material from sources approved by Project Manager.
2. Use material with plasticity index not less than 12, nor more than 20 when tested in accordance with ASTM D4318. Maximum liquid limit shall be 45, unless approved by Project Manager. Do not use blend of cohesive and granular soils to achieve required plasticity index.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Notify Project Manager and testing laboratory 5 days in advance of opening borrow source to permit obtaining samples for qualification testing. When material does not meet specification requirements, locate another source of borrow.
- B. Clear approved source area of trees, stumps, brush, roots, vegetation, organic matter, and other unacceptable material before excavation.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Excavation

Provide adequate drainage of surface water so that surface water run off does not enter borrow pit excavation.

B. Hauling

Use covered trucks. Conform to requirements of Section 01555 - “Traffic Control and Regulation”.

C. Embankment

Conform to requirements of Section 02330 - "Embankment".

3.04 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

Test and analyze soil materials in accordance with ASTM D4318 and ASTM D2216 under provisions of Section 01454 - "Testing Laboratory Services".

3.09 – 3.10 NOT USED

END OF SECTION

## Section 02320

## UTILITY BACKFILL MATERIALS

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes:

- A. Material Classifications.
- B. Utility Backfill Materials:
  - 1. Concrete sand
  - 2. Gem sand
  - 3. Pea gravel
  - 4. Crushed stone
  - 5. Crushed concrete
  - 6. Bank run sand
  - 7. Select backfill
  - 8. Random backfill
  - 9. Cement stabilized sand
- C. Material Handling and Quality Control Requirements.

## 1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. No payment will be made for backfill material. Include payment in unit price for applicable utility installation.
  - 2. Payment for backfill material, when included as separate pay item or when directed by Project Manager, is on cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Plans, or as directed by Project Manager.
  - 3. Payment for backfill of authorized over-excavation is in accordance with Section 02318 - "Extra Unit Price Work for Excavation and Backfill".

4. 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 REFERENCES

- A. ASTM C33/C33M - Standard Specification for Concrete Aggregate.
- B. ASTM C40/C40M - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- C. ASTM C123/C123M - Standard Test Method for Lightweight Particles in Aggregate.
- D. ASTM C131/C131M - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.
- E. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- F. ASTM C142/C142M - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- G. ASTM D1140/D1140M - Standard Test Methods for Determining the Amount of Material Finer than 75- $\mu$ m (No. 200) Sieve in Soils by Washing.
- H. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- I. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- J. ASTM D4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Heating.
- K. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
- L. TxDOT Tex-110-E - Particle Size Analysis of Soils.
- M. TxDOT Tex-460-A - Determining Crushed Face Particle Count.

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – "Submittal Procedures".



- B. Submit 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. Comply with Paragraph 2.04.A, Material Testing.
- D. Before stockpiling materials, submit copy of temporary easement or approval from landowner for stockpiling backfill material on private property.
- E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 02316 – “Excavation and Backfill for Structures”
- E. Section 02317 – “Excavation and Backfill for Utilities”
- F. Section 02318 – “Extra Unit Price Work for Excavation and Backfill”
- G. Section 02321 – “Cement Stabilized Sand”
- H. Section 02711 – “Hot Mix Asphalt Base Course”
- I. Section 02712 – “Cement Stabilized Base Course”
- J. Section 02713 – “Recycled Crushed Concrete Base Course”
- K. Section 02951 – “Pavement Repair and Resurfacing”
- L. Section 03315 – “Concrete for Utility Construction”

#### 1.06 QUALITY ASSURANCE

- A. Tests
  - 1. Perform tests of sources for backfill material in accordance with Paragraph 2.04.A.2.
  - 2. Verification tests of backfill materials may be performed by the Owner in accordance with Section 01454 - “Testing Laboratory Services” and in accordance with Paragraph 3.05.

## 1.07 SYSTEM DESCRIPTION (NOT USED)

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.
- B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Project Manager in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.
- C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.
- D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

## 1.09 PROJECT SITE CONDITIONS (NOT USED)

## 1.10 DEFINITIONS

- A. Unsuitable Material:
  - 1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D2487.
  - 2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.
  - 3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.
  - 4. Materials contaminated with hydrocarbons or other chemical contaminants.
- B. Suitable Material:
  - 1. Materials meeting specification requirements.
  - 2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.
- C. 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 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. Foundation base provides smooth, level working surface for construction of concrete foundation.
- E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.
- F. Embedment Material: Soil material placed under controlled conditions within 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 trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.
- H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.
- I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be 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 for Utilities" for other definitions regarding utility installation by trench construction.

1.11 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

### A. Material Classifications

- 1. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D2487. Material use and application is defined in utility installation specifications and Plans either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

2. Class Designations Based on Laboratory Testing:
- a. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
    - 1) Plasticity index: non-plastic.
    - 2) Gradation:  $D_{60}/D_{10}$  - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
  - b. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
    - 1) Plasticity index: non-plastic to 4.
    - 2) Gradations:
      - a) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
      - b) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
      - c) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.
  - c. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
    - 1) Plasticity index: greater than 7.
    - 2) Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.
  - d. Class IVA: Lean clays (CL).
    - 1) Plasticity Indexes:
      - a) Plasticity index: greater than 7, and above A line.
      - b) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
    - 2) Liquid limit: less than 50.
    - 3) Gradation: amount passing No. 200 sieve - greater than 50 percent.

- 4) Inorganic.
- e. Class IVB: Fat clays (CH)
  - 1) Plasticity index: above A line.
  - 2) Liquid limit: 50 or greater.
  - 3) Gradation: amount passing No. 200 sieve - greater than 50 percent.
  - 4) Inorganic.
- f. Use soils with dual class designation according to ASTM D2487, and which are not defined above, according to more restrictive class.

**B. Product Descriptions**

- 1. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), 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 Project Manager. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Section 02316 - "Excavation and Backfill for Structures" and Section 02317 - "Excavation and Backfill for Utilities".
- 2. 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 following limits for deleterious materials:
  - a. 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 C142/C142M.
  - b. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C123/C123M.
  - c. Organic impurities: No color darker than standard color when tested in accordance with ASTM C40/C40M.
- 3. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Project Manager, provided that physical property criteria are determined to be satisfactory by testing.

4. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D2487) meeting following requirements:
- Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D1140/D1140M. Amount of clay lumps or balls not exceeding 2 percent.
  - Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D4318: Plasticity index: not exceeding 7.
5. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C33/C33M and graded within following limits when tested in accordance with ASTM C136/C136M:

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

6. Gem Sand: Sand conforming to requirements of ASTM C33/C33M for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C136/C136M:

Sieve	Percent Passing
3/8"	95 to 100
No. 4	60 to 80
No. 8	15 to 40

7. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C136/C136M:

Sieve	Percent Passing
1/2"	100
3/8"	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

8. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:
- Materials of one product delivered for same construction activity from single source, unless otherwise approved by Project Manager.
  - Non-plastic fines.
  - Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C131/C131M.
  - Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.
  - Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable material for embedment where crushed stone is shown on applicable utility embedment drawing details.
  - Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are 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.
  - 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	-
¾"	60 - 90	90 - 100	100
½"	25 - 60	-	90 - 100
3/8"	-	20 - 55	40 - 70
No. 4	0 - 5	0 - 10	0 - 15
No. 8	-	0 - 5	0 - 5

9. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in

accordance with Section 02951 - "Pavement Repair and Resurfacing", to meet plasticity criteria.

10. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Section 02316 - "Excavation and Backfill for Structures" and Section 02317 - "Excavation and Backfill for Utilities".
11. Cement Stabilized Sand: Conform to requirements of Section 02321 - "Cement Stabilized Sand".
12. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - "Concrete for Utility Construction".
13. Flexible Base Course Material: Conform to requirements of applicable portions of Section 02711 - "Hot Mix Asphalt Base Course", Section 02712 - "Cement Stabilized Base Course", and Section 02713 - "Recycled Crushed Concrete Base Course".
14. Flowable Fill Material: Where shown on Plans, controlled low-strength material consisting of fluid mixture of cement, fly ash, aggregate, water, and with admixtures as necessary to provide workable properties. Long-term unconfined compressive strength shall be 300 psi minimum.

C. Sources

1. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.
2. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Project Manager may obtain samples for verification testing.
3. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of 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 material is approved by Project Manager, expense for sampling and testing required to change to different material will be credited to the Owner through change order.
4. Bank run sand, select backfill, and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete Work from off-site sources.



5. The Owner does not represent or guarantee that any soil found in excavation Work shall be suitable and acceptable as backfill material.

## 2.03 FABRICATION (NOT USED)

## 2.04 SOURCE QUALITY CONTROL

### A. Material Testing

1. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:
  - a. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.
  - b. Plasticity of material passing No. 40 sieve
  - c. Los Angeles abrasion wear of material retained on No. 4 sieve
  - d. Clay lumps
  - e. Lightweight pieces
  - f. Organic impurities
2. Production Testing. Provide reports to Project Manager from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.
3. Assist Project Manager in obtaining material samples for verification testing at source or at production plant.
4. Testing of Flowable Fill Material shall be performed in accordance with ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

## PART 3 EXECUTION

### 3.01 – 3.04 NOT USED

3.05 FIELD QUALITY CONTROL

A. Quality Control

1. The Project Manager 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 Work.
2. The Project Manager may re-sample material at any stage of Work or location if changes in characteristics are apparent.

3.06 – 3.10 NOT USED

END OF SECTION

## Section 02321

## CEMENT STABILIZED SAND

## PART 1 GENERAL

## 1.01 SECTION INCLUDES

Cement stabilized sand material.

## 1.02 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 3.06.A 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.

## 1.03 REFERENCES

- A. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
- B. ASTM C40/C40M – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
- C. ASTM C42/C42M – Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- D. ASTM C94/C94M – Standard Specification for Ready-Mixed Concrete.
- E. ASTM C123/C123M – Standard Test Method for Lightweight Particles in Aggregate.
- F. ASTM C142/C142M – Standard Test Method for Clay Lumps and Friable Particles in Aggregates.
- G. ASTM C150/C150M – Specification for Portland Cement.
- H. ASTM DASTM D558 – Standard Test Method for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.
- I. ASTM DASTM D1632 – Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.

- J. ASTM DASTM D1633 – Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
- K. ASTM DASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- L. ASTM DASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
- M. ASTM DASTM D3665 – Standard Practice for Random Sampling of Construction Materials.
- N. ASTM DASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- O. Texas Administrative Code §290.44(e)(4)(B) - Public Drinking Water; Subchapter D: Rules and Regulations for Public Water Systems; Water Distribution

#### 1.04 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 2.04.A, Materials Qualifications.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 02320 – “Utility Backfill Materials”
- E. Design Requirements
  - 1. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours using no less than 1.1 sacks of cement per ton of dry sand.
    - a. Design shall be based on strength specimens molded in accordance with ASTM D558 at moisture content within 3 percent of optimum and within 4 hours of batching.
    - b. Determine minimum cement content from production data and statistical history.

1.06 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Cement: Type I Portland cement conforming to ASTM C150/C150M.
  - B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C33/C33M, 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 United Soil Classification System of ASTM DASTM D2487.
    - 2. Deleterious materials:
      - a. Clay lumps, ASTM C142/C142M; less than 0.5 percent.
      - b. Lightweight pieces, ASTM C123/C123M; less than 5.0 percent.
      - c. Organic impurities, ASTM C40/C40M, color no darker than standard color.
    - 3. Plasticity index of 4 or less when tested in accordance with ASTM DASTM D4318.
  - C. Water: Potable water, free of oils, acids, alkalis, organic matter or other deleterious substances, meeting requirements of ASTM C94/C94M.
  - D. Mixing Materials
    - 1. Add required amount of water and mix thoroughly in pugmill-type mixer.
    - 2. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.
- 2.03 FABRICATION (NOT USED)
- 2.04 SOURCE QUALITY CONTROL
- A. Material Qualification
    - 1. Determine target cement content of material as follows:
      - a. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.

- b. Complete molding of samples within 4 hours after addition of water.
  - c. Perform strength tests (average of two specimens) at 48 hours and 7 days.
  - d. Perform cement content tests on each sample.
  - e. Perform moisture content tests on each sample.
  - f. Plot average 48-hour strength vs. cement content.
  - g. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).
2. Test raw sand for following properties at point of entry into pug-mill:
- a. Gradation
  - b. Plasticity index
  - c. Organic impurities
  - d. Clay lumps and friable particles
  - e. Lightweight pieces
  - f. Moisture content
  - g. Classification
3. Present data obtained in format similar to that provided in sample data form attached to this Section.
4. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:

$$f'_c + \frac{1}{2} \text{ standard deviation}$$

## PART 3 EXECUTION

### 3.01 – 3.02 NOT USED

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. PLACING

- 1. Place sand-cement mixture in maximum 8-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM DASTM D558, unless otherwise specified. Refer to related specifications for

thickness of lifts in other applications. Target moisture content during compaction is  $\pm 3$  percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

2. Do not place or compact sand-cement mixture in standing or free water.
3. Where potable water lines cross wastewater lines, embed wastewater line with cement stabilized sand in accordance with Texas Administrative Code §290.44(e)(4)(B):
  - a. 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).
  - b. Unless otherwise shown on Plans, embed wastewater main or lateral minimum of six inches above and below.
  - c. Use brown coloring in cement stabilized sand for wastewater main or lateral bedding for identification of pressure rated wastewater mains during future construction.

#### 3.04 REPAIR/RESTORATION (NOT USED)

#### 3.05 FIELD QUALITY CONTROL

- A. Testing shall 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 stabilized sand shall be taken in the field at point of delivery in accordance with ASTM D3665. Obtain three individual samples of approximately 12 to 15 pounds each from the first, middle, and last third of the truck and composite them into one sample for test purposes.
- C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM DASTM D558, Method A, without adjusting moisture content. Samples shall 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 shall be removed from molds and cured in accordance with ASTM D1632.
- E. Specimens shall be tested for compressive strength in accordance with ASTM D1633, Method A. Two specimens shall be tested at 48 hours plus or minus 2 hours and two specimens shall be tested at 7 days plus or minus 4 hours.

- F. A strength test shall be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength shall 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 D1633 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 D1633
  - 16. Supplier Mixture identification
  - 17. Specimen diameter and height, in.
  - 18. Specimen cross-sectional area, sq. in.



## I. Acceptance

1. Strength level of material will be considered satisfactory if:
  - a. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
  - b. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.
2. 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 3.06.A Adjustment for Deficient Strength.
3. The material will be considered unacceptable and subject to removal and replacement at Contractor's expense when individual strength test (average of two specimens) have 7-day strength less than 70 psi.
4. 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.
5. Testing laboratory shall notify Contractor, Program Manager, and material supplier by E-mail of tests indicating results falling below specified strength requirements within 24 hours.
6. If any strength test of laboratory cured specimen falls below the specified strength, Contractor may, at his 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 3.03A.
7. 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 than 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

## 3.06 ADJUSTING

## A. Adjustment for Deficient Strength

1. When mixture produces 7-day compressive strength greater than or equal 100 pounds per square inch, then material will be considered satisfactory and bid price will be paid in full.
2. When mixture produces 7-day compressive strength less than 100 pounds per square inch and greater than or equal to 70 pounds per square inch, material

shall be accepted contingent on credit in payment to the owner. Compute credit by the following formula:

$$\text{Credit per Cubic Yard} = \frac{\$30.00 \times 2 (100 \text{ psi} - \text{Actual psi})}{100}$$

3. 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 the Owner.

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY

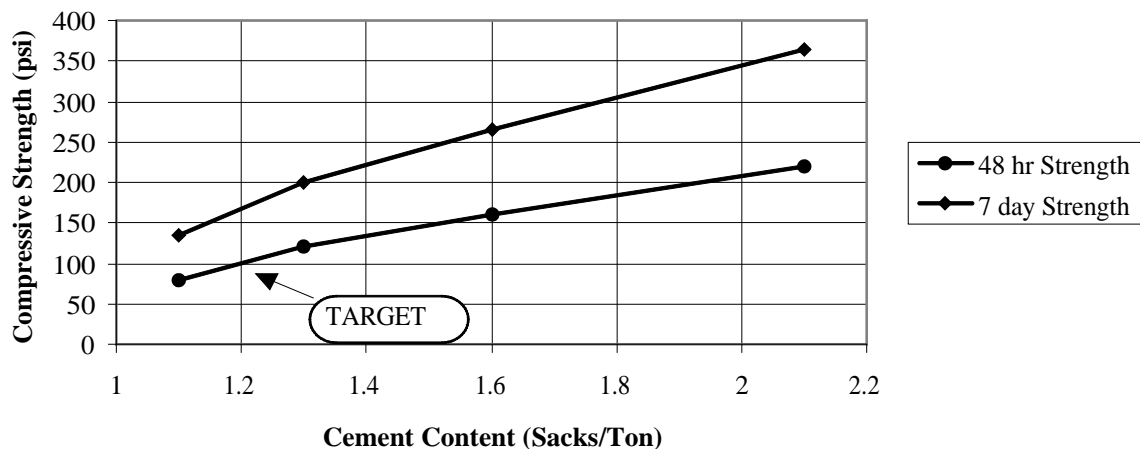
STANDARD SPECIFICATION

CEMENT STABILIZED SAND

<b>Supplier:</b> City Stabilized Sand	<b>Plant No:</b> 1 - Main Street	<b>Date of Tests:</b> January 1, 1997
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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		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		N.H.C.R.W.A.		
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 02330

EMBANKMENT

PART 1 GENERAL

1.01 SUMMARY

This Section includes construction of embankments with excess excavated material and borrow.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for embankment under this section. Include payment in unit price for excavation or borrow.
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 REFERENCES

- A. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soils Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>).
- B. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
- C. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS (NOT USED)

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01454 – “Testing Laboratory Services”
- C. Section 01576 – “Waste Material Disposal”
- D. Section 02315 – “Roadway Excavation”
- E. Section 02316 – “Excavation and Backfill for Structures”

- F. Section 02317 – “Excavation and Backfill for Utilities”
- G. Section 02319 – “Borrow”
- H. Section 02320 – “Utility Backfill Materials”
- I. Section 02511 – “Water Lines”

1.06 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Refer to Section 02315 – “Roadway Excavation” for acceptable excess materials from roadway excavation.
- B. Refer to Section 02317 – “Excavation and Backfill for Utilities” for acceptable excess materials from utility excavation and trenching.
- C. Refer to Section 02319 – “Borrow” for acceptable borrow materials.

2.03 – 2.04 NOT USED

## PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Examination
  - 1. Verify borrow and excess excavated materials to be reused are approved.
  - 2. Verify removals and clearing and grubbing operations have been completed.
- B. Backfill test pits, stump holes, small swales and other surface irregularities. Backfill and compact in designated lift depths to requirements for embankment compaction.
- C. Record location and plug and fill inactive water and oil wells. Conform to Texas State Health Department, Texas Commission on Environmental Quality and Texas Railroad Commission requirements. Notify Project Manager prior to plugging wells.
- D. Excavate and dispose of unsuitable soil and other unsuitable materials which will not consolidate. Backfill and compact to requirements for embankment. Unsuitable soil is defined in Section 02316 – “Excavation and Backfill for Structures” and Section 02320 – “Utility Backfill Materials”.

- E. Backfill new utilities below future grade. Conform to requirements of Sections 02317 – “Excavation and Backfill for Utilities”, and 02511 – “Water Lines”.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Placing Embankment

1. Do not conduct placement operations during inclement weather or when existing ground or fill materials exceed 3 percent of optimum moisture content. Contractor may manipulate wet material to facilitate drying, by disking or windrowing.
2. Do not place embankment fill until density and moisture content of previously placed material comply with specified requirements.
3. Scarify areas to be filled to minimum depth of 4 inches to bond existing and new materials. Mix with first fill layer.
4. Spread fill material evenly, from dumped piles or windrows, into horizontal layers approximately parallel to finished grade. Place to meet specified compacted thickness. Break clods and lumps and mix materials by blading, harrowing, disking or other approved method. Extend each layer across full width of fill.
5. Each layer shall be homogeneous and contain uniform moisture content before compaction. Mix dissimilar abutting materials to prevent abrupt changes in composition of fill.
6. Layers shall not exceed the following compacted thickness:
  - a. Areas indicated to be under future paving or shoulders, to be constructed within 6 months: 6 inches when compacted with pneumatic rollers, or 8 inches when compacted with other rollers.
  - b. Other areas: 12 inches
7. For steep slopes, cut benches into slope and scarify before placing fill. Place increasingly wider horizontal layers of specified depth to level of each bench.
8. Build embankment layers on back slopes, adjacent to existing roadbeds, to level of old roadbed. Scarify top of old roadbed to minimum depth of 4 inches and recompact with next fill layer.
9. Construct to lines and grades shown on Plans.
10. Remove unsuitable material and excess soil not being used for embankment from site in accordance with requirements of Section 01576 – “Waste Material Disposal”.

11. Maintain moisture content of embankment materials to attain required density.
12. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D698, unless otherwise indicated on Plans:
  - a. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.
  - b. Other areas: Minimum density of 90 percent of maximum dry density.

**B. Tolerances**

Top of compacted surface: Plus or minus ½-inch in cross section or 16 foot length.

**3.04 REPAIR/RESTORATION (NOT USED)**

**3.05 FIELD QUALITY CONTROL**

- A. Compaction Testing shall be performed in accordance with ASTM D1556/D1556M or ASTM D6938 under provisions of Section 01454 – “Testing Laboratory Services”.
- B. A minimum of three tests shall be taken for each 1000 linear feet per lane of roadway or 500 square yards of embankment per lift.
- C. If tests indicate Work does not meet specified compaction requirements, recondition, recompact, and retest at no additional cost.

**3.06 – 3.08 NOT USED**

**3.09 PROTECTION**

- A. Protect trees, shrubs, lawns, existing structures, and other features outside of embankment limits.
- B. Protect utilities above and below grade, which are to remain.
- C. Conform to protection requirements of Section 02315 – “Roadway Excavation”.

**3.10 SCHEDULES (NOT USED)**

**END OF SECTION**

## Section 02336

## LIME-STABILIZED SUBGRADE

## PART 1 GENERAL

## 1.01 SUMMARY

- A. This Section includes foundation course of lime-stabilized subgrade material.
1. Application of lime slurry to subgrade.
  2. Mixing, compaction, and curing of lime slurry, water, and subgrade into a stabilized foundation.

## 1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
1. Measurement and payment for lime-stabilized subgrade is on per ton basis compacted in place to proper density. Separate measurement will be made for each required thickness of subgrade course.
    - a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Plans. Limits for measurement will be extended to include installed lime stabilized subgrade material that extends to 2 feet beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for lime stabilized subgrade in areas beyond these limits.
    - b. Limits of measurement and payment shall match pavement replacement limits shown on Plans, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager.
  2. Measurement and payment for lime is by ton of 2,000 pounds dry weight basis. Calculate weight of dry solids for lime slurry based on percentage by dry weight solids.
  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.

## 1.03 REFERENCES

- A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>).
- B. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).



- C. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- D. TxDOT Tex-101-E (Part III) - Preparing Soil and Flexible Base Materials for Testing.
- E. TxDOT Tex-140-E - Measuring Thickness of Pavement Layer.
- F. TxDOT Tex-600-J - Sampling and Testing Lime.

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit certification that hydrated lime, quicklime, or commercial lime slurry complies with specifications.
- C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”

#### 1.06 – 1.07 NOT USED

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. Bagged lime shall bear manufacturer’s name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.
- B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

#### 1.09 PROJECT SITE CONDITIONS (NOT USED)

#### 1.10 DEFINITIONS

- A. Moist Cure: Curing soil and lime to obtain optimum hydration.
- B. 1,000-Foot Roadway Section: 1,000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

#### 1.11 – 1.13 NOT USED

### PART 2 PRODUCTS

#### 2.01 MANUFACTURER(S) (NOT USED)

## 2.02 MATERIALS AND/OR EQUIPMENT

## A. WATER

Use clean, clear water, free from oil, acids, alkali, or vegetation.

## B. LIME

1. Type A - Hydrated Lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide as listed in chemical composition chart.
2. Type B - Commercial Lime Slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.
3. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:
  - a. Grade DS: Pebble quicklime of gradation suitable for use in preparation of slurry for wet placing.
  - b. Grade S: Finely-graded quicklime for use in preparation of slurry for wet placing. Do not use grade S quicklime for dry placing.
4. Conform to the following requirements:

CHEMICAL COMPOSITION	TYPE		
	A	B	C
Active lime content, % by weight $\text{Ca}(\text{OH})_2 + \text{CaO}$	90.0 min <sup>1</sup>	87.0 min <sup>2</sup>	-
Unhydrated lime content, % by weight CaO	5.0 max	-	87.0 min
Free water content, % by weight $\text{H}_2\text{O}$ :	5.0 max	-	-
SIZING			
Wet Sieve, as % by weight residue retained:			
No. 6	0.2 max	0.2 max <sup>2</sup>	8.0 max <sup>3</sup>
No. 30	4.0 max	4.0 max <sup>2</sup>	-
Dry sieve, as % by weight residue retained:			
1-inch	-	-	0.0
3/4-inch	-	-	10.0 max

Notes:

1. Maximum 5.0% by weight CaO shall be allowed in determining total active lime content.
2. Maximum solids content of slurry.
3. Total active lime content, as CaO, in material retained on No. 6 sieve shall not exceed 2.0% by weight of original Type C lime.

5. Deliver lime slurry to job site as commercial lime, or prepare at job site by using hydrated lime or quicklime. Provide slurry free of liquids other than water and of consistency that can be handled and uniformly applied without difficulty.
6. Lime containing magnesium hydroxide is prohibited.

C. SOIL

Soil to receive lime treatment may include borrow or existing subgrade material, existing pavement structure, or combination of all three. Where existing pavement or base material is encountered, pulverized or scarify material so that 100 percent of sampled material passes 2-inch sieve.

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

A. Examination

1. Verify compacted subgrade will support imposed loads.
2. Verify subgrade lines and grades.

B. Complete backfill of utilities prior to stabilization.

C. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:

1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.
2. Provide cut to depth as specified or shown in the Plans.

D. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.

E. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by Project Manager.

F. Pulverize existing material so that 100 percent passes a 1¾-inch sieve.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Lime Slurry Application

1. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on same working day.

2. Minimum lime content shall be 5 percent of dry unit weight of subgrade as determined by ASTM D698.

B. Preliminary Mixing

1. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain homogeneous friable mixture free of clods and lumps.
2. Shape mixed subgrade to final lines and grades.
3. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.05C can be met during preliminary mixing:
  - a. With light pneumatic rollers.
  - b. Cure soil-lime material for 24 to 72 hours or as required to obtain optimum hydration. Keep subgrade moist during cure.

C. Final Mixing

1. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.
2. Add water to bring moisture content of soil mixture to optimum or above.
3. Mix and pulverize until all material passes 1¾-inch sieve; minimum of 85 percent, excluding non-slacking fractions, passes ¾-inch sieve; and minimum of 60 percent excluding non-slacking fractions passes No. 4 sieve. Test according to TxDOT Tex-101-E, Part III using dry method.
4. Shape mixed subgrade to final lines and grades.
5. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

D. Compaction

1. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D698 on material sample from roadway after final mix with lime.
2. Start compaction immediately after final mixing.
3. Spread and compact in two or more equal layers where total compacted thickness is greater than 8 inches.
4. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.

5. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.
6. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Plans.
7. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

E. Curing

1. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.
2. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
3. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.04 REPAIR/RESTORATION

A. Rework of Failed Sections

1. Rework sections that do not meet specified thickness.
2. Perform the following steps when more than 72 hours have lapsed since completion of compaction.
  - a. Moist cure for minimum of 3 days after compaction to required density.
  - b. Add lime at rate of 25 percent of specified rate at no additional cost.
  - c. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.05 FIELD QUALITY CONTROL

A. Tolerances

1. Completed surface: smooth and conforming to typical section and established lines and grades.
2. Top of compacted surface: Plus or minus  $\frac{1}{4}$  inch in cross section or in 16-foot length.
3. Depth of lime stabilization shall be plus or minus one inch of specified depth for each 1,000-foot roadway section.

- B. Testing shall be performed under provisions of Section 01454 - Testing Laboratory Services.
- C. Test soils, lime, and mixtures as follows:
  - 1. Tests and analysis of soil materials shall be performed in accordance with ASTM D4318, using the wet preparation method.
  - 2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.
  - 3. Sample mixtures of hydrated lime or quicklime in slurry form shall be tested to establish compliance with specifications.
  - 4. Moisture-density relationship shall be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, Moist Preparation Method.
- D. In-place depth will be evaluated for each 1,000-foot roadway section and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 1,000-foot section, 3 phenolphthalein tests will be performed. Average stabilization depth for 1,000-foot section will be based on average depth for three tests.
- E. Perform compaction testing in accordance with ASTM D6938. Three tests shall be performed for each 1,000-foot roadway section.
- F. Pulverization analysis shall be performed as required by Paragraph 3.05C on material sampled during mixing of each production area. Three tests shall be performed per 1,000-foot roadway section or a minimum of once daily.

3.06 – 3.08 NOT USED

3.09 PROTECTION

- A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.
- B. Repair defects immediately by replacing material to full depth.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02337

**LIME/FLY-ASH STABILIZED SUBGRADE**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This Section includes foundation course of lime/fly-ash stabilized subgrade material.
  - 1. Application of lime slurry and fly-ash to Subgrade
  - 2. Mixing, compaction, and curing of lime, slurry, fly-ash, water and subgrade into a stabilized foundation

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices.
  - 1. Measurement and payment for lime/fly-ash stabilized subgrade are on per ton basis compacted in place to proper density. Separate measurement will be made for each required thickness of subgrade course.
    - a. Limits of measurement shall match actual pavement replaced, but no greater than the maximum pavement replacement limits shown on Plans. Limits for measurement will be extended to include installed lime/fly ash stabilized subgrade material that extends to 2 feet beyond outside edge of pavement to be replaced, except where proposed pavement section shares a common longitudinal or transverse edge with existing pavement section. No payment will be made for lime/fly ash stabilized subgrade in areas beyond these limits.
    - b. Limits of measurement and payment shall match pavement replacement limits shown on Plans, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager.
  - 2. Payment for hydrated lime and quicklime is by ton of 2,000 pounds dry-weight basis.
  - 3. Payment for commercial lime slurry is by ton of 2,000 pounds of lime calculated on percentage by weight of dry solids for grade of slurry.
  - 4. Payment for fly ash is on unit price basis per ton.
  - 5. 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 REFERENCES**

ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit certification that fly-ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.
- C. Submit weight tickets, certified by supplier, with each bulk delivery of materials to work site.

1.05 e

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 02336 – “Lime Stabilized Subgrade”

1.06 – 1.07 NOT USED

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Conform to requirements of Section 02336 – “Lime Stabilized Subgrade”.
- B. Quicklime can be dangerous; exercise extreme caution if used for Work. Become informed about recommended precautions in handling, storage and use of quicklime.

1.09 PROJECT SITE CONDITIONS (NOT USED)

1.10 DEFINITIONS

- A. Moist Cure: Curing soil lime/fly-ash material to obtain optimum hydration.
- B. 1,000-Foot Roadway Section: 1,000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.11 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Water: clean, clear and free from oil, acids, alkali, or vegetable matter.
- B. Conform to requirements of Section 02336 – “Lime Stabilized Subgrade” for Type A hydrated lime, Type C quicklime, and Type B commercial lime slurry shall.



- C. Fly-Ash: Residue or ash remaining after burning finely pulverized coal at high temperatures conforming to requirements of ASTM C618, Class C, and following:
  - 1. Minimum CaO content of 20 percent
  - 2. Loss on ignition not to exceed 3 percent
  - 3. Contain no lignite ash
- D. Asphaltic Seal Cure: Conform to requirements of Section 02336 – “Lime Stabilized Subgrade”.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

3.01 – 3.02 NOT USED

#### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

Conform to Part 3 of Section 02336 – “Lime Stabilized Subgrade” with following exceptions:

- 1. Include fly ash in percentage amounts in lime or lime slurry as established from geotechnical evaluation for application, mixing, and compaction.
- 2. Apply lime/fly-ash as single mix, single pass over lower PI soils.
- 3. Conduct operations to minimize elapsed time between mixing and compacting lime/fly-ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction, and not more than 6 hours after adding and mixing last stabilizing agent.

#### 3.04 REPAIR/RESTORATION (NOT USED)

#### 3.05 FIELD QUALITY CONTROL

- A. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.
- B. Soil shall be sampled to establish percent of fly-ash and hydrated lime, quicklime, or lime slurry to be applied to subgrade material.
- C. Testing shall be in accordance with Part 3 of Section 02336 – “Lime-Stabilized Subgrade”.

3.06 – 3.10 NOT USED

END OF SECTION

Section 02338

PORTLAND CEMENT STABILIZED SUBGRADE

PART 1 GENERAL

1.01 SUMMARY

This Section includes foundation course of Portland cement stabilized natural subgrade material.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for Portland cement stabilized subgrade is on per ton basis compacted in place to proper density. Separate measurement will be made for each different required thickness of subgrade course.
  - a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Plans. Limits for measurement will be extended to include installed Portland cement stabilized subgrade material that extends to 2 feet beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for Portland cement stabilized subgrade in areas beyond these limits.
  - b. Limits of measurement and payment shall match pavement replacement limits shown on Plans, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager.
2. Payment for Portland cement is by ton of 2,000 pounds dry-weight basis.
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.

1.03 REFERENCES

- A. ASTM C150/C150M - Standard Specification for Portland Cement.
- B. ASTM D558 - Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.
- C. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
- D. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

- E. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit certification that Portland cement complies with these specifications.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Water

Water: clean, clear and free from oil, acids, alkali, or organic matter.

- B. Portland Cement

ASTM C150/C150M Type I; bulk or sacked.

- C. Soil

Provide soil consisting of approved material free from vegetation or other objectionable matter encountered in existing roadbed.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Examination

1. Verify compacted subgrade is ready to support imposed loads.
2. Verify subgrade lines and grades are correct.

B. Preparation

1. Backfill for utilities below future grade.
2. Verify subgrade is firm and able to support, without displacement, construction equipment at specified density. Correct soft or yielding subgrade and stabilize by scarifying and aerating or by adding cement and compacting to uniform stability.
3. Grade, shape, and compact, as required, to allow construction of Portland cement treatment for in-place materials to lines, grades, thickness, and typical cross section shown on Plans. Remove unsuitable soil or material and replace with acceptable material.
4. Pulverize soil so that at completion of moist-mixing, 100 percent by dry weight passes 1-inch sieve, and minimum of 80 percent passes No. 4 sieve, exclusive of gravel or stone retained on these sieves. Pulverize existing bituminous wearing surfaces so that 100 percent will pass 2-inch sieve.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Equipment

Apply Portland cement treatment with machine or combination of machines and auxiliary equipment to produce specified results. Mixing may be accomplished by multiple-pass traveling mixing plant or single-pass traveling mixing plant. Provide sufficient equipment to enable continuous progression of work.

B. Mixing

1. Do not place and mix cement when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.
2. Spread cement uniformly on soil at rate specified by laboratory. When bulk cement spreader is used, position it by string lines or other approved method to ensure uniform distribution of cement. Apply cement only to area where operations can be continuous and completed in daylight, within 1 hour of application. Amount of moisture in soil at time of cement placement shall not exceed quantity that will permit uniform mixture of soil and cement during dry mixing operations. Do not exceed specified optimum moisture content for soil cement mixture.
3. Do not allow equipment other than that used in spreading and mixing, to pass over freshly spread cement until it is mixed with soil.
4. Dry mix cement with soil after cement application. Continue mixing until cement has been sufficiently blended with soil to prevent formation of cement balls when water is applied. Mixture of soil and cement that has not been compacted and finished shall not remain undisturbed for more than 30 minutes.

5. Immediately after dry mixing is complete, uniformly apply water as necessary and incorporate it into mixture. Pressurized equipment must provide adequate supply to ensure continuous application of required amount of water to sections being processed within 3 hours of cement application. Ensure proper moisture distribution at all times. After last increment of water has been added, continue mixing until thorough and uniform mix has been obtained.
6. Ensure percentage of moisture in mixture, based on dry weights, is within 2 percentage points of specified optimum moisture content prior to compaction. When uncompacted soil cement mixture is wetted by rain indicating that average moisture content exceeds tolerance given at time of final compaction, reconstruct entire section in accordance with this Section at no additional cost.

C. Compaction

1. Prior to beginning compaction, ensure mixture is in loose condition for its full depth. Uniformly compact loose mixture to specified density, lines, and grades.
2. After soil and cement mixture is compacted, apply water uniformly as needed and mix thoroughly. Then reshape surface to required lines, grades, and cross section and lightly scarify to loosen imprints left by compacting or shaping equipment.
3. Roll resulting surface with pneumatic-tired roller and “skin” surface with power grader. Thoroughly compact with pneumatic roller, adding small increments of moisture, as needed. When aggregate larger than No. 4 sieve is present in mixture, make one complete coverage of section with flat-wheel roller immediately after skinning operation. When approved by Project Manager, surface finishing methods may be varied from this procedure, provided dense uniform surface, free of surface compaction planes, is produced. Maintain moisture content of surface material at its specified optimum during finishing operations. Compact and finish surface within period not to exceed 2 hours, to produce smooth, closely knit surface, free of cracks, ridges, or loose material, conforming to crown, grade, and line shown on Plans within period not to exceed 2 hours.

D. Construction Joints

At end of each day's construction, form straight transverse construction joint by cutting back into total width of completed work to form true 2-inch depth vertical face free of loose and shattered material. Construct cement treatment for large wide areas in series of parallel lanes of convenient length and width approved in advance by Project Manager.

E. Curing

1. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. When open, restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

2. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.
3. Place base and surface within 14 days after final mixing and compaction, unless prior approval is obtained from Project Manager.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

A. Tolerances

1. Completed surface: smooth and conforming to typical section and established lines and grades.
2. Top of compacted surface: Plus or minus ¼-inch in cross section or in 16-foot length.

B. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.

C. In-place density shall be determined in accordance with ASTM D6938 or ASTM D1556. Minimum of three tests shall be taken for each 1000 feet per lane of roadway or 500 square yards of embankment.

3.06 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

A. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.

B. Tests and analysis of soil materials shall be performed in accordance with ASTM D4318.

C. Soil shall be evaluated to establish ratio of cement to soil to obtain desired stability. Normal range is 6 percent to 10 percent by weight.

D. The percentage of moisture in soil, at time of cement application, shall be determined by ASTM D558. Moisture shall not be allowed to exceed quantity that will permit uniform, complete mixture of soil and cement during dry mixing operations nor specified optimum moisture content for soil cement mixture, as determined.

3.09 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course.

B. Repair defects immediately by replacing material to full depth.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02400

**TUNNEL SHAFTS**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes construction, maintenance, and backfilling requirements of tunnel shafts.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices.**

1. Tunnel shafts, both those shown on Plans and those additional ones needed for Contractor's operations, are incidental to tunnel construction and no separate payment will be made for them. Manholes constructed in tunnel shafts are to be paid separately at contract unit price as specified in Section 02081 – "Cast-in-place Concrete Manholes" or Section 02082 – "Precast Concrete Manholes".
2. Removal and replacement of surface improvements necessary for shaft construction, such as sidewalks, asphaltic or concrete pavement, base and subbase, curbs, curb and gutter, driveways, topsoil, sodding, and hydro-mulch are incidental to tunnel construction and no separate payment will be made for them.

- 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 REFERENCES (NOT USED)**

**1.04 SUBMITTALS**

- A.** Conform to requirements of Section 01330 – "Submittal Procedures".
- B.** Shaft design submittals by Contractor shall be signed and sealed by Professional Engineer registered in State of Texas. If trench box is used in tunnel shaft and such utilization is in a manner other than what is indicated and certified in manufacturers technical data, submit trench box manufacturer certification of proposed usage.
- C.** Submit shaft construction drawings and seal slabs. Clearly indicate allowable surcharge loads and restrictions on surcharge capacity, including live loads, on shaft construction drawings. Indicate thrust blocks or other reactions required for pipe jacking, when applicable.



1. Location of shafts by station and limits of working sites.
  2. Description of site security arrangements in conformance with Paragraph 3.03.C, Shaft Construction.
  3. Description of method of extending shaft above flood level in conformance with Paragraph 3.03.C, Shaft Construction.
  4. Any geotechnical/boring undertaken by Contractor for whatever purpose connected to Work.
- D. Shaft Monitoring Plan: Submit for review prior to construction, shaft monitoring plan that includes schedule of instrumentation design, layout of instrumentation parts, equipment installation details, manufacturer's catalog literature, and monitoring report forms.
- E. Structures Assessment. Provide preconstruction and post-construction assessment reports for critical structures located within radius of shaft center equal to shaft depth plus shaft radius, measured in plan. Include photographs or video of any existing damage to structures in vicinity of shafts in assessment reports.
- F. Submit shaft surface settlement monitoring plan for review prior to construction. Identify location of settlement monitoring points, reference benchmarks, survey frequency and procedures, and reporting formats on plan.
- G. Submit readings of monitoring plans to Project Manager as soon as readings have been taken.
- H. Submit shaft temporary deck drawings and calculations to Project Manager, signed and sealed by Contractor's Professional Engineer in event that shaft is not needed for immediate construction activity, in conformance with Paragraph 3.03.C, Shaft Construction.
- 1.05 RELATED REQUIREMENTS
- A. Section 01300 – "Submittal Procedures"
  - B. Section 01504 – "Temporary Facilities and Controls"
  - C. Section 01555 – "Traffic Control and Regulation"
  - D. Section 01576 – "Waste Material Disposal"
  - E. Section 01578 – "Control of Ground Water and Surface Water"
  - F. Section 02081 – "Cast-In-Place Concrete Manholes"

- G. Section 02082 – “Precast Concrete Manholes”
- H. Section 02316 – “Excavation and Backfill for Structures”
- I. Section 02317 – “Excavation and Backfill for Utilities”
- J. Section 02321 – “Cement Stabilized Sand”
- K. Section 02431 – “Tunnel Grout”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 SYSTEM DESCRIPTION

A. Performance Requirements

- 1. Shaft design must include allowance for contractor’s equipment and stored material and spoil stockpile as appropriate. Design must also allow for HS-20 highway loading if located in the vicinity of a paved area and/or allow for Cooper E-80 locomotive loading if located in the vicinity of a railroad.
- 2. Design shaft to withstand full hydrostatic head without failure.
- 3. Design shaft located within 50-year flood plain with water retaining liner extending 2 feet above 50-year flood elevation. It is acceptable when liner is stored at site for immediate installation in lieu of it being installed at shaft, provided that shaft liner extends at least 2 feet above existing ground elevation.
- 4. Design shaft cover for minimum 25 pounds per square foot distributed load plus 300-pound point load.
- 5. Design steel plate deck, if such is required, for HS-20 loading.

1.08 – 1.13 NOT USED

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Location of Access Shafts

1. Contractor has sole responsibility for selection of shaft sites needed for construction operations unless otherwise indicated on Plans. Location will be subject to approval of the Project Manager.
2. Locate shafts and associated Work areas to avoid blocking driveways and cross streets, and to minimize disruption to business and commercial interests. Avoid shaft locations near areas identified as residential or potentially contaminated.
3. Plan shaft locations to minimize interference with storm drainage channels, ditches, water lines, sanitary sewers, storm water sewers or culverts, which, when damaged, could result in ground washout or flooding of shafts and tunnels.

**B. Utility Relocation**

1. Relocate utilities as shown on Plans. Utility relocations required by Contractor for shaft construction shall take into account zone of potential settlement in vicinity of shaft.
2. Obtain approval from Project Manager for permanent relocations prior to relocating.

**C. Shaft Construction**

1. Conform to the following for ground support systems:
  - a. Install liner elements, bracing and shoring structural members at locations and in method sequence and tolerances defined on shaft construction drawings as excavation progresses.
  - b. Ensure bracing and shoring are in contact with liner to provide full support as shown in shaft construction drawings. Evaluate and check modifications to liner, bracing, and shoring. Obtain approval from Contractor's Professional Engineer and submit to Project Manager.
  - c. Install seal slab as soon as final depth and stable bottom conditions have been reached and accepted by Project Manager. Construct seal slab capable of withstanding full piezometric pressure, either by pressure relief using under drains, or in case of more permeable ground condition, by use of structural reinforced slab. Construct seal slab in accordance with design provided by Contractor's Professional Engineer.
  - d. Design and construct entire shaft to appropriate factors of safety against yield, deformation, or instability as determined by Contractor's

- Professional Engineer. Shaft must withstand full hydrostatic head without failure.
- e. Special framing, bracing or shoring required around tunnel “eyes” or other penetrations shall be in-place according to shaft construction drawings before liner or any bracing or shoring at penetration is cut or removed.
  - f. Securely breast and shore face of starter or back tunnels to resist both soil and hydrostatic pressure.
  - g. When applicable, pressure grout voids or seepage paths around shafts and adjoining tunnels in accordance with Section 02431- “Tunnel Grout”. Pressure grout bolted steel liner plates as they are installed, unless otherwise approved by Project Manager. Perform secondary or ‘back grouting’ as ground measurement, voids, or deformation of shaft liner are detected.
- 2. Install suitable thrust or reaction blocks as required for pipe jacking equipment.
  - 3. Provide drainage from shafts while Work is in progress and until adjacent pipe joints have been sealed and shaft is backfilled. Conform to requirements of Section 01578 – “Control of Ground Water and Surface Water”.
  - 4. Surface Water Control. Divert surface water runoff and discharge from dewatering system away from shaft. Protect shafts from infiltration or flooding.
  - 5. Each surface work site is to be surrounded by security fence meeting requirements of Section 01504 – “Temporary Facilities and Controls”, which shall be secure any time site is unattended by Contractor’s personnel.
  - 6. Protect shaft, when not in use by second security fence at perimeter of shaft, or alternatively by cover designed in accordance with Paragraph 1.07.A, Performance Requirements.
  - 7. Provide portable concrete traffic barriers at locations where work site is situated adjacent to highway, road, driveway, or parking lot. Angle traffic barriers in direction of lane flow. Do not place perpendicular to on-coming traffic.
  - 8. Provide and maintain traffic control system in accordance with provision of Section 01555 – “Traffic Control and Regulation”.
  - 9. Cover shaft which is constructed more than 60 days in advance of its intended use by steel plate deck designed by Contractor’s Professional Engineer, and

restore surface to permit full traffic flow during time shaft is not in use. Remove from site other material and equipment used by Contractor including portable concrete traffic barriers, traffic control system, fencing and reinstall at time shaft is re-opened for use.

10. Construct suitable guardrail barrier around periphery of shaft, meeting applicable safety standards. Properly maintain barrier throughout period shaft remains open. Repair broken boards, supports, and structural members. Provide ladder with safety cage when required by OSHA in each shaft. In addition, provide full cover or other security barrier for each access shaft in which there is no construction activity or which is unattended by Contractor's personnel.
11. Size of Shafts: Make size adequate for construction of permanent structures indicated on Plans and to provide adequate room to meet operational requirements for tunnel construction and backfill.

**D. Backfill**

1. Provide cement-stabilized sand to minimum depth of 10 feet above crown of pipe, but where shaft is located in paved area, cement-stabilized sand shall be used to within one foot of pavement subgrade elevation. Provide cement-stabilized sand in accordance with Section 02321 – "Cement-stabilized Sand". Compact cement-stabilized sand in accordance with Section 02317 – "Excavation and Backfill for Utilities". In locations where backfill is not subject to traffic loading, depth above initial cement-stabilized sand may be backfilled with select backfill in accordance with Section 02316 – "Excavation and Backfill of Structures". When insufficient work space exists, Grout manhole or structure annular space in accordance with Section 02431 – "Tunnel Grout".
2. Remove shaft liner above level of 8 feet below ground surface, unless otherwise indicated on Plans. Maintain sufficient ground support to meet excavation safety requirements while removing shaft structure.

**E. Monitoring**

1. Monitoring Instrumentation. Instrumentation specified and readings shall be accessible at all times to Project Manager.
  - a. Install and maintain instrumentation system to monitor and detect movement of ground surface and adjacent structures. Establish vertical survey control points at distance from construction area that avoids disturbance due to ground settlement.

- b. Project Manager may through independent contractor or consultant, install instrumentation in, on, near, or adjacent to construction work. Provide access to Work for such independent installations.
  - c. Install instruments in accordance with Plans and manufacturer's recommendations.
- 2. Surface Settlement Monitoring
  - a. Establish monitoring points on all critical structures.
  - b. Record location of settlement monitoring points with respect to construction baselines and 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.
  - c. Monitoring points to measure ground elevation are required at distance of 10 feet and 20 feet from perimeter of shaft on each of four radial lines, at 90 degrees to each other.
  - d. Railroads. Monitor ground settlement of track subbase at centerline of each track when within zone of potential settlement.
- 3. Reading Frequency and Reporting. Submit to Project Manager, records of readings from various instruments and survey points.
  - a. Record all shaft monitoring readings at least once per week starting prior to shaft construction and continuing until shaft has been backfilled and until no more detectable movement occurs.
  - b. Immediately report to Project Manager any movement, cracking, or settlement which is detected.
  - c. Following substantial completion but prior to final completion, make final survey of all shaft related monitoring points.

F. Disposal of Excess Material

Remove spoil in accordance with Section 01576 – "Waste Material Disposal".

3.04 – 3.10 NOT USED

END OF SECTION

SECTION 02425

TUNNEL EXCAVATION AND PRIMARY LINER

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Tunnel construction operation with primary lined tunnel installed during tunnel drive followed by placement of water line inside tunnel after completion of tunnel construction. This Specification is intended to be primarily functional in nature and to define in general terms Work to be accomplished.
- B. Construction Methods: Various construction methods such as TBM, hand tunneling, or shield are allowed. Liners include rib and lagging, steel liner plate, bolted steel liner etc. Liners may be expanded or grouted.

1.02 MEASUREMENT AND PAYMENT

- A. No separate payment will be made for Work performed under this Section such as excavation, liner, grouting, instrumentation, or monitoring. Include cost of tunnel excavation and primary liner in accordance with Section 02511 – “Water Lines”.
- B. Where such effort is necessary, cost for ground water control during course of tunnel work included in unit prices for water main in tunnel.
- C. Ground water control required during course of Project to lower water table for other utility installation, to remove standing water, surface drainage seepage, or to protect ongoing Work against rising waters or floods considered incidental to Work being performed.
- D. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in Total Stipulated Price.

1.03 REFERENCES

- A. The publications listed below form part of this specification to extent referenced. Publications are referred to in text by abbreviations only.
  - 1. AREMA Manual for Railway Engineering (Applicable sections).
  - 2. American Association of State Highway and Transportation Officials (AASHTO).
  - 3. American Society for Testing and Materials (ASTM).

- a. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
- b. ASTM A1064/1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- c. ASTM A283/A283M – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- d. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- e. ASTM A328/A328M – Standard Specification for Steel Sheet Piling.
- f. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- g. ASTM C33/C33M – Standard Specification for Concrete Aggregates.
- 4. ASTM C150/C150M – Standard Specification for Portland Cement. American Water Works Association (AWWA)
  - a. AWWA C206 – Field Welding of Steel Water Pipe.
  - b. AWWA C200 – Steel Water Pipe, 6-inches and Larger.
- 5. Occupational Safety and Health Administration (OSHA): Particular attention is called to Subpart S of OSHA Standards (29 CFR 1926/1920), published as U.S. Department of Labor Publication 2207, Revised Oct. 1, 1979. Second revision dated August 1, 1989. See Federal Register dated June 2, 1989 for revised standard and commentary.

#### 1.04 SUBMITTALS

- A. Procedures: Conform to requirements of Section 01330 – “Submittal Procedures”. Project Manager will review plans, details, and data for compliance with requirements of the Specification. Such review shall not be construed to relieve Contractor of responsibilities under Contract. Contractor shall not commence work on items requiring Contractor’s work plan, construction drawings, or other submittals until submittals have been reviewed and accepted by Project Manager. All structural designs and other engineered components must be signed and sealed by Professional Engineer registered in the State of Texas.
- B. Tunneling Work Plan: Submit to Project Manager for review, Tunneling Work Plan with complete construction drawings, complete written description identifying details of proposed method of construction and sequence of operations to be performed during construction, as required by method of tunnel excavation and liner installation. Submit sufficiently detail construction drawings and descriptions to demonstrate to



Project Manager whether proposed materials and procedures will meet requirements of Specification, as indicated below:

1. Submit Contractor's work plan and construction drawings on following items, depending on method of construction:
  - a. If use of mechanized excavating equipment (such as TBM or shielded excavators) is proposed, submit arrangement drawings and technical specifications of machine and trailing equipment (including modifications), experience record with this type of machine of both Contractor and proposed operator and copy of manufacturer's operation manual for machine.
  - b. The Contractor may elect to use tunnel shield that is separate from mechanized excavation equipment or for use with hand excavation. When use of tunnel shield is proposed, submit arrangement drawings, design criteria, dimensional data, and method of excavation and operation of shield, including acceptable method for supporting, controlling, and closing face of heading.
  - c. Complete details of equipment, methods and procedures to be used for ground support, including but not limited to primary liner installation, timing of installation in relation to excavation plan, bulkheads and equipment.
  - d. Grouting techniques meeting requirements this Section and Section 02431 – "Tunnel Grout".
  - e. Procedures for measuring excavation quantities versus forward progress during tunneling operation (for earth pressure balance TBM only).
  - f. Method of controlling line and grade of excavation.
  - g. Details of muck removal, including equipment type, number, and disposal location.
  - h. Description of ventilation system, lighting system, and electrical system.
  - i. Proposed contingency plans for critical phases and areas of tunneling.
  - j. Special activities at critical utility crossings, or for Work potentially affecting other facilities and existing utilities where special precautions must be taken during construction.
2. Submit design criteria established by Contractor's Engineer for primary liner, including design calculations and installation details, and certification by qualified Professional Engineer registered in the State of Texas that structural

- design of primary tunnel meets criteria and specified requirements for range of field conditions.
3. Submit layout and design of proposed access shafts and shafts for permanent installations in accordance with Section 02400 – “Tunnel Shafts”.
  4. Submit ground water and surface water control system details per requirements in this Section and in accordance with Section 01578 – “Control of Ground Water and Surface Water”.
  5. All structural designs and other engineered items must be signed and sealed by qualified Professional Engineer Registered in the State of Texas unless otherwise specified.
- C. Quality Control Methods: Submit description of quality control methods Contractor proposes to use in this operation to Project Manager. Include in submittal the following items:
1. Supervision: Supervisory control to ensure that Work is performed in accordance with Plans and Specifications and Contractor’s work plan and construction drawings.
  2. Line and Grade: Procedures for surveying, controlling, and checking line and grade, including field forms for establishing and checking line, and grade.
  3. Tunneling Observation and Monitoring: Procedures for preparing and submitting daily logs of tunneling operations, including field forms, to meet requirement of Paragraphs 3.05, Tunneling Data and 3.06, Control of Tunnel Line and Grade of this Section.
  4. Monitoring Instrumentation: Conform to requirements of Paragraph 3.08A, Monitoring Instrumentation of this Section.
  5. Settlement Survey Plan, to meet requirements of Paragraph 3.08C, Settlement Surveying of this Section. This plan may be submitted as part of Instrumentation Monitoring Plan.
  6. Building Condition/Assessment Plans: Conform to requirements of Paragraph 3.08B, Buildings and Structures Assessment of this Section.
- D. Geotechnical and Environmental Investigation: Include results of geotechnical and environmental investigations performed by Contractor as relevant to tunneling in Work Plan. Submit these reports to the Project Manager for record purposes only.
- E. Safety: Submit to Project Manager procedures to meet all applicable OSHA requirements including the following as minimum: Submit these procedures for record purpose only.

1. Protection against soil instability and ground water inflow.
2. Safety for shaft access and exit including ladders, stairs, walkways, and hoists.
3. Means of mechanical and hydraulic equipment operations, and for lifting and hoisting equipment and material.
4. Ventilation, lighting, and communication systems.
5. Monitoring for hazardous gases.
6. Protection against flooding.
7. Means for emergency evacuation.
8. Protection of shaft including traffic barriers, accidental or unauthorized entry, and falling objects.
9. Emergency protection equipment and self-rescue equipment.
10. Safety supervising responsibilities.

1.05 RELATED REQUIREMENTS

- A. Section 01330 – “Submittal Procedures”
- B. Section 01504 – “Temporary Facilities and Controls”
- C. Section 01578 – “Control of Ground Water and Surface Water”
- D. Section 02400 – “Tunnel Shafts”
- E. Section 02431 – “Tunnel Grout”
- F. Section 02511 – “Water Lines”
- G. Section 02517 – “Water Line in Tunnels”
- H. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”
- I. Section 02621 – “Geotextile”
- J. Design Criteria
  1. Design primary liner for appropriate loading conditions, including but not limited to: overburden and lateral earth pressures, handling and installation stresses, loads imposed by tunnel shield or tunnel boring machine thrust jacks, subsurface soil and water loads, grouting, and all other conditions of service. Contractor responsible for design of primary liner to carry thrust of jacking or

other construction forces or loads anticipated. Contractor's Professional Engineer is responsible for design of primary tunnel liner system.

2. At railroad crossings, unless otherwise specified by railroad authority use Cooper E-80 locomotive loading distribution criteria in accordance with AREMA specifications for culverts. Account for additive loadings for multiple tracks in design. Provide liner type for railroad crossings as specified or as otherwise required by railroad authority. Acceptable monitoring devices, such as closed circuit television, which permit continuous monitoring of conditions at face by qualified observers, from outside tunnel, may be used.
3. Use HS-20 vehicle loading distributions for truck loading criteria in accordance with AASHTO.
4. Compatibility of Methods:
  - a. Use compatible methods of excavation, liner, and ground stabilization and ground water control.
  - b. Design primary lining, when used to provide thrust for propulsion of shield, to withstand this thrust without damage or distortion. Configure propulsion jacks on shield so that thrust is uniformly distributed and will not damage or distort primary liner.
  - c. Use compatible tunneling method with possible restrictions on Work, such as influence on existing installations or potential ground water contamination.
5. Demonstrate that chosen method will prevent flow of water or soil into tunnel and provide stability of face under anticipated conditions.

1.06 – 1.08 NOT USED

#### 1.09 PROJECT SITE CONDITIONS

##### A. Safety Requirements:

1. Perform Work in manner to maximize safety and avoid exposure of men and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards and Contractor's safety procedures.
2. Whenever there is emergency or stoppage of Work which is likely to endanger tunnel excavation or adjacent structures, operate full work force for 24 hours a day, including weekends and holidays, without intermission until potentially hazardous conditions no longer exist or jeopardizes stability and safety of Work or existing installations.

3. Perform tunnel construction in a manner that shall minimize movement of ground in front and surrounding tunnel. Prevent significant subsidence of surface and protect structures and utilities above, and in vicinity of, tunnel from damage.
  4. Support ground continuously in a manner to prevent loss of ground and keep perimeters and faces of tunnel and bottoms of shafts stable. Use filter-fabric and other means as necessary behind primary liner to prevent soil migration into tunnel.
- B. Surveillance of Headings: When Contractor is not able to close face of machine because of maintenance requirements, maintain qualified personnel on duty to observe conditions that might threaten stability of heading whenever tunnel excavation is suspended or shut down. Equip personnel with approved contingency plan to take appropriate action to prevent or limit damage should conditions which threaten stability of heading occur.
- C. Air Quality:
1. Conduct tunneling operations by methods and with equipment which shall positively control dust, fumes, vapors, gases, or other atmospheric impurities in accordance with OSHA, Federal, State, and City requirements.
  2. Provide approved mining instrumentation for testing quality of tunnel atmosphere and obtain samples, under working conditions, at prescribed intervals in accordance with above referenced requirements. Submit results of air quality tests to Project Manager.
- D. Ground Conditions: Perform sufficient exploration by geotechnical and environmental borings in advance of construction to define necessary parameters for design of primary tunnel liner, planning and designing ground water control system, and for selection of tunneling method and equipment to successfully complete each tunnel reach. Present results of Contractor's geotechnical and environmental investigations in related work plans.
- 1.10 DEFINITIONS
- A. Tunneling Work Plan is defined as written description together with sketches, drawings, schedules, and other documents defining Contractor's planned methods and procedures for tunneling operations.
- B. Contractor's Construction Drawings are defined as drawings by which Contractor proposes to furnish, construct, install, and operate referenced item.
- C. Primary Liner is defined as Contractor's initial construction liner and tunnel support installed by Contractor for ground stability and safety during construction in

preparation for the installation of water line. Contractor chooses method of tunnel construction in accordance with this Specification. Inclusion of various methods in specification or reviews by Project Manager of Contractor's submittals shall not be construed by Contractor as endorsement by Project Manager that all such methods are constructible or will work for specific subsurface soils encountered.

- D. Carrier Pipe is referred to as water line or permanent (secondary) liner. Such water line/permanent liner is defined and installed in accordance with Section 02517 – “Water Line in Tunnels” or Section 02511 – “Water Lines”.
- E. Tunnel Boring Machine (TBM): Mechanized and fully shielded excavating equipment that is steerable, guided and articulated, with man entry.
- F. Shield: Fabricated ground support, circular in section, providing 360 degree protection to those working in it. Shield shall have cutting edge, and be equipped with independently operated hydraulic propulsion rams, allowing it to be steered. Liner is erected within tail attached to shield.
- G. Open Face: Face of heading or tunnel which is unsupported during excavation (e.g., in hand mining or shield excavation).
- H. Closed Face: Face of heading or tunnel which is supported during excavation process from TBM, where cutter head allows both partial exposure of face and full closure, by means of hydraulically operated gates.

1.11 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Primary Tunnel Liner and Supports

- 1. The primary tunnel liner may consist of steel ribs and lagging, steel liner plates, precast concrete segments, steel casing pipe, or combinations of these. Lagging may be timber or steel. Box tunnels with timber supports will not be allowed. Utilize additional support elements including shotcrete, additional steel sets, breasting, spilling, forepoling, crown bars, soil anchors, or fabrics, as required to provide safe, stable excavation.
- 2. Use steel liner plates, steel casing, or steel lagging with steel ring beams as primary liner for tunneling under Texas Department of Transportation rights-of-way.

3. Use steel casing as primary liner for tunneling under railroad rights-of-way.
4. Use steel casing as primary liner for tunneling in fault zone crossings and when tunneling under drainage channels, creeks, bayous, and gullies.

**B. Material Standards**

1. Where use of following materials is required, conform to requirements of following minimum standards:

<b><u>Material</u></b>	<b><u>Reference Standards</u></b>
Cement	ASTM C150/C150M
Structural Concrete	
Reinforcing Steel Wire	ASTM A82 or A1064/A1064M
Reinforcing Steel Wire Fabric	ASTM A1064/A1064M
Reinforcing Steel Bars	ASTM A615/A615M , Grade 60
Sand and Aggregate	ASTM C33/C33M
Structural Steel	ASTM A36/A36M
Steel Piles, Sheets	ASTM A328
Rings and Ribs	ASTM A36/A36M
Steel Plates	ASTM A36/A36M and A283/A283M
Lumber and Timber	Hardwood, sound or better, as defined by Commercial Standard C560
Steel Casing Pipe	AWWA C200

**C. Steel Liner Plates**

1. Except as otherwise specified, furnish materials according to applicable requirements of AREMA Manual for Railway Engineering.
2. Bolts and nuts: Conform to ASTM A307, Grade A. Use bolts no less than 1/2 inch in diameter for plate gauge 7 or thinner and no less than 5/8 inch in diameter for greater plate thicknesses.
3. Punch plates for bolting on both longitudinal and circumferential seams and fabricate to permit complete erection from inside tunnel. Use plates of uniform fabrication and use interchangeable plates for those intended for one size tunnel.
4. Use new material for construction of liner plates. Used plates shall not be acceptable.
5. Provide steel liner plates manufactured by Contech Construction Products (2-flange), Commercial Pantex Sika, Inc. (4-flange), or approved equal, and

certified by manufacturer of compliance with specifications. Provide tensile strength, yield strength, and minimum elongation of liner plates. Also, provide design calculations for either 2-or 4-flange liner plates, as appropriate for Contractor's method of construction. All steel liner plate designs shall meet following minimum factors of safety:

Seam Strength.....	3
Buckling .....	2
Maximum Deflection .....	2% (of normal tunnel diameter)

6. Maintain minimum thickness of metal for these steel plates as shown on Plans, allowing for standard mill tolerances.
7. Equip steel liner plates with approximately 2-inch-diameter grout holes furnished with plugs. Locate holes near plate centers, such that when plates are installed there shall be one line of holes along crown and along each side of tunnel, not more than 18 inches above invert. Locate holes in each line at no more than every other plate and stagger.
8. Protective coating not required for steel liner plates, unless otherwise specified or shown on Plans.
9. Install gaskets between liner plates when required to control seepage, or as specified or shown in Plans.
10. Steel ribs used with liner plates: Conform to requirements of Paragraph 2.06, Steel Beams and Lagging.

**D. Steel Casing Pipe**

1. Casing pipe: Provide new uncoated welded steel pipe, manufactured in accordance with AWWA C200. Comply with Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”.
2. Design stress in pipe wall shall be no greater than 50 percent of minimum yield point of steel or 18,000 psi, whichever is less when subjected to loading conditions.
3. Design deflection to be used in determining wall thickness shall not exceed 3 percent of nominal casing pipe size.
4. Bedding constant to be used in determining wall thickness shall be 0.10. Lag factors shall be 1.0 for all live loads.
5. Casing pipe design shall also include stresses due to jacking forces when pipe is to be installed by jacking method.



6. Equip casing pipe with approximately 2-inch diameter grout holes furnished with plugs. Place holes in pattern so that each succeeding hole from top dead center is 60 degrees right, then 60 degrees left, then top dead center. Locate holes in each line no more than 9 feet apart.
7. Conform casing pipe used in fault zones to welding and weld testing requirements specified in Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”.
8. Casing pipe used in fault zones must be plugged at each end with clay bricks around O.D. of pipe minimum of one foot thickness measured into casing to prevent infiltration of soil into annular space.

E. Steel Ribs and Lagging

1. Steel ribs and auxiliary structural members shall be free of defects which may impair or reduce their structural integrity. Ribs shall be accurately curved to proper radius of tunnel section (or shaft section) and rib segments shall fit closely for bolted connections at segmental and transverse joints. Provide steel appurtenances required for installation of ribs such as tie rods, bolts, splice plates, dutchmen and drift pins, with ribs.
2. Minimum factors of safety:
  - a. Buckling .....2
  - b. Stiffness .....3

F. Timber

1. Use new timber for primary liner ground support without defects, of true dimensions and of quality grade and wood type defined by Contractor’s Engineer.

G. Filter Fabric

See Section 02621 – “Geotextile” for requirements of material and minimum installation requirements. Install fabric, and backer rods, as required to prevent loss of fine-soil sediments into tunnel.

H. Equipment

1. Use only the tunneling method or equipment which shall produce specified results for soils encountered. However, use tunneling method, whether hand or machine, with full-face closure capabilities.
2. Diesel, electrical, hydraulic, or air-powered equipment is subject to applicable Federal and State regulations. Diesel engines equipped with scrubbers are

acceptable only when tunneling in free air with adequate ventilation. Provide compressed air and electricity for Contractor's operations from source outside tunnel.

3. When TBM is used, employ equipment that shall be capable of handling various anticipated ground conditions. In addition, TBM shall:
  - a. Be capable of minimizing loss of ground ahead of and around machine and providing satisfactory support of excavated face. Use TBM with, when necessary for ground control, earth-pressure balance, or slurry-shield capabilities.
  - b. Conform to shape of tunnel with uniform perimeter that is free of projections that could produce over-excavation or voids. TBM shield shall be continuous around its full perimeter; open-bottom shield is not acceptable.
  - c. Have tail section long enough to enable setting of initial supports within machine, while still providing at least 12-inches of overlap beyond last installed support elements when thrusting jacks are extended to fullest extent possible.
  - d. Have propulsion jacks capable of moving machine in forward direction while maintaining construction tolerances with respect to line and grade, without damage to previously-installed tunnel supports. Design propulsion system so that in event of failure of any element of system, there is no movement backward and there is no overstressing or distortion of tunnel supports.
  - e. Incorporate seal in TBM tail shield to prevent leakage of grout between shield and liner into tunnel space, when grout is required immediately behind shield.
  - f. Have motors and operating controls protected against water inflow.
  - g. Provide bi-directional drive on cutter head wheel, or fins or grippers to control roll due to rotation.
  - h. Provide means for maintaining tunnel face under wet and adverse soil conditions. Use closure doors on cutter wheel or other means, such as earth-pressure balance or slurry shield, acceptable to Project Manager.
4. When a tunnel shield is used (with or without attached mechanized excavating equipment), employ shield that shall be capable of handling various anticipated ground conditions. In addition, tunnel shield shall:

- a. Conform to shape of tunnel with uniform perimeter that is free of projections that could produce over excavation or voids. Appropriately sized overcutting bead or taper along length of shield may be provided to facilitate steering. Shield shall be continuous around its full perimeter; open bottom shield is not acceptable. Although it is recognized that capability to over excavate beyond perimeter of shield may be necessary under certain conditions, make provisions to prevent accidental over excavation.
  - b. Have hood, poling or breasting plates, shelves and breast jacks, breast tables, and combinations of these and other bracing as necessary to fully support face of tunnel excavation without loss of ground.
  - c. Have tail section long enough to enable setting of initial supports within shield while still providing at least 12-inches of overlap beyond last-installed support elements when shield has been pushed forward to fullest extent possible.
  - d. Have propulsion system for moving shield in forward direction, while maintaining construction tolerances with respect to line and grade, without damage to previously-installed tunnel support. Design propulsion system so that in event of failure of any element of system, there is no movement backward and there is no overstressing or distortion of tunnel supports.
  - e. Have motors and operating controls protected against water inflow.
  - f. Incorporate seal in tail of shield to prevent leakage of grout between shield and liner into tunnel space, when grout is required immediately behind shield.
5. Air Quality: Provide equipment to adequately ventilate entire tunnel operation during construction, in accordance with OSHA requirements.
- a. Provide portable testing equipment for carbon monoxide gas, hydrogen sulfide gas, oxygen deficiency, and explosive gases. Monitoring for other constituents may be required while tunneling in potentially contaminated areas as defined in Contractor's safety plan.
  - b. Provide audible automatic gas alarm on TBM to detect explosive gases. Locate alarm near tunnel face.
  - c. Equip motors and controls with automatic shutoff methane monitoring system.

6. Lighting: Provide adequate lighting with lights at 50 feet, maximum spacing in tunnel. Fixtures shall be in watertight enclosures with suitable guards. Provide separate circuits for lighting and for electrical equipment.
7. Electrical: Equip electrical systems utilized on TBM with appropriate ground fault system. Electrical systems are to be insulated, not permitting bare-wire exposures.
8. Access: Provide safe access through tunnel to TBM.
  - a. Provide walkway in tunnels greater than 10 feet in diameter which is separate from tracks used by spoil removal equipment.
  - b. Equip locomotives or cars used for transport of personnel with necessary safety devices.
9. Necessary equipment for tunnel excavation includes telephones, signal systems, fire extinguishers, safety equipment, and other equipment required by Contractor's method of construction, work plan, and safety plan. Maintain equipment in good repair, and readily available at place of work.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

#### 3.01 GENERAL / MANUFACTURER(S)

- A. Use of various materials and construction methods for tunnel excavation and ground support, such as by tunnel boring machine (TBM), hand tunneling or shield will be allowed provided that proposed products and methods will complete Project in accordance with Specifications, this Section, applicable safety codes, and Project schedules. Contractor responsible for final constructed product, materials and tools used, and for furnishing labor and qualified superintendents necessary for selected method of construction.
- B. Use tunnel liner or casing of a size so that minimum clearance at the bottom between O.D. of carrier pipe and inside of liner is minimum 4 inches, and minimum clearance at the top between O.D. of pipe and inside of liner or casing is in accordance with following:

<b>Carrier Pipe Net I.D.</b>	<b>Minimum Clearance to Top</b>
$\geq 48"$	9"
42"	7"
36"	5"
$\leq 30"$	3"

- C. This clearance also applies to distance between carrier pipe and electrical conducting pipe support system.
- D. Furnish all items, such as TBM or shield with excavation equipment, spoil disposal systems, muck trains, hoist, grouting, signal systems, ventilation, safety equipment, and survey controls necessary to excavate and advance tunnel and construct primary tunnel liner by selected method.

### 3.02 PREPARATION

- A. Contractor shall be responsible for his means and methods of tunneling construction and shall ensure safety of Work, Contractor's employees, public, and adjacent property, whether public or private.
- B. Execute Work of excavating, lining, grouting, and construction of tunnel so that ground settlement or loss will be minimized. Completed primary tunnel lining shall have full bearing against earth with no voids or pockets left in Work. Fill peripheral space between support elements and excavated surface no less frequently than after each shore or close by expanding support elements against ground as shield advances. Provide stability of face under anticipated conditions.
- C. Maintain clean working conditions inside tunnel and remove muck, debris, material spills, unusable supports, and other material not required for tunneling.
- D. Be aware that various existing soil borings, piezometers, or instrument wells may coincide with proposed tunnel alignment. These may or may not have been backfilled with grout and therefore caution should be used in tunneling through these existing borings. Take mitigating measures to counter effect these boreholes, piezometers, or instrument wells may have on tunneling operations.
- E. Perform tunneling under railroad embankments, highways, or streets to prevent interference with operation of railroad, highways, or streets.
- F. Do not perform any surface activities pertaining to water line construction within a tunnel area unless otherwise approved by Project Manager.
- G. Conduct tunneling operations in accordance with applicable safety rules and regulations, OSHA Standards, and Contractor's Safety Plan.

- H. Perform additional exploration of ground conditions by geotech borings if needed to define necessary parameters for design and for selection of tunneling method. No additional pay.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Tunnel Excavation and Primary Liner Installation

1. Tunnel Excavation:

- a. The selected method of tunnel excavation is subject to review by the Project Manager.
- b. Conduct tunneling operations in accordance with applicable safety rules and regulations, and Contractor's safety plan. Use methods which include due regard for safety of workmen, adjacent structures, utilities, and public.
- c. Limit tunnel excavation to within easements and rights-of-way indicated on Plans, and to lines and grades designated on Plans. Perform excavation of sufficient size to allow installation of water line to lines and grades indicated on Plans.
- d. Locate equipment powered by combustible fuels at suitable distances from shafts to prevent possibility of explosion and fire in shafts or tunnel.
- e. During open-face excavation:
  - 1) Excavate face commencing at crown and proceed down to invert. Excavate both sides of heading simultaneously. Keep hood buried in soil ahead where soils include sands and silts.
  - 2) Keep face breasted or otherwise supported; employ other means as necessary to maintain face stability and prevent falls, excessive ravelling, or erosion. Maintain standby face supports for immediate use when needed.
  - 3) During shut-down periods, support face of excavation by positive means; do not rely solely on hydraulic pressure for support. When face is untouched for more than 24 hours, and when required by Project Manager, fully breast face and shove shield tight against it.
- f. During closed-face excavation:

- 1) Carefully control and monitor volume of spoil removed. For earth-pressure balance TBM, balance spoil removed with advance rate and excavation rate.
    - 2) When cutting face is withdrawn, keep excavated face stabilized as required.
  - g. Advancing Shield: During forward movement of shield, provide sufficient support at excavation face to prevent movement of materials except materials as are physically displaced by elements of shield itself. Excavation shall not be advanced beyond the edge of the shield.
2. Size of Tunnel: Determine adequate tunnel size and section to match construction methods described in work plan. Build tunnels of sufficient size to permit efficient excavation operations, to provide sufficient working space for placing primary tunnel liner, and to allow for installation of water line as shown on Plans or indicated in Specifications. Dimensions shown on Plans do not necessarily represent size or section suitable for construction methods or operational procedures as may be proposed or conducted by Contractor.
3. Primary Liner:
- a. Provide primary liner for tunnel which is capable of supporting ground and hydrostatic forces until permanent water pipe has been installed and grouted in place, and to resist construction loads.
  - b. Use methods that ensure full bearing of soil against primary liner without significant settlement or movement of surrounding soil. To fill void behind primary liner, either expandable liner (e.g., ring beams and timber lagging) or nonexpandable liner (e.g., bolted steel liner plates) may be used provided grout is placed behind nonexpandable liner. Grout excavation not to true shape as result of careless excavation or loss of ground.
  - c. The primary liner's seepage inflow for each 100-foot length of tunnel shall not exceed 3 gallons per minute, including inflow through face or shield. Localized inflow shall not exceed 0.5 gallons per minute. Provide drainage facilities to remove inflow of water from tunnels and shafts. Provide means to prevent inflow of soil fines associated with water inflow by use of filter fabrics or other approved methods.
  - d. Expandable liner shall be continuous and shall be expanded to limits of excavation promptly after it is out of shield.
  - e. During excavation of tunnel, advance TBM or shield only far enough to permit construction of one primary liner ring beam set, or rings of

bolted steel liner plates that can be assembled entirely within tail shield of TBM.

- f. Install filter fabric around exterior of primary liner when using non-watertight liner and when tunneling through sandy or silty ground conditions. Install backer rods at ribs as required to control migration of fines. Close windows in lagging.
- g. Provide hog rods, struts, or similar members when required to maintain roundness. After grouting, liner shall be no more than 3 percent out of round as measured by difference between maximum and minimum measured diameter divided by average diameter.

4. Hand Jacking of Casing:

- a. Provide heavy-duty jacks of capacity suitable for forcing casing pipe through ground. Construct operating jacks so that even pressure is applied to all jacks used. Provide suitable jacking head, (timber, etc.), and suitable bracing between jacks and jacking head. Provide suitable jacking frame and/or back stop. Set casing pipe to be jacked on guides, (timber, etc.), properly braced together, to support section of pipe, and direct it to proper line and grade. Place whole jacking assembly so as to line up with direction and grade of casing pipe.
- b. Excavate ground material just ahead of casing pipe by use of air-powered tools, excavating machine, or other acceptable means, and remove through casing pipe. Then force casing pipe through ground with jacks, into space thus provided. Dispose excavated material as specified.
- c. Trim excavation in manner so that at least one third of circumference of excavation conforms to contour and grade of casing pipe. Provide clearance of not more than 2 inches for upper half of casing pipe with clearance tapering off to zero at point where excavation conforms to contour of casing pipe. Cutting edge of steel plate installed around head end of casing pipe extending short distance beyond end of casing pipe with inside angles or lugs to keep cutting edge from slipping back onto casing pipe may be used.
- d. In addition to requirements set for in this specification, Contractor shall:
  - 1) Excavate face commencing at crown and proceed down to invert. Excavate heading so that both sides of heading are excavated simultaneously.



- 2) At all times maintain standby face supports to allow for immediate use when needed.
    - 3) At end of each shift and whenever excavation is suspended or shut down, install breast boards, or other approved methods, across full face of heading.
  - e. Distance that excavation extends beyond end of casing pipe shall not exceed three feet. Decrease this distance as directed by Project Manager, or due to character of material being excavated.
  - f. Jack the casing pipe, insofar as practical, from low or downstream end. Lateral or vertical variation in final position of casing pipe from line and grade as established by Project Manager will be permitted only to extent of 1 inch in 10 feet, provided that variation is regular and only in one direction and that final grade of flow line is in direction indicated on plans. Remedy overcutting by pressure grouting entire length of installation. Use of grout mix immediately behind shield tail shall have efficient tail seal to prevent flow of grout into shield.
  - g. Depending on character of soil encountered during jacking operation, carry on operation without interruption, insofar as practical, to prevent casing pipe from becoming firmly set in ground.
  - h. Remove and replace casing pipe damaged in jacking operations by Contractor at no additional cost to Owner.
  - i. Backfill pits or trenches which have been excavated to aid jacking operations as soon as casing pipe is complete in place, equipment and appurtenances have been removed and structure, which is to be built in excavated zone, is in place. In no case shall pits remain open without appropriate safety barricades, concrete traffic barriers (CTB's), railing, or plates.
  - j. When jacking casing pipe, water jetting of casing pipe bedding or backfill is not allowed. In unconsolidated soil formations, use gel-forming colloidal drilling fluid consisting of at least 10 percent of high grade fully hydrated bentonite to seal voids outside walls and furnish lubrication for installation of casing pipe.
5. Grouting:
- a. Detailed requirements pertaining to grout mix design and tunnel grouting are provided in Section 02431 – “Tunnel Grout”.

- b. Furnish and operate suitable equipment for grouting operations to effectively and completely fill voids outside of primary tunnel liner as quickly as possible.
- c. Provide in tunneling work plan description of primary liner grouting operations, including:
  - 1) Arrangement of grouting equipment including mixer, pumps, piping and hoses, valves, pressure gauges and injection fixtures.
  - 2) Location, spacing, and size of grout ports and vents.
  - 3) Grouting sequence for initial backfill of voids between liner and ground, and for second stage back grouting.
  - 4) Grout injection pressures and estimated volumes.
  - 5) Procedure to check for remaining voids.
  - 6) Sampling procedures and locations for quality control testing.
  - 7) Grout production and quality shall be in accordance with Contractor's mix design and grout production plan as required by Section 02431 – "Tunnel Grout".
- d. Use care in grouting operations to prevent damage to adjacent utilities or other properties. Ensure that pressure used in grouting is not great enough to distort or imperil Work.
- e. Fill voids behind non-expandable primary liner with sand-cement grout promptly after liner is out of shield. Grout pressure shall not exceed value that may cause damage or distortion to installed liner plate rings. Grout from bottom up and plug each grout hole promptly after grout has been placed. Provide seals on tail of TBM which will prevent grout from moving into shield.
- f. Liner requiring grout shall be back grouted (second stage grouting) once each shift, or more often when required to ensure that all voids are filled.
- g. Place grout behind tunnel liner at end of each day or at every 4 feet of tunnel installed, whichever is less, unless in opinion of Project Manager, ground conditions are such as to require each ring to be grouted immediately after erection. Upon completion of each grouting operation, sound primary liner and immediately correct voids discovered by necessary means as approved by Project Manager. After all voids are successfully filled, grout holes shall be packed, when

necessary, with dry mortar mix and threaded taps securely placed in holes.

- h. Completely and immediately fill voids outside limits of tunnel excavation created by caving or collapse of earth cover over excavation, or by other cause, with sand cement grout. Perform second grouting to fill soft spots or voids which may be detected, no later than 24 hours after initial grouting of primary liner.
- i. Perform quality control sampling and testing of grout.
  - 1) Grout production shall be in accordance with Section 02431 – “Tunnel Grout”.
  - 2) Measure density of grout throughout placement procedure as directed by Project Manager. Measure grout density at discharge point and discharge grout until density is within 0.3 pounds per gallon of input density.
  - 3) Take samples of well-mixed grout for 28-day compressive strength tests at beginning, middle, and end of each grouting operation.

**B. Tunneling Data**

- 1. Submit shift logs of construction events and observations within 24 hours of operation on at least following:
  - a. Location of face by station and progress of tunnel drive during shift.
  - b. Observation of lost ground and other signs of ground movement.
  - c. Location and elevation of significant soil strata boundaries and brief soil descriptions.
  - d. Ground water control operations, piezometric levels, ground water inflow location, and rates.
  - e. Completed field forms for establishing and checking line and grade and achieved tolerance relative to design alignment.
  - f. Operation shut-down periods or other interruptions in Work, and reason.
  - g. Any unusual condition or event.
  - h. Hours worked per shift on tunneling operation.
- 2. Clearly mark primary liner every 20 feet along tunnel with distance in feet from centerline of preceding shaft.

C. Tunnel Connections, Terminations, and Temporary Bulkheads

1. Connect new tunnels to existing structures by removing existing bulkheads, when necessary, and sealing junction as shown on Plans.
2. Seal terminations of tunnels, which are not connected to permanent structures, by temporary bulkhead.
3. Design temporary bulkheads where and when required and obtain Project Manager's acceptance of design prior to constructing it. Provide bulkheads capable of resisting lateral earth and hydrostatic pressures, waterproof, and capable of being removed without damaging water line or plastic liner.

D. Monitoring

1. Monitoring Instrumentation: This specification establishes minimum instrumentation requirements for tunneling. Additional instrumentation requirements for critical areas may be specified elsewhere in Specifications or on Plans. Contractor may install more extensive system at Contractor's sole expense. Instrumentation specified shall be accessible at all times to Project Manager.
  - a. Submit for review, prior to construction, Monitoring Plan including instrument installation design, instrumentation points location and layout, manufacturer's catalog literature, installation report formats.
  - b. Install and maintain system of instrumentation to monitor tunneling operation and to detect movement in soil and adjacent structures. Instruments shall consist of no less than sufficient number of inclinometers and crack monitors at bridge and adjacent structures and sufficient piezometers. Use monuments sufficiently removed from construction to avoid errors in readings due to ground settlement.
  - c. Installation of instrumentation by Contractor shall not preclude Project Manager, through independent contractor or consultant, from installing instrumentation in, on, near, or adjacent to construction work. Provide access to work for independent installations.
  - d. Install soil instruments such as piezometers, inclinometers, extensometers, and crack monitors by qualified subcontractor specializing in geotechnical work.
  - e. Install extensometers to depth of 5 feet above crown of water line tunnel as shown on Plans to measure vertical movements in soils during and subsequent to tunneling. Extensometer consists typically of three-prong anchor, 1/4-inch standard stainless steel inner pipe, and 1-inch standard Schedule 80 PVC outer pipe. Pipes are assembled in sections

and fastened together with standard couplings to required anchor depths. Locate top of extensometer within flush-mounted hand hole cover capable of withstanding HS-20 truck loading. Geotechnical instrumentation installation subcontractor shall provide procedures for installation of extensometers as part of Monitoring Plan.

2. Building and Structures Assessment: Submit for review prior to construction, Building and Structures Assessment Plan. Provide preconstruction and post-construction assessment reports for buildings and structures located within distance equal to depth of tunnel but at least 50 feet in plan from proposed tunnel centerline and shafts. Include photographs or video of existing damage to structures in vicinity of water line alignment in assessment reports.
3. Settlement Surveying: This specification establishes minimum settlement survey requirements for structures and ground surface monitoring points.
  - a. Submit settlement surveying and monitoring plan for review prior to construction. Plan shall identify location of settlement monitoring points, reference benchmarks, survey schedules and procedures and reporting formats.
  - b. Locate survey points on all structures within distance equal to depth of tunnel but at least 50 feet in plan from tunnel centerline.
  - c. Record horizontal coordinates and elevations (with accuracy of 0.01 feet) for each survey point location. Reference survey points so that they may be accurately reestablished when lost or destroyed.
  - d. Unless otherwise specified, record ground surface elevations on center line ahead of TBM and at 20 feet either side of center line at minimum of 100-foot intervals or at least three locations per tunnel drive. Starting 100 feet ahead of TBM and continuing until TBM is 100 feet beyond measurement point or until further movement is not detected, unless otherwise directed by Project Manager. Record cross-sectional points at 10-foot spacing for distance of 50 feet each side of center line or to ROW, whichever is less.
  - e. Locate survey points at crossings under installations as follows:
    - 1) Roads: 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 intersection.
  - f. For shaft settlement see Section 02400 – “Tunnel Shafts”.

4. Measure and maintain records of deformation of primary liner.
5. Reading Schedule and Reporting: Submit readings from various instruments and survey points weekly to Project Manager. Take daily Readings as required by Project Manager when construction is approaching or near critical structures (structures, bridge piers, pipelines, etc., partially or entirely located within distance equal to depth of tunnel but at least 50 feet in plan from tunnel centerline). Take initial readings of surface points before excavation or construction is started.
  - a. Immediately report to Project Manager movement, cracking, or settlement which is detected and take immediate remedial action. Contractor shall be fully responsible for damage to adjacent structures.
  - b. At end of construction after water line is installed, and dewatering is discontinued, make final survey of control points established for instrumentation and observation. Submit final readings to Project Manager. Make visual inspection of structures adjacent to water line and report to Project Manager condition of structures, damage incurred during construction, and corrective action taken.

E. Disposal of Excess Material

Remove spoil from job site and dispose in accordance with Section 01504 – “Temporary Facilities and Controls”.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

A. Control of Tunnel Line and Grade

1. Construction Control:
  - a. The Project Manager will establish baseline and benchmarks indicated on Plans. Check these baseline and benchmarks at beginning of Work and report errors or discrepancies to Project Manager.
  - b. Use baseline and benchmarks established by Project Manager to furnish and maintain reference lines and grades for construction. Use these lines and grades to establish location of tunnel, water line, and structures.
  - c. Establish and be fully responsible for accuracy of controls for construction of Project, including access shaft locations, structures, tunnel line, and grade. Utilize laser to insure line and grade are maintained during tunneling process.

- d. Establish control points sufficiently removed from tunnel operation not to be affected by potential ground movement.
  - e. Maintain daily surveying records of alignment and grade and submit three copies of records to Project Manager by end of day after Work performed. Locate points at top, bottom, and each side of springline.
  - f. Check tunnel survey control against aboveground undisturbed reference at least once each week and once for each 250 feet of tunnel constructed, or more often as needed or directed by Project Manager.
2. Earth Movement: Contractor is responsible for damages due to settlement from construction-induced activities or occurrences.
- a. Take precautions to avoid damage or settlement to buildings, structures, roads, and utilities to work in proximity of tunnel. Minimum precautions to include use of construction methods and equipment to minimize loss of earth at tunnel face and settlement of soil around primary tunnel liner.
  - b. Refer to Paragraph 3.08, Monitoring, for detecting earth movement.
  - c. In event movement of ground is detected, Project Manager may order work stopped and secured. Before proceeding, correct problems causing or resulting from movement.
  - d. Be aware that when settlement of ground surface should occur during construction of tunnel which will affect accuracy of temporary benchmarks established by Project Manager, detect and report movement. Locations of permanent NHCRWA monumentation benchmarks are indicated on Plans; Contractor may use these to verify temporary benchmark accuracy. Advise Project Manager of settlement affecting permanent monumentation benchmarks. Upon completion, submit field books pertaining to monitoring of permanent monumentation benchmarks to Project Manager.
3. Tunnel Line and Grade:
- a. Survey crown, invert, and spring line on each side of primary liner at 50-foot intervals, or minimum of once per shift, or more frequently when line and grade tolerances have been exceeded, to ensure alignment is within tolerances specified. Conduct survey immediately behind tunnel excavation to allow immediate correction of misalignment.

- b. Control excavation of tunnel and construction of primary liner to allow construction of carrier pipe within 6 inches on line and 4 inches on grade and to maintain circular shape of tunnel.
- c. Alignment adjustments between primary tunnel liner and water main shall not encroach on minimum required clearance of 4 inches defined in Section 02517 – “Water Line in Tunnels”.
- d. If unable to maintain specified tolerances, bear full responsibility and expense of correction (redesign, easement acquisition, etc.). When these tolerances are exceeded and redesign of structures is required, obtain services of qualified Professional Engineer registered in the State of Texas for redesign. Submit plans showing changes to Project Manager for review.
- e. Backfill (grout) and reconstruct tunnel built outside tolerance to be within tolerance when so directed by Project Manager.

**B. Ground and Surface Water Control and Ground Stabilization**

- 1. Provide necessary ground water and surface water control measures to perform Work and to provide safe working conditions. Detailed plans for ground and surface water control methods shall be executed as designed by the Contractor’s Engineer. Prevent excessive inflow of water into excavation during construction of tunnel and installation of carrier pipe and grouting of annular space. Ground water control method shall provide means to prevent piping of fines into shafts or tunnel and other adverse effects due to ground water inflow. Surface water control method shall provide means to control impacts of surface water above or along tunneling operations. Additional requirements are included in Section 01578 – “Control of Ground Water and Surface Water”.
- 2. Anticipate that portions of tunnel excavation may be below ground water table and in cohesionless soils, even when not indicated on soil borings, and in conditions which may require ground water control system for tunneling operations. Install filter fabrics, backer-rods and other means as necessary to prevent piping of fines into tunnel. Remove water that may be encountered during course of Work by pumping, well pointing, deep well pumping, or other means determined by Contractor as necessary to achieve stable conditions and applied in manner as described in Section 01578 – “Control of Ground Water and Surface Water”. Standing water is not permitted at face or in tunnel.



3. The ground water control method used shall not cause damage to adjacent structures or property due to lowering of water table and subsequent ground settlement. In event damage does occur, correct damage and settle claims arising from damage at no additional cost.
4. If Contractor chooses pumping installations to control ground water level or installs pervious liner through water bearing layers, install and maintain instrumentation system to monitor water level and to detect movement in adjacent structures and property. Monitor water level by recording initial water level before dewatering is started and thereafter on weekly basis. Remove water monthly from piezometers to demonstrate that they are operable. Submit weekly reports of water levels to Project Manager. Provide access to piezometers for Project Manager to perform independent measurements.
5. Maintain dewatering system for tunnels in continuous operation until minimum of 48 hours after carrier pipe has been installed and annular space is fully grouted, or until watertight liner designed for hydrostatic pressures is installed.
6. If eductors, well points, or deep wells are used, space them adequately to provide necessary dewatering. Use sand packing, and other means to prevent pumping of fine sands or silts from subsurface and to minimize ground subsidence. Check continuously to ensure that subsurface soil is not being removed by ground water control operation or subsurface drainage into shafts or through pervious liner. Before operations begin, maintain availability of pumping equipment and other machinery on site to assure that operation of dewatering system can be maintained.
7. When groundwater control is necessary, do not begin tunneling operations until monitoring data shows that it is safe to do so. When dewatering is sole means of ground water control, draw piezometric level at least down below elevation of invert of tunnel, or to lower elevation as required for excavation face and tunnel stability.

3.06 – 3.10 NOT USED

END OF SECTION

Section 02431

TUNNEL GROUT

PART 1 GENERAL

1.01 SUMMARY

This 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 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.

1.03 REFERENCES

- 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 C33ASTM 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 Preplaced-Aggregate Concrete.
- H. ASTM C 942. Standard Test Method for Compressive Strength of Grout for Preplaced-Aggregate Concrete in the Laboratory.
- I. ASTM C33ASTM C 1017. Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

#### 1.04 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 shall include sketches as appropriate, indicating type and location of mixing equipment, pumps, gauges, injection points, venting method, flow lines, pressure measurement, volume measurement, grouting sequence, schedule, and stage volumes, as well as procedures to resist movement and counteract floating the carrier pipe during grouting operations. Tests and certifications shall have been performed within last 12 months prior to date of submittal.
- C. Grouting contractor shall provide a project history showing a minimum of 5 years of work and at least 10,000 linear feet of experience in grouting tunnels.
- D. 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” for further requirements)
- E. For cellular grout, also submit the following:
1. Foam concentrate supplier's certification of product application for foam concentrate.
  2. A description of proposed cellular grout production procedures.
- F. Maintain and submit logs of grouting operations indicating pressure, density, and volume for each grout placement.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02517 – “Water Line in Tunnel”
- D. Section 03315 – “Concrete for Utility Construction”

#### 1.06 – 1.09 NOT USED

#### 1.10 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. Sewer or water line installed inside primary tunnel support.

#### 1.11 – 1.13 NOT USED

**PART 2 PRODUCTS**

**2.01 MANUFACTURER(S) (NOT USED)**

**2.02 MATERIALS AND/OR EQUIPMENT**

- 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.
  - 2. Alternative grout for annular grouting of water line: Low density (cellular) grout.
  - 3. Grout for annular grouting of sanitary sewer: Low density (cellular) grout, unless otherwise approved by Project Manager.
  - 4. Grout for filling space around manholes in shafts: Sand-cement mortar mix.
  - 5. Ground stabilization: Sand-cement mortar mix.
- C. Do not include toxic or poisonous substances in grout mix or otherwise inject such substances underground.
- D. Grout
  - 1. Develop one or more mixes based on following criteria as applicable and provide test reports from a professional laboratory for each mix design:
    - a. Size of annular void between carrier pipe and liner, or size of void between primary liner and surrounding soil
    - b. Absence or presence of groundwater
    - c. Adequate retardation
    - d. Non-shrink characteristics
    - e. Pumping distances
  - 2. Prepare mixes that satisfy required application. Provide materials conforming to the following standards:
    - a. Cement: ASTM C 150

- b. Fly Ash: ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementitious material in mix design.”
  - c. Water: Potable
  - d. Foam: ASTM C 869. The foaming agent shall maintain stability until the cement sets to form a self-supporting matrix comprising closed cells and low water absorptive characteristics.
  - e. Slurry: ASTM C 138
  - f. Cellular Grout: ASTM C 138
  - g. Sand for sand-cement mortar mix: ASTM C 144
  - h. Retarder/water reducer: ASTM C494, Type D
  - i. Plasticizer/water reducer: ASTM C494, Type A
  - j. Fine aggregate: ASTM C33
3. Provide grout meeting the following minimum requirements:
- a. Low Density Cellular Grout
    - 1) Cement content shall be no less than 200 lb/cubic yard.
    - 2) Water content shall be no more than 65 percent.
    - 3) Wet density shall be no less than 65 lb/cubic foot.
    - 4) Minimum compressive strength shall be 100 psi after 7 days and 300 psi after 28 days.
  - b. Conventional (Mortar) Grout
    - 1) Conventional grout shall consist of a pumpable mix of 1-part cement, 2-part clean sand, water free from organics and deleterious materials, and a small amount of bentonite for pumpability and stability. The unit weight shall not be less than 130 lb/cubic foot.
    - 2) Minimum 28-day unconfined compressive strength shall be 1,500 psi for water lines and 1,000 psi for other carrier pipes.
    - 3) Determine strength by ASTM C942.

4. 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.
5. Admixtures.
  - a. Use admixtures meeting ASTM C 494 and ASTM C 1017 as required, to improve pumpability, control time of set, hold sand in suspension and reduce segregation and bleeding.
  - b. For cellular grout, do not use foam or admixtures that promote steel corrosion
  - c. Ensure that admixtures used in mix are compatible. Provide written confirmation from admixture manufacturers of their compatibility.
  - d. Admixtures shall not contain chlorides, and shall be non-toxic after 30 days.
  - e. Amount of admixture added to concrete shall be in accordance with the manufacturer's recommendations.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

#### 3.01 GENERAL / MANUFACTURER(S) (NOT USED)

#### 3.02 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, type of 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.
- E. Verify that locations where grout is to be placed are clean and free of standing or running water.
- F. A bulkhead designed by the Contractor shall be placed in the annular space at each end of tunnel section that is to be grouted. Provide an opening in the crown in addition to other required vent outlets. Provide an opening for the tunnel invert drain and at the

casing invert to facilitate draining water away from the Work during grouting operations.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Equipment

1. Batch and mix grout in equipment of sufficient size and capacity to provide necessary quality and quantity of grout for each placement stage.
2. 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. Foam Generator for Cellular Grout: Foam shall be generated by combining controlled quantities of air, water, and foaming agent under pressure in accordance with the foaming agent manufacturer's recommendations. The temperature of water used in generating the foam shall be maintained below 80°F, or as recommended by the foaming agent manufacturer. Foam shall be discharged into the mixer and blended with the cement slurry.
4. Mixing: The mixer shall be configured for compatibility with the pump to ensure continuous and uniform flow at the point of placement. The mixer shall be capable of providing a super-wetted, homogenized mix. The mixer shall be fitted with a meter with an accuracy of  $\pm 1$  gallon to measure the volume of water added to dry mix ingredients. An automated system shall be provided capable of delivering a neat cement grout to the mixer and pump in the tunnel where grouting is to be performed.
5. Pumping: Pumping equipment shall be capable of pumping concrete without pulsation or segregation. Pumping equipment shall be operated to convey a continuous and uniform stream of concrete without air pockets. Pumping equipment shall be equipped with a water connection for flushing the system and a device to limit pumping pressure as required to prevent damage to pipe.
6. Agitator: A separate agitator shall be provided to serve as a holding tank between the mixer and the pump. The agitator shall be equipped with baffles to induce turbulence and rotating paddles to ensure thorough mixing of the grout before and during injection.
7. Piping, Injection Hoses, Ports, Valves and Connections: Concrete shall be conveyed to placement points using piping or rubber hoses, with all components having an internal diameter of at least 2 inches. Do not allow hardened grout or concrete to obstruct or coat pipe or hose internally. A system of valves shall be furnished in the line at or near the points of injection



to facilitate sample collection. Suitable stop valves shall be furnished at injection points for use in venting air or maintaining pressure, as required.

8. Provide certified oil-filled gauges scaled to not more than 150% of the maximum allowable pressure, accurate to within 0.5% over the full range of the gauge. Pressure gauges shall be certified and calibrated in accordance with ASME B40.1, Grade 2A. Pressure gauges shall be oil-filled type gauges attached to a saddle-type diaphragm seal (gauge saver) to prevent clogging with grout.

**B. Pressure Grouting for Primary Tunnel and Shaft Liner**

1. Perform grouting operations to fill voids outside of primary tunnel or shaft liner.
2. 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 shall prevent grout from spilling.
3. For nonexpendable primary liners installed by hand mining or in shafts, grout once every 4 feet but no later than the end of each, or more frequently when conditions dictate. Upon completion of each grouting operation, sound tunnel liner and immediately correct voids discovered by necessary means.
4. Use care in grouting operations to prevent damage to adjacent utilities or other properties. Keep grout pressure below value that may cause damage or distortion to installed tunnel liner or shaft liner. Control grout pressures so that tunnel or shaft liner is not overstressed, and ground heave is avoided.
5. For liner requiring grout, perform back grouting once each shift, or more often when required to ensure that all voids are filled.
6. Grout shall only be pumped to one hole at a time.
7. Grouting shall be performed in a progressive, methodical manner, moving from hole to hole, starting at one end of the tunnel and working to the other end. Grouting shall be from lower holes to higher holes as the case may be.
8. To the extent possible, air and groundwater shall be relieved through valved, open, and ungrouted holes downstream of the hole being grouted. Valved, open, and ungrouted holes shall not be closed until grout of the same consistency as that being injected issues forth.
9. Contractor shall remove grout valves and shall cap the grout ports after grout has reached initial set.

C. Annular Grouting for Water and Sewer Line in Tunnels and Augers

1. Methods employed shall completely fill the annular space between tunnel liner and carrier pipe with grout.
2. Placement
  - a. 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.
  - b. 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.
  - c. Pump grout until grout within 5 percent of specified density discharges from end opposite injection point, to ensure grout is not diluted by extraneous water in annulus.
  - d. For sewer line 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.
  - e. Use methods as required to avoid pipe flotation and damage to pipe. Complete each lift for a particular section of tunnel being grouted before starting the next lift. Lift heights shall be limited to avoid pipe flotation and to maintain cellular grout parameters within specified limits. There shall be no fewer than 2 lifts per annular grouting operation.
3. Remove temporary bulkheads installed for grouting.
4. Batch and mix cellular grout mechanically with a colloidal mixer at the project site to ensure consistency of mix. Wet solids thoroughly before introduction of foaming agent. Operate batching system to maintain slurry density with the requirements of Paragraph 3.05.B.3. Shear foam into slurry in accordance with manufacturer's recommendations.
5. Control ground water as necessary to permit completion of grouting without separation of grout materials.

D. Pressure Grouting for Jacked Sewer Pipe

1. 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.
2. 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.
3. Control ground water as necessary to permit completion of grouting without separation of grout materials.
4. Limit pressures to prevent damage or distortion to pipe or to keep flexible pipe within acceptable tolerances.
5. Pump grout until material discharging is similar in consistency to that at point of injection.

E. Ground Stabilization Grouting

1. Completely fill voids outside limits of excavation caused by caving or collapse of ground with sand-cement grout. Perform second grouting to fill soft spots or voids which may be detected, no later than 24 hours after initial grouting of tunnel liner.
2. Take care in grouting operations to prevent damage to adjacent utilities or public or private property. Grout at pressure that shall not distort or imperil portion of Work or existing installations or structures.
3. 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 demonstrate that void has been filled.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 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 Water and Sewer Line in Tunnels and Augers.
1. Make one set of four compressive test specimens for every 200 feet of pipe installed in primary lined tunnel.
  2. For 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.
  4. Measure and record the volume of grout placed. Compare actual volume placed for each length of tunnel being grouted with the theoretical volume for that length of tunnel being grouted. Collect samples of fresh cellular grout at the injection point or discharge point.
  5. Wet Density Test for Cellular Grout: Sample at the injection point every 30 minutes, after a change in the mix batched, and whenever compression test cylinders are made.
  6. Compression Tests: Take two sets of two cylinders for every 200 cubic yard batched, but no less than two sets per day, two sets per annulus between carrier pipe and tunnel liner grouted, or two sets per lift. Test two cylinders at 28 days and test the additional two cylinders at 56 days, if fly ash is used. For testing, cylinders shall be capped with plaster of Paris; sulfur caps are not permitted.
- 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.

3.06 – 3.10 NOT USED

END OF SECTION

Section 02441

MICROTUNNELING AND PIPE-JACKED TUNNELS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

- A. Tunnel construction of sewers by one-pass methods with or without man entry. Construction methods involve jacking pipe following hand-shield excavation or tunnel boring machine (TBM) or micro-tunnel boring machine (MTBM), with pipe serving as both tunnel liner during construction and sewer pipe after completion of construction.
- B. Select centrifugally-cast fiberglass pipe (FRP), vitrified clay pipe (VCP), reinforced concrete pipe (RCP) for storm or sanitary sewers. Use plastic-lined RCP for sanitary sewers. Unlined RCP or RCP lined with liner other than that specified in Section 02427 - Plastic Liner for Large-diameter Concrete Sewers and Structures will not be allowed for sanitary sewers.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Length of sewer installed will be measured by linear foot along center line of completed sewer from center line to center line of manholes, as designated on Drawings; and to end of stubs or termination of pipe; and to inside face of lift station and treatment plant works. Installation of sewer within limits of structure other than manholes will not be considered for measurement and payment at unit price bid.
  - 2. Payment will include and be full compensation for labor, equipment, materials, and supervision for construction of sewer and excavation, complete in place including disposal of excess materials, sheeting, shoring or bracing, dewatering, utility adjustments, connections to existing sewers, grouting when required, tests, backfilling, clean-up, and other related work necessary for construction as specified or as shown on Drawings.
  - 3. Payment for installation of sewer will be authorized by Project Manager in two parts. Pay estimates for partial payments will be made as measured above according to following schedule:
    - a. 95 percent payment will be made for jacked pipe installed but not yet grouted, in cases where grouting is specified.
    - b. 100 percent payment will be authorized on linear foot basis for amount of jacked sewer pipe installed, including grouting when specified.

4. Monitoring will be paid for at lump sum price for installations, observations, and reporting.

- 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. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.
- B. American Association of State Highway and Transportation Officials (AASHTO).
- C. Occupational Safety and Health Administration (OSHA).
- D. National Electrical Code - (NFPA 70).

#### 1.04 DEFINITION

- A. Jacked Pipe. Method for installing sewer pipe that serves as initial construction lining and tunnel support, installed for stability and safety during construction, and as sewer pipe. Pipe is shoved forward, or jacked, as tunnel is advanced.
- B. Microtunneling. Method of installing pipe by jacking pipe behind microtunnel boring machine which is connected to and shoved forward by pipe being installed, generally precluding man entry.
- C. Tunnel Boring Machine (TBM). Mechanized excavating equipment that is steerable, guided and articulated, connected to and shoved forward by pipe being installed, with man entry.
- D. Microtunnel Boring Machine (MTBM). Mechanized excavating equipment that is remotely-controlled, steerable, guided and articulated, connected to and shoved forward by pipe being installed, usually precluding man entry.
- E. Tunneling Methodology. Written description, together with supporting documentation that defines plans and procedures for microtunneling or pipe jacking operations.
- F. Zone of Active Excavation. Area located within radial distance about surface point immediately above face of excavation equal to depth to bottom of excavation.
- G. Critical Structure. Building, structure, bridge, pier, or similar construction partially or entirely located within zone of active excavation.

#### 1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Following submittals are required:

1. Tunneling Methodology. Brief description of proposed tunnel methodology. Description should be sufficient to convey following:
  - a. Proposed method of tunnel construction and type of face support.
  - b. Manufacturer and type of tunneling equipment proposed; type of lighting and ventilation systems.
  - c. Number and duration of shifts planned to be worked each day.
  - d. Sequence of operations,
  - e. Locations of access shafts and work sites.
  - f. Method of spoil transportation from face, surface storage, and disposal location.
  - g. Capacity of jacking equipment and type of cushioning.
  - h. Identify critical utility crossings and special precautions proposed.
2. Drawings and Calculations: Submit for record purposes, drawings and calculations for tunnel support system. Provide adequate drawings and installation details for construction. For pipe jacking and microtunneling, show pipe and pipe joint detail. Documents must be signed and sealed by Professional Engineer registered in State of Texas. Calculations shall include clear statement of criteria used for design as described in Paragraph 1.06, Design Criteria.
3. Quality Control: Submit for review brief description of quality control methods including:
  - a. Method and frequency of survey control.
  - b. Example of tunnel daily log.
4. Geotechnical Investigation: When geotechnical investigations are conducted, submit results to Project Manager for record purposes.
5. Monitoring Plans:
  - a. Instrumentation Monitoring Plan: Submit for review, prior to construction, monitoring plan that includes schedule of instrumentation design, layout of instrumentation points, equipment installation details, manufacturer's catalog literature, and monitoring report forms.
  - b. Surface Settlement Monitoring Plan. Submit settlement monitoring plan for review prior to construction. Identify on plan location of settlement

monitoring points, reference benchmarks, survey frequency and procedures, and reporting formats.

6. Structures Assessment. Provide preconstruction and postconstruction assessment reports for critical structures, namely those located within zone of active excavation from proposed tunnel centerline. Include photographs or video of existing damage to structures in vicinity of sewer alignment in assessment reports.
7. Readings of all monitoring shall be submitted to Project Manager.
8. Daily Reports: Maintain shift log as defined in Paragraph 3.04, Pipe-jacked Tunneling Data, and make available to Project Manager on request.

#### 1.06 DESIGN CRITERIA

- A. Assume responsibility for selection of appropriate pipe and pipe joints to carry thrust of any jacking forces or other construction loads in combination with overburden, earth and hydrostatic loads. Design of any pipe indicated on Drawings considers in-place loads only and does not take into account any construction loads. Criteria for longitudinal loading (jacking forces) on pipe and joints shall be determined, based on selected method of construction.
- B. Jacked pipe shall be designed to withstand thrust from MTBM, TBM or shield and pipe advance without damage or distortion. Propulsion jacks shall be configured so that thrust is uniformly distributed and will not damage or distort pipe.
- C. Take into account loads from handling and storing.
- D. Criteria to be used at railroad crossings shall be Cooper E-80 locomotive loading distributions in accordance with AREMA specifications for culverts. In design, account for additive loadings due to multiple tracks.
- E. Criteria to be used for truck loading shall be HS-20 vehicle loading distributions in accordance with AASHTO.
- F. Provide pipes of diameter shown on Drawings. Substitution of pipe with larger diameter to suit MTBM or TBM equipment availability will only be permitted if demonstrated to satisfaction of Project Manager that design flows and velocities can be achieved.

## PART 2 PRODUCTS

### 2.01 SEWER PIPE

- A. Assume responsibility for selecting appropriate pipes and pipe joints to safely carry loads imposed during construction, including jacking forces. Pipe joints shall be flush with outside pipe face when pipes are assembled. Pipe materials shall be selected from following:



- B. Centrifugally-cast fiberglass pipe, joints, and fittings to be in accordance with Section 02504 - Centrifugally-Cast Fiberglass Pipe.
- C. Vitrified clay pipe, joints, and fittings to be in accordance with Section 02508 - Extra Strength Clay Pipe.
- D. Plastic-lined reinforced concrete pipe with joints and fittings to be in accordance with Section 02611 - Reinforced Concrete Pipe and Section 02427 - Plastic Liner for Large-Diameter Concrete Sewers and Structures. Plastic liner is not required for storm sewers.
- E. Use pipe that is round with smooth, even outer surface, and has joints that allow for easy connections between pipes. Design pipe ends so that jacking loads are evenly distributed around entire pipe joint and such that point loads will not occur when pipe is installed. Pipe used for pipe jacking shall be capable of withstanding all forces that will be imposed by process of installation, as well as final in-place loading conditions. Protect driving ends of pipe and joints against damage.

### PART 3 EXECUTION

#### 3.01 CONSTRUCTION OPERATIONS CRITERIA

- A. Use methods for microtunneling and pipe-jacked tunneling operations that will minimize ground settlement. Select method which will control flow of water and prevent loss of soil into tunnel and provide stability of face under anticipated conditions.
- B. Conduct tunneling operations in accordance with applicable safety rules and regulations, OSHA standards and Contractor's safety plan. Use methods which include due regard for safety of workmen, adjacent structures, utilities, and public.
- C. Maintain clean working conditions wherever there is man access.
- D. For tunneling under railroad embankments, highways, or streets, perform installation so as to avoid interference with operation of railroads, highways, or streets, except as approved by owner of facility.

#### 3.02 GROUND WATER CONTROL

Provide ground water control measures in conformance with Section 01578 - Control of Ground Water and Surface Water, when necessary to perform Work.

#### 3.03 EQUIPMENT

- A. Full directional guidance of shield, TBM, or MTBM is prerequisite of this method of construction.

- B. Assume responsibility for selection of tunneling equipment which, based on past experience, has proven to be satisfactory for excavation of soils to be encountered.
- C. Employ tunneling equipment that will be capable of handling various anticipated ground conditions and is capable of minimizing loss of soil ahead of and around machine and shall provide satisfactory support of excavated face.
- D. Tunnel Boring Machine (TBM). A TBM used for pipe-jacking shall conform to shape of tunnel with uniform perimeter that is free of projections that could produce over- excavation or voids. Appropriately sized overcutting bead may be provided to facilitate steering. In addition it shall:
  - 1. Be capable of full face closure.
  - 2. Be equipped with appropriate seals to prevent loss of bentonite lubricant.
  - 3. Be capable of correcting roll by reverse drive or fins.
  - 4. Be designed to handle adverse ground conditions including ground water ingress.
  - 5. Be equipped with visual display to show operator actual position of TBM relative to design reference.
- E. Tunnel Shield. If hand shield is used for pipe-jacked tunneling (with or without attached mechanized excavating equipment), shield must be capable of handling various anticipated ground conditions. In addition, shield shall:
  - 1. Conform to shape of tunnel with uniform perimeter that is free of projections that could produce over-excavation or voids. Appropriately-sized overcutting bead may be provided to facilitate steering.
  - 2. Be designed to allow face of tunnel to be closed by use of gates or breasting boards without loss of ground.
- F. Microtunneling Equipment. In case of MTBM, use spoil transportation system which:
  - 1. Balances soil and ground water pressures by use of slurry or earth pressure balance system; system shall be capable of adjustments required to maintain face stability for particular soil condition and shall monitor and continuously balance soil and ground water pressure to prevent loss of slurry or uncontrolled soil and ground water inflow, or, in case of slurry spoil transportation system:
    - a. Provides pressure at excavation face by use of slurry pumps, pressure control valves, and flow meter.
    - b. Includes slurry bypass unit in system to allow direction of flow to be changed and isolated, as necessary.

- c. Includes separation process. Design it to provide adequate separation of spoil from slurry so that slurry with sediment content within limits required for successful tunneling can be returned to cutting face for reuse. Appropriately contain spoil at site prior to disposal.
  - d. Uses type of separation process suited to size of tunnel being constructed, soil type being excavated, and work space available at each work area for operating plant.
  - e. Allows composition of slurry to be monitored to maintain slurry weight and viscosity limits required.
2. In case of cased auger earth pressure balance system, system shall be capable of adjustments required to maintain face stability for particular soil condition to be encountered. Monitor and continuously balance soil and ground water pressure to prevent loss of soil or uncontrolled ground water inflow.

In cased auger spoil transportation system, manage pressure at excavation face by controlling volume of spoil removal with respect to advance rate. Monitor speed of rotation of auger flight, and addition of water.

3. Remote Control System. Provide MTBM which includes remote control system with following features:
- a. Allows for operation of system without need for personnel to enter tunnel. Has display available to operator, at remote operation console, showing position of shield in relation to design reference together with other information such as face pressure, roll, pitch, steering attitude, valve positions, thrust force, and cutter head torque; rate of advance and installed length.
  - b. Integrates system of excavation and removal of spoil and its simultaneous replacement by pipe. As each pipe section is jacked forward, control system shall synchronize all of operational functions of system.
4. Active Direction Control. Provide MTBM which includes active direction control system with following features:
- a. Controls line and grade by guidance system that relates actual position of MTBM to design reference (e.g., by laser beam transmitted from jacking shaft along pipe to target mounted in shield).
  - b. Provides active steering information which shall be monitored and transmitted to operating console.
  - c. Provides positioning and operation information to operator on control console.
5. Use generator which is suitably insulated for noise ("hospital" type) in residential or commercial areas.

- G. Pipe Jacking Equipment. Provide pipe jacking system with following features:
1. Has main jacks mounted in jacking frame located in starting shaft.
  2. Has jacking frame which successively pushes string of connected pipes following tunneling excavation equipment towards receiving shaft.
  3. Has sufficient jacking capacity to push tunneling excavation equipment and string of pipe through ground. Incorporates intermediate jacking stations, if required.
  4. Has capacity at least 20 percent greater than calculated maximum jacking load.
  5. Develops uniform distribution of jacking forces on end of pipe by use of spreader rings and packing, measured by operating gauges.
  6. Provides and maintains pipe lubrication system at all times to lower friction developed on surface of pipe during jacking.
  7. Jack Thrust Reactions. Use reactions for pipe jacking that are adequate to support jacking pressure developed by main jacking system. Special care shall be taken when setting pipe guide rails in jacking shaft to ensure correctness of alignment, grade, and stability.
- H. Air Quality. Provide equipment to maintain proper air quality of manned tunnel operations during construction in accordance with OSHA requirements.
- I. Enclose lighting fixtures in watertight enclosures with suitable guards. Provide separate circuits for lighting, and other equipment.
- J. Electrical systems shall conform to requirements of National Electrical Code - NFPA70.

#### 3.04 PIPE-JACKED TUNNELING DATA

Maintain shift logs of construction events and observations. Project Manager shall have access to all logs with regard to following information:

1. Location of boring machine face or shield by station and progress of tunnel drive during shift.
2. Hours worked per shift on tunneling operations.
3. Completed field forms, such as steering control logs, for checking line and grade of tunneling operation, showing achieved tolerance relative to design alignment.
4. Maximum pipe jacking pressures per drive.
5. Location, elevation, and brief soil descriptions of soil strata.

6. Ground water control operations and piezometric levels.
7. Observation of any lost ground or other ground movement.
8. Any unusual conditions or events.
9. Reasons for operational shutdown in event drive is halted.

### 3.05 EXCAVATION AND JACKING OF PIPE

#### A. Tunnel Excavation.

1. Keep tunnel excavation within easements and rights-of-way indicated on Drawings and to lines and grades designated on Drawings.
2. Perform tunneling operations in manner that will minimize movement of ground in front of and surrounding tunnel. Prevent damage to structures and utilities above and in vicinity of tunneling operations.
3. Open-face excavations:
  - a. Keep face breasted or otherwise supported and prevent falls, excessive raveling, or erosion. Maintain standby face supports for immediate use when needed.
  - b. During shut-down periods, support face of excavation by positive means; no support shall rely solely on hydraulic pressure.
4. Closed-face excavation:
  - a. Carefully control volume of spoil removed. Advance rate and excavation rate to be compatible to avoid over excavation or loss of ground.
  - b. When cutting head is withdrawn or is open for any purpose, keep excavated face supported and stabilized.
5. Excavated diameter should be minimum size to permit pipe installation by jacking with allowance for bentonite injection into annular space.
6. Whenever there is condition encountered which could endanger tunnel excavation or adjacent structures, operate without intermission including 24-hour working, weekends and holidays, until condition no longer exists.
7. Assume responsibility for damage due to settlement from any construction-induced activities.

B. Pipe Jacking

1. Cushion pipe joints as necessary to transmit jacking forces without damage to pipe or pipe joints.
2. Maintain envelope of bentonite slurry around exterior of pipe during jacking and excavation operation to reduce exterior friction and possibility of pipe seizing in place.
3. If pipe seizes up in place and elect to construct recovery access shaft, obtain approval from Project Manager. Coordinate traffic control measures and utility adjustments as necessary prior to commencing work.
4. In event section of pipe is damaged during jacking operation, or joint failure occurs, as evidenced by inspection, visible ground water inflow or other observations, submit for approval his methods for repair or replacement of pipe.

C. Grouting. Grouting requirements are defined in Section 02431 - Tunnel Grout.

3.06 CONTROL OF LINE AND GRADE

A. Construction Control.

1. Project Manager will establish baselines and benchmarks indicated on Drawings. Check baselines and benchmarks at beginning of Work and report any errors or discrepancies to Project Manager.
2. Use baselines and benchmarks established by Project Manager to establish and maintain construction control points, reference lines and grades for locating tunnel, sewer pipe, and structures.
3. Establish construction control points sufficiently far from work so as not to be affected by ground movement caused by pipe-jacked tunneling operations.

B. Bench Mark Movement. Ensure that if settlement of ground surface occurs during construction which affects accuracy of temporary benchmarks detect and report such movement and reestablish temporary bench marks. Locations of permanent monumentation benchmarks are indicated on Drawings. Advise Project Manager of any settlement affecting permanent monumentation benchmarks.

C. Line and Grade.

1. Check and record survey control for tunnel against above-ground undisturbed reference at least once for each 250 feet of tunnel constructed.
2. Record exact position of MTBM or TBM or shield after each shove to ensure alignment is within specified tolerances. Make immediate correction to alignment before allowable tolerances are exceeded.

3. When excavation is off line or grade, make alignment corrections to avoid reverse grades in gravity sewers.
4. Acceptance criteria for sewer pipe shall be plus or minus 6 inches in horizontal alignment from theoretical at any point between manholes, including receiving end, and plus or minus 1½ inches in elevation from theoretical.
5. Pipe installed outside tolerances and subsequently abandoned shall first be fully grouted.

### 3.07 MONITORING

- A. Instrumentation Monitoring. Instrumentation requirements are shown on Drawings. Instrumentation specified shall be accessible at all times to Project Manager. Readings shall be submitted promptly to Project Manager.
  1. Install and maintain instrumentation system to monitor and detect movement of ground surface and adjacent structures. Establish vertical control points at distance from construction areas that avoids disturbance due to ground settlement.
  2. Installation of instrumentation shall not preclude Project Manager, through independent contractor or consultant, from installing instrumentation in, on, near, or adjacent to construction work. Access shall be provided to work for such independent installations.
  3. Instruments shall be installed in accordance with Drawings and manufacturer's recommendations.
- B. Surface Settlement Monitoring
  1. Establish monitoring points on all critical structures.
  2. Record location of settlement monitoring points with respect to construction baselines and elevations. Record elevations to accuracy of 0.01 feet for each monitoring point location. Monitoring points should be established at locations and by methods that protect them from damage by construction operations, tampering, or other external influences.
  3. Ground surface elevations shall be recorded on centerline ahead of tunneling operations at minimum of 100-foot intervals or at least three locations per tunnel drive. For sewers greater than 60-inch diameter, also record similar data at approximately 20 feet each side of centerline. Settlement monitoring points must be clearly marked by studs or paint for ease of locating.
  4. Railroads. Monitor ground settlement of track subbase at centerline of each track.

5. Utilities and Pipelines. Monitor ground settlement directly above and 10 feet before and after utility or pipeline intersection.

C. Reading Frequency and Reporting. Submit to Project Manager, records of readings from various instruments and survey points.

1. Instrumentation monitoring results to be read at frequency specified and unless otherwise specified, shall be started prior to zone of active excavation reaching that point, and shall be continued until zone of active excavation has passed and until no further detectable movement occurs.
2. Surface settlement monitoring readings shall be taken:
  - a. Prior to zone of active excavation reaching that point,
  - b. When tunnel face reaches monitoring point (in plan), and
  - c. When zone of active excavation has passed and no further movement is detected.
3. All monitoring readings shall be submitted promptly to Project Manager.
4. Immediately report to Project Manager any movement, cracking, or settlement which is detected.
5. Following substantial completion but prior to final completion, make final survey of all monitoring points.

3.08 DISPOSAL OF EXCESS MATERIAL

Remove spoil in accordance with Section 01576 - Waste Material Disposal.

3.09 ACCEPTANCE TESTING

Acceptance testing is to be carried out by methods described in Section 02533 - Acceptance Testing for Sanitary Sewer.

END OF SECTION



Section 02447

DRY AND SLURRY AUGERING OF PIPE AND CONDUIT

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Installing water service pipe by methods of augering or casing by jacking and boring.
- B. Installing Telecommunication Conduit along or under Public Ways.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. No separate payment will be made for augering pipe for water lines under this Section. Include payment in unit price for Section 02511 – “Water Lines”.
  - 2. When open-cut construction is requested by Contractor for his convenience in areas designated for augering, and when approved in advance by Program Manager, such areas shall be paid for at Unit Price for Section 02511 – “Water Lines”.
  - 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.

1.03 REFERENCES

- A. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- B. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
- C. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- D. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.04 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”

- C. Section 01555 – “Traffic Control and Regulation”
- D. Section 01576 – “Waste Material Disposal”
- E. Section 01578 – “Control of Ground Water and Surface Water”
- F. Section 02233 – “Clearing and Grubbing”
- G. Section 02260 – “Trench Safety Systems”
- H. Section 02317 – “Excavation and Backfill for Utilities”
- I. Section 02425 – “Tunnel Excavation and Primary Liner”
- J. Section 02431 – “Tunnel Grout”
- K. Section 02502 – “Steel Pipe and Fittings”
- L. Section 02511 – “Water Lines”
- M. Section 02517 – “Waterline in Tunnels”
- N. Regulatory Requirements
  - 1. Conform to TxDOT requirements for installations under State Highways. Engineer will obtain required permits for State Highway crossings.
  - 2. Installations Under Railroads:
    - a. 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.
    - b. Use auger method only.
    - c. Damages due to delays caused by railroad requesting work to be done at hours which will not inconvenience railroad will be at no additional cost.
    - d. Maintain equipment and excavations minimum 35-foot clearance from centerline of tracks.

#### 1.05 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit product data for casings, insulators / casing spacers, spacing of insulators / casing spacers for specific pipe and location on project.

- C. Prior to installation of pits, submit for Program Manager's approval, pit locations, size, depth, and areas for storage, material, and spoil handling. Acceptance of Project Manager does not relieve Contractor from responsibility to obtain specified results.
- D. Show actual pit locations dimensioned on as-built drawings so that they can be identified in field.
- E. Submit copy of executed railroad company rights of entry to Program Manager.
- F. Provide cutting head size to be used in conjunction with slurry augers.

1.06 – 1.09 NOT USED

1.10 DEFINITIONS

- A. Auger Methods:
  - 1. Dry Auger Method: Installation of steel casing by excavating soil at advancing end of casing and transporting spoil through casing by otherwise uncased auger, while advancing casing by jacking at same rate as auger excavation progresses.
  - 2. Slurry Auger Method: Installation of steel casing or carrier pipe by first drilling small diameter pilot hole from pit to pit, followed by removing excess soil and installing casing or pipe by pull-back or jacking method.
  - 3. Annular Space: space between carrier pipe and primary tunnel liner, casing, or ground.

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Criteria for Selection of Material

Contractor shall be responsible for selection of casing, pipe, and pipe joints to carry anticipated thrust of jacks or loads.
- B. Piping and Fittings: As required by Specification or Plans.
- C. Casings: Provide steel casing in accordance with Section 02502 – “Steel Pipe and Fittings”. The size of casing shall be based on the minimum clearance between the carrier pipe and the casing as defined in Section 02425 – “Tunnel Excavation and Primary Liner”, Paragraph 2.01.B. Additionally, the sizing of casings shall exceed the O.D. of any external joint restraints. Provide casing with smooth, continuous interior surface.

- D. Casing Spacer Dimensional Requirements: Provide casing spacer width 8 inches for pipe sizes up to and including 12 inches; 12 inches for pipe sizes larger than 12 inches. Wood skids or concrete “donuts” are not acceptable. Maximum pipe diameter for use of spacers is 30 inches. Additionally, the sizing of casing spacers shall exceed the O.D. of any external joint restraints.
1. For pipe materials 12 inches and smaller, use Advance Products & Systems, Inc. Model SI8-2, Pipeline Seal & Insulator Model C8G-2 or approved equal.
  2. For pipe materials above 12 inches, use Advance Products & Systems, Inc. Model SI12-2, Pipeline Seal & Insulator Model C12G-2 or approved equal.
- E. Casing Spacer Material Requirements: Bolt-on style with shell made of two sections of 14-gauge carbon steel, hot rolled, cleaned, and lined with PVC liner, 0.090 inch thick with Durometer A 85-90 overlapping edges to secure liner to spacer; deep embossed flanges for added strength; coated prior to installation of liner and runner with fusion-bonded PVC powder of 14 to 20 mils thickness; electroplated studs, nuts, and washers.
1. Runners: Supported by 10-gauge carbon steel MIG risers welded to shell. Total length of weld beads shall be at least 50 percent of the length of the runner. Fill bolt holes with caulk or approved equal to provide a water-tight seal. Minimum requirements: Glass reinforced plastic conforming to the following tests:
    - a. Tensile Strength: ASTM D 638; 17,600 psi
    - b. Flexural Strength: ASTM D 790; 25,300 psi
    - c. Compression Strength: ASTM D 695; 18,000 psi
    - d. Deflection Temperature at 264 psi: ASTM D 648; 405 F
    - e. Polyethylene runners are not acceptable.
- F. Casing End Seals: Provide Advance Products & Systems, Inc. Model AC, Pipeline Seal and Insulator Model C, or approved equal.
- G. Annular Grout:
1. Material: Low density (cellular) grout or sand-cement mortar mix.
  2. Provide annular grout in accordance with Section 02431 – “Tunnel Grout”.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Conform to applicable provisions of Section 02233 – “Clearing and Grubbing”.
- B. Utility Relocations: Relocate utility lines clear of pit and zone of potential significant settlement or other ground disturbance.
- C. Install casings as required by Plans, in accordance with this Section.
- D. Install temporary solid plug at open end of water line to prevent contamination.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Limits on Auger Length Without Steel

- 1. Do not exceed the lengths for auger holes in Table 1 when augering without steel casing between pits. See Paragraph 3.03.A.2 for restrictions.

Table 1  
Acceptable Lengths for Auger Holes Without Steel Casing

Pipe Diameter	Max Length (LF)
Less than or equal to 8-inches	125
12-inches	100
16 to 20-inches	80
24 to 30-inches	60

- 2. If groundwater is encountered in the auger hole and the dewatering system is not able to dry up the subsurface to provide stable conditions, the lengths above should be reduced based on the field conditions as agreed to by the Project Manager. Reduced auger hole lengths shall be at least 25% of the above listed maximum length.

B. Traffic Control

- 1. Conform to applicable provisions of Section 01555 – “Traffic Control and Regulation”.
- 2. Secure right-of-entry for crossing Railroad Company's easement or right-of-way.
- 3. 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. Provide additional barricades and lights as directed by Project Manager.

**C. Pits**

1. Locate auger pits where there is minimum interference with traffic or access to property. Avoid locating pits close to storm drainage channels, ditches, storm water lines, or culverts, or near potentially contaminated areas.
2. Pit Size: Size pits to provide adequate room to meet operational requirements for auger construction as well as structures indicated on Plans. Provide minimum 6-inch space between casing or pipe and walls of bore pit. Maximum allowable width of pit shall be no greater than 5 feet outside of the casing or pipe. Width of pit at surface shall not be less than at bottom.
3. Excavate bore pits to a finished grade of at least 6 inches lower than grade indicated by stakes.
4. Backfill in accordance with Section 02317 – “Excavation and Backfill for Utilities”.
5. Auger pits that are excavated and backfilled as part of open-cut water line construction shall be in accordance with Section 02317 – “Excavation and Backfill for Utilities”.
6. Provide and properly maintain safety protection against traffic, and accidental or unauthorized entry. Provisions shall include concrete traffic barriers or other suitable barrier around periphery of pit as appropriate.
7. Fully cover and secure pits with steel plates where no construction activity is in progress.
8. Install sheeting, lining, shoring, and bracing required for protection of workmen and public in accordance with Section 02260 – “Trench Safety Systems”.
9. 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 of Ground Water and Surface Water”.

**D. Slurry Augering**

1. Auger from approved pit locations. Excavate for pits and install shoring as outlined above under Paragraph 3.03.C, Pits. Auger mechanically with use of pilot hole entire length of crossing and check for line and grade. Diameter of auger hole not to exceed pipe bell diameter plus 2 inches. Place excavated material outside working pit and dispose of as specified. Use water or other

fluids in connection with boring operation only to lubricate cuttings; jetting is not permitted.

2. In unconsolidated soil formations, gel-forming colloidal drilling fluid may be used. Fluid is to consist of at least 10 percent of high-grade processed bentonite and shall consolidate cuttings of bit, seal walls of hole, and shall furnish lubrication for subsequent removal of cuttings and installation of pipe.
3. Depending on character of soil encountered during augering operation, conduct operations without interruption, insofar as practical, to prevent hole from collapsing or pipe from seizing up in hole before installation is complete.
4. Cover the open end of pipe before inserting into the auger hole.
5. Allowable variation from line and grade shall be as specified under Paragraph 3.03.G, Jacking.
6. Remove and replace pipe damaged in augering operations.

E. Dry Augering of Steel Casing

1. Provide jacks, mounted on frame or against backstop, of capacity suitable for forcing excavating auger and casing through soil conditions to be encountered. Operate jacks so that even pressure is applied to casing.
2. Provide steerable front section of casing to allow vertical grade adjustments. Provide water level or other means to allow monitoring of grade elevation of auger casing.
3. Bentonite slurry may be used to lubricate casing during installation. Use of water to facilitate removal of spoil and to lubricate exterior casing is permitted; however, water jetting for excavation of soil is not allowed when jacking casing.
4. The annular space of dry augers shall be grouted when necessary in accordance with Sections 02431 – “Tunnel Grout” and 02517 – “Waterline in Tunnels”.

F. Filling Annular Space When Using Slurry Auger Method

1. For pipe diameters up to 16 inches, for installation of water line, block void space around pipe in augered hole with approximately 12 inches of packed clay or approved equal material to prevent bedding or backfill from entering void around pipe in augered hole when compacted. For pipe diameters 4 inches through 8 inches use minimum ½-cubic-foot clay; for pipe diameters 12 inches through 16 inches use minimum ¾-cubic-foot clay.
2. When diameter of auger hole exceeds diameter of bell by more than 2-inches, grout the annular space between the pipe and the excavated hole.

3. For pipe diameter greater than or equal to 20 inches, grout the annular space between pipe and excavated hole.
4. Refer to the Material Applications for Tunnel & Auger Construction table under Paragraph 3.03.K.

**G. Jacking**

1. Comply with Section 02260 – “Trench Safety Systems” for all pits, end trenches, and other excavations relating to Work required by specifications. Dewater as required to provide safe working conditions.
2. Wherever end trenches are cut into sides of embankment or beyond it, sheath securely and brace such work to prevent earth caving.
3. Make up only one joint at time in pit or trench prior to jacking.
4. Do not interfere with operation of railroad, street, highway, or other facility, nor to weaken or damage embankment or structure.
5. Use heavy-duty jacks sized for forcing casing through embankment. Use appropriate jacking head, usually of timber, and bracing between jacks and jacking head and jacking frame or backstop. Apply jacking pressure uniformly around ring of casing. Set casing to be jacked on guides, properly braced together, to support section of casing and to direct it in proper line and grade. Place jacking assembly in line with direction and grade of casing. Excavate embankment material just ahead of casing and remove material through casing. Force casing through embankment with jacks into excavated auger hole.
6. Conform excavation for underside of casing to contour and grade of casing, for at least one third of circumference of casing. Provide clearance of not more than 2 inches for upper half of casing. Taper off upper clearance to zero at point where excavation conforms to contour of casing.
7. Excavation may extend beyond end of casing depending on character of material, but shall not exceed 2 feet. Decrease advance excavation at direction of Program Manager, when character of material being excavated makes it desirable to keep advance excavation closer to end of casing.
8. Jack casing from low or downstream end. Lateral or vertical variation in final position of casing from line and grade as shown on Plans will be permitted only to extent of 1 inch in 10 feet, provided such variation is regular and only in one direction and that final grade of flow line is in direction indicated on Plans.



9. 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.
10. Once jacking of casing is begun, carry on without interruption, insofar as practicable, to prevent casing from becoming firmly set in embankment.
11. Remove and replace casing damaged in jacking operations.
12. Backfill pits or trenches excavated to facilitate jacking operations immediately after completion of jacking of casing.
13. Grout annular space between casing and excavated hole when loss of embankment occurs or when clearance of 2 inches is exceeded.

H. Spacer Installation

1. There must be no inadvertent metallic contact between casing and carrier pipe. Place spacers to ensure that carrier pipe is adequately supported throughout length, particularly at ends, to offset settling, and possible electrical shorting. Place end spacer within 6 inches of end of casing pipe, regardless of size of casing and carrier pipe or type of spacer used. Spacing between spacers depends largely on load bearing capabilities of pipe coating and flexibility of pipe.
2. Grade bottom of trench adjacent to each end of casing to provide firm, uniform, and continuous support for carrier pipe. When trench requires some backfill to establish final trench bottom grade, place backfill material in 6-inch lifts and compact to density of undisturbed soil.
3. Install casing spacers in accordance with manufacturer's instructions. Take special care to ensure that sub-components are correctly assembled and evenly tightened, and that no damage occurs during tightening of insulators or carrier pipe insertion.
4. Seal annulus between carrier pipe and casing with casing end seals at each end of casing.
5. Insulator Spacing:
  - a. Spacing shall be as shown on Plans with maximum distance between spacers to be 10 feet for pipe sizes 4 to 14 inches and 8 feet for pipe sizes 16 to 30 inches.
  - b. For ductile iron pipe or bell-and-spigot pipe, install spacers within one foot on each side of bell or flange and one in center of joint when 18- to 20-foot-long joints are used.

- c. If casing or carrier pipe is angled, bent, or dented, reduce spacer runner as directed by Project Manager.

**I. Settlement Monitoring**

- 1. Monitor ground surface elevation along length of augering operation. Locate and record settlement monitoring points with respect to construction baseline and elevations. Ground surface elevations shall be monitored in at least three locations per auger drive with a maximum spacing not to exceed 100-feet. Establish monitoring points on all critical structures. Monitoring points should be established at locations and by methods that protect them from damage by construction operations, tampering, or other external influences. Record elevations to accuracy of 0.01 feet for each monitoring point location.
  - a. Railroads: Monitor ground settlement of track subbase at centerline of each track.
  - b. Utilities and pipelines: Monitor ground settlement directly above and 10 feet before and after utility or pipeline intersection
- 2. Reading Frequency and Reporting. Submit to Project Manager records of readings from various instruments and survey points. Take settlement survey readings:
  - a. Prior to auger excavation reaching point
  - b. After auger reaches monitoring point in plan
  - c. After grouting of ground supporting casing is complete
- 3. Immediately report to Project Manager movement, cracking, or settlement which is detected.
- 4. Following substantial completion but prior to final completion, make final survey of monitoring points and submit to Project Manager records of readings.

**J. Disposal of Excess Material**

Conform to applicable provisions of Section 01576 – “Waste Material Disposal”.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 02465

**DRILLED SHAFT FOUNDATIONS****PART 1 GENERAL****1.01 SUMMARY**

This Section includes construction of foundations consisting of reinforced concrete drilled shafts.

**1.02 MEASUREMENT AND PAYMENT****A. Unit Prices.**

1. No separate payment will be made for drilled shaft foundations under this Section. Include cost in lump sum payment for structure requiring drilled shaft foundations.
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 REFERENCES**

- A. ACI 336.1 - Standard Specification for the Construction of Drilled Piers
- B. TxDOT Standard Specification Item 416 - Drilled Shaft Foundations

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit work plan for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to drilled shaft activities. Descriptions, with supporting illustrations, shall be sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Plans.
- C. Submit project record documents under provisions of Section 01785 – “Project Record Documents”. Record locations of drilled shafts, as installed referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts, and gradients.

**1.05 RELATED REQUIREMENTS**

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 01504 – “Temporary Facilities and Controls”
- E. Section 01576 – “Waste Material Disposal”
- F. Section 01785 – “Project Record Documents”
- G. Section 03210 – “Reinforcing Steel”
- H. Section 03315 – “Concrete for Utility Construction”

1.06 – 1.13 NOT USED

**PART 2 PRODUCTS****2.01 MANUFACTURER(S) (NOT USED)****2.02 MATERIALS AND/OR EQUIPMENT****A. EQUIPMENT**

Perform excavation with equipment suitable for achieving requirements of this Specification.

**B. MATERIAL**

- 1. For cast-in-place concrete, use Class A concrete. Refer to Section 03315 – “Concrete for Utility Construction”.
- 2. For reinforcing steel, refer to Section 03210 – “Reinforcing Steel”.

2.03 – 2.04 NOT USED

**PART 3 EXECUTION****3.01 GENERAL / MANUFACTURER(S) (NOT USED)****3.02 PREPARATION**

Conduct an inspection to determine condition and locations of existing structures and other permanent installations, prior to commencing Work.

**3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION****A. EXCAVATION**

1. Perform excavation required for drilled cylindrical shafts, at locations shown on Plans through whatever materials encountered, to dimensions and elevations shown or required by site conditions. When satisfactory material is not encountered at plan depth, bottom of shaft will be adjusted or foundation altered, as determined by Project Manager, to satisfactorily comply with design requirements.
2. Do not make shaft excavations within 3 shaft diameters (edge to edge) of shafts which have been concreted within previous 24 hours.
3. Inspect drilled shaft excavations for verticality and side sloughing. Verticality is specified at one inch in 10 feet of shaft length. Check to full depth of dry auguring prior to introducing drilling mud. Straighten or add suitable reinforcing steel to shafts not meeting specified tolerance.
4. Slurry is to contain 4 to 8 percent by weight of bentonite additive and satisfy slurry specifications set forth in ACI 336.1, Section 2.3.5.2e. These requirements are more stringent than TxDOT Standard Specification Item 416.3.1. Stricter slurry specifications are required to assure suspension of detritus from drilling operations, and to ensure adequate cleaning of slurry prior to concreting. Cleaning of slurry is important to prevent deposition of detritus on reinforcement cages and ensure that inclusions of detritus will not be formed within concrete mass.
5. At final bearing elevation, clean bottom of each shaft and remove seepage water for examination by Project Manager before reinforcing steel and concrete is placed. Suitable access and lighting for proper inspection of completed excavation is to be provided. Reinforcing steel and concrete is to be placed in drilled shaft without delay after approval of excavation by Project Manager.

**B. DRILLED SHAFT CONSTRUCTION**

1. Drilled shaft construction and installation is to follow TxDOT Standard Specification Item 416 (with exceptions noted below) and ACI 336.1.
2. Before placing concrete, clean out shaft bottom with drilling bucket in order to remove sediments which may not be displaced by concrete. Clean shaft bottom with "clean-out" bucket until rotation on bottom without crowd (i.e., penetration under force) produces little spoil. Probing after cleaning out is essential to verify condition of base of shaft.
3. Concrete is to conform to requirements of ACI 336.1 Section 2.3.5.5.

4. Concrete is to be placed continuously in shaft to construction joint indicated on Plans or as directed in TxDOT Standard Specification Item 416.3.3. Concrete is to be placed through suitable tube or tremie to prevent segregation of materials. Tremie pipe diameter is to be at least 8 times as large as largest concrete aggregate size.
5. Computation of final concrete volume for each shaft is to be made. Core and check the integrity of shafts taking an unreasonably high or low volume of concrete.
6. If caving soil conditions or excessive groundwater is encountered, use of temporary casing is permitted to prevent caving of material around shaft and to control seepage of groundwater into excavation.
7. Casing material is to be metal of ample strength to withstand handling stresses, pressure of concrete and of surrounding earth or backfill materials and is to be water-tight. Casing shall be smooth, clean, and free of accumulations of hardened concrete. Outside diameter of casing is not to be less than specified diameter of drilled shaft.
8. Elapsed time is not to exceed one hour from beginning of concrete placement in cased portion of shaft, until extraction of casing is begun.
9. Withdraw temporary casings as shaft is filled with concrete, or immediately following concreting operation. Bottom of casing is to always remain at least one foot below level of concrete during placement to overcome hydrostatic pressure. Smoothly extract casing with vibratory hammer. Casing extraction is to be at slow, uniform rate with pull in line with vertical axis of shaft. Leave no casing in place.
10. If upward movement of concrete or reinforcing steel occurs inside casing at beginning of pulling operation or at anytime during pulling, stop pulling immediately and leave casing in place.
11. If casing must be left in place, Project Manager is to be informed to determine shaft capacity calculations.

C. Disposal of Excess Material

Dispose of excess materials in accordance with requirements of Section 01504 – “Temporary Facilities and Control” or Section 01576 – “Waste Material Disposal”.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.

3.06 – 3.10 NOT USED

END OF SECTION

Section 02501

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SUMMARY

This Section includes ductile iron pipe and fittings for water lines, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for ductile iron pipe and fittings under this Section, with the exception of extra fittings in place. Include cost in unit prices for Work as specified in the following Sections, as applicable:
  - a. Section 02511 – “Water Lines”
  - b. Section 02531 – “Gravity Sanitary Sewers”
2. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

B. Extra ductile iron compact fittings in place shall be for additional fittings required to complete job. This is not to exclude extension of pipe across driveway or intersection for purpose of terminating line in more advantageous position. This determination shall be at discretion of Project Manager. This bid item includes additional fittings as may be necessary to complete job in conformance with intent of Plans. Payment for Extra Ductile Iron Compact Fittings in Place will be on a per ton basis.

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total stipulated price.

1.03 REFERENCES

- A. ANSI/AWS D11.2 – Guide for Welding Iron Castings
- B. ANSI A21.4 (AWWA C 104) – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
- C. ANSI A21.10 (AWWA C 110) – Standard for Ductile-Iron and Gray-Iron Fittings.
- D. ANSI A21.11 (AWWA C 111) – Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.



- E. ANSI A21.15 (AWWA C 115) – Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
  - F. ANSI A21.16 (AWWA C 116) – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
  - G. ANSI A21.50 (AWWA C 150) – Standard for Thickness Design of Ductile-Iron Pipe.
  - H. ANSI A21.51 (AWWA C 151) – Standard for Ductile-Iron Pipe, Centrifugally Cast.
  - I. ANSI A21.53 (AWWA C 153) – Standard for Ductile-Iron Compact Fittings.
  - J. ASME B 16.1 – Gray Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, and 250.
  - K. ASTM D 1248 – Standard Specification Polyethylene Plastics Extrusion Materials for Wire and Cable.
  - L. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  - M. ASTM G 62 – Standard Test Methods for Holiday Detection in Pipeline Coatings.
  - N. AWWA C 105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - O. AWWA C 300 – Reinforced Concrete Pressure Pipe, Steel-Cylinder Type.
  - P. AWWA C 600 – Standard for Installation of Ductile-Iron Mains and Their Appurtenances.
  - Q. SSPC-SP 6 – Steel Structures Painting Council, Commercial Blast Cleaning.
  - R. American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering.
  - S. American Association of State Highway Transportation Officials (AASHTO).
- 1.04 SUBMITTALS
- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
  - B. For pipes 30 inches and greater submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing the following:
    - 1. Manufacturer’s pipe design calculations.
    - 2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fittings, flange, and special details, with plan view of each pipe

segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Plans. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (\*.PDF). Provide As-Built lay schedule if any changes are made during construction.

3. Calculations and limits of thrust restraint.
  4. Class and length of joint.
  - C. Submit critical locate report meeting the requirements of Section 02317- "Excavation and Backfill for Utilities".
  - D. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A21.51.
  - E. Submit certifications that pipe joints have been tested and meet requirements of ANSI A21.11.
  - F. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.
  - G. Submit pipe coatings and lining material certifications.
  - H. Submit polyethylene encasement material in accordance with Section 02528 – "Polyethylene Wrap".
- 1.05 RELATED REQUIREMENTS
- A. Section 01270 – "Measurement and Payment"
  - B. Section 01330 – "Submittal Procedures"
  - C. Section 01782 – "Operations and Maintenance Data"
  - D. Section 02317 – "Excavation and Backfill for Utilities"
  - E. Section 02511 – "Water Lines"
  - F. Section 02515 – "Hydrostatic Testing of Pipelines"
  - G. Section 02528 – "Polyethylene Wrap"
  - H. Section 02531 – "Gravity Sanitary Sewers"
  - I. Section 09901 – "Painting and Protective Coating"

J. Section 15155 – “Couplings and Coupling Adapters”

K. Section 16640 – “Cathodic Protection for Pipelines”

1.06 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Ductile Iron Pipe

1. Ductile Iron Pipe Barrels: Shall conform to AWWA C115, C150, and C151 and bear mark of Underwriters’ Laboratories approval. Unless otherwise shown on Plans, provide a class of pipe that shall exceed the designed thickness calculations using the conditions listed in Paragraph 2.01.E and meet the following minimum classifications:
  - a. Pressure Class 250 for water lines in open cut.
  - b. Pressure Class 300 for water lines in casing or augered hole.
  - c. Pressure Class 300 for sanitary sewers.
  - d. Pressure Class 350 for flanged pipe.
2. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.
3. Provide Cathodic Protection System for pipelines larger than 24 inches in accordance with Section 16640 – “Cathodic Protection for Pipelines” and as shown on Plans. For pipelines 24 inches and smaller, furnish ductile iron pipe meeting the following criteria:
  - a. Provide minimum Pressure Class 300.
  - b. For augered sections or sections installed inside a casing, provide coating and encasement requirements per paragraph 2.05.
  - c. Adhere to other requirements specified herein (e.g., insulation kits, etc.).
4. For all ductile iron pipelines whether or not cathodically protected, provide polyethylene encasement material and installation in accordance with AWWA C105, and backfill as specified. Minimum of two complete wraps of 8-mil-thick polyethylene.

5. For use of pressure class pipe for water lines, design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Plans. Design pipes with Marston's earth loads for a transition width trench for zero to 16 feet of cover. Use Marston's earth loads for a trench width of O.D. (of pipe) + 4 feet for pipe greater than 16 feet of cover. Use Marston's equations for a trench condition in both open-cut and tunnel applications. Design for most critical groundwater level condition. Pipe design conditions:
  - a. Working pressure = 100 psi.
  - b. Hydrostatic field test pressure = 150 psi.
  - c. Maximum pressure due to surge = 150 psi.
  - d. Minimum Pressure due to surge = -10 psi.
  - e. Design tensile stress due to surge or hydrostatic test pressure: No greater than 50% minimum yield.
  - f. Design bending stress due to combined earth loads and surge or hydrostatic test pressure: No greater than 48,000 psi.
  - g. Unit weight of fill  $\leq 120$  pcf.
  - h. Deflection lag factor ( $D_i$ ) = 1.2.
  - i. Bedding constant ( $K$ ) = 0.1.
  - j. Moment coefficient = 0.16.
  - k. Fully saturated soil conditions  $h_w = h = \text{depth of cover above top of pipe}$ .
6. Hydrostatic Test of Pipe: AWWA C 151, Section 5.2.1, at point of manufacture. Hold test for a Minimum 2 minutes for thorough inspection of pipe. Repair or reject pipe revealing leaks or cracks.
7. Pipe Manufacturer for large diameter water lines: Minimum of 5 years of successful pipe installations in continuous service. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

<b>Line Diameter</b>	<b>Required Bends*</b>
20 and 24 inches	Four 45E bends per 5,000 LF of water line
> 24 inches	Four 22.5E bends per 10,000 LF of water line

\*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer's option (i.e. two 22.5° bends are equivalent to one 45° bend) and shall be counted as one fitting.

Manufacturer or supplier must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of Project Manager where unforeseen obstacles are encountered during construction. These fittings are in addition to any fittings called out in construction documents and must be available at all times.

8. Provide flange adapter with insulating kit as required when connecting new piping to existing piping and piping of different materials, unless otherwise approved by Project Manager.
9. Clearly mark pipe section to show location and pressure class color coded.
10. No welding will be permitted on Ductile Iron Pipe except at restrained joint spigots. No field welding is allowed.

**B. Joints**

1. Joint Types: ANSI A21.11 push-on; ANSI A21.11 mechanical joint; or ANSI A21.16 flanged end. Provide push-on joints unless otherwise indicated on the Plans or required by these specifications. For bolted joints, conform to requirements of AWWA C111.
2. Where required by Plans, provide approved restrained joints for buried service.
3. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.
4. Provide for restrained joints designed to meet test pressures required under Section 02515 – “Hydrostatic Testing of Water Lines” as applicable. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.
5. Electrical Bond Wires: Use stranded, copper cable furnished with high molecular weight polyethylene insulation (HMWPE). Use wire gauge (AWG) as shown on Plans.
6. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer for pipe joints or restraint

joints. Submit details of other methods of providing curves and bends for consideration by Project Manager. When other methods are deemed satisfactory, install at no additional cost.

C. Gaskets

1. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material in accordance with ANSI A21.11 or ASTM F 477 (One Bolt only); for flanged joints  $\frac{1}{8}$ -inch-thick gasket in accordance with ANSI A21.15.

D. Fittings

1. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they connect to.
2. Push-on Fittings: ANSI A21.10; ductile iron ANSI A21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.
3. Flanged Fittings: ANSI 21.10; ductile iron ANSI A21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.
4. Mechanical Joint Fittings: ANSI A21.11; pressure rated at 250 psi.
5. Ductile Iron Compact Fittings: Shall conform to AWWA C153 and shall be:
  - a. Fusion bonded epoxy lined or
  - b. Cement mortar lined.
6. For tangential flanged outlets shown on Plans, substitute with a tee with an equivalent sized outlet unless otherwise approved by Project Manager.

E. Coatings and Linings

1. Water line Interiors: ANSI A21.4, cement lined with seal coat; ANSI A21.16 fusion bonded epoxy coating for interior; comply with NSF 61.
2. Sanitary Sewer and Force Main Interiors:
  - a. Preparation: Commercial blast cleaning conforming to SSPC-SP6.
  - b. Liner thickness: Nominal 40 mils, minimum 35 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6 inches back from end.

- c. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.
- d. Acceptable Lining Materials:
  - 1) Provide approved virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage; heat bonded to interior surface of pipe and fittings.
  - 2) Ceramic Epoxy - Protecto 401 or approved equal
- 3. Sanitary Sewer Point Repair Pipe: For pipes lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.02E, Sanitary Sewer and Force Main Interiors.
- 4. Exterior encasement and coating requirements for buried waterlines:
  - a. Open cut construction method:
    - 1) Provide double wrap polyethylene encasement in accordance with AWWA C105 and the requirements of Section 02528 – “Polyethylene Wrap” for buried waterlines both with and without cathodic protection, and
    - 2) Provide prime coat and outside asphaltic coating conforming to ANSI A21.10, ANSI A21.15, or ANSI A21.51 for pipe and fittings.
  - b. Auger, casing, or liner construction method:
    - 1) Provide prime coat and outside asphaltic coating conforming to ANSI A21.10, ANSI A21.15, or ANSI A21.51 for pipe and fittings, and.
    - 2) Provide double wrap with polyethylene encasement. Place circumferential wraps of tape of plastic tie strap at two-foot intervals along the barrel of the pipe, and thoroughly seal each end of the polyethylene tube.
- 5. Exterior waterline coating requirements for above ground, atmospheric conditions: Refer to Section 09901 – “Protective Coatings”.
- 6. Exterior Coating for Sanitary Sewer: Prime coat and outside asphaltic coating conforming to ANSI A21.10, ANSI A21.15, or ANSI A21.51 for pipe and fittings in open cut excavation and in casings.

7. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners.
8. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer for maximum resistance to the contaminants identified in the Phase II Environmental Site Assessment Report.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

3.01 – 3.02 NOT USED

#### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Conform to installation requirements of Sections 02511 – “Water Lines” and 02531 – “Gravity Sanitary Sewers”, except as modified in this Section.
- B. Install in accordance with AWWA C 600 and manufacturer’s recommendations.
- C. Install double wrap Polyethylene encasement in conformance with requirements of AWWA C105 and Section 02528 – “Polyethylene Wrap”.
- D. Provide electrical continuity bonding across buried mechanical and push-on joint assemblies, except where insulating flanges are required by Plans.
  1. Provide minimum number of bond wires shown on Plans. Remove one inch of HMWPE insulation from each end of bond wire prior to attaching.
  2. Secure wire onto pipe using approved Thermite Welding procedures.
  3. Coat bare metal and weld metal after weld is secure. Use coal-tar compound or other compatible coating. For polyurethane coated pipe, use compatible polyurethane coating.
  4. Visually inspect Thermite Weld connections for electrical continuity, strength and suitable coating prior to backfilling or placing pipe in augered hole or casing.

#### 3.04 REPAIR/RESTORATION

Field Repair of Coatings:

Repair damages to asphalt coating with bitumastic asphalt per manufacturer’s recommendations.

3.05 – 3.10 NOT USED



END OF SECTION

## Section 02502

## STEEL PIPE AND FITTINGS

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes:

- A. Steel pipe and fittings for water lines for aerial crossings, aboveground piping, and encasement sleeves. Do not bury steel pipe, unless it is large diameter water line.
- B. Specifications identify requirements for small-diameter less than or equal to 20 inches.

## 1.02 MEASUREMENT AND PAYMENT

## A. Unit Prices

- 1. No payment will be made for steel pipe and fittings under this Section. Refer to Section 02511 – “Water Lines” for measurement and payment.
- 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 REFERENCES

- A. AASHTO – Standard Specifications for Highway Bridges.
- B. ASME B16.1 – Cast-Iron Pipe Flanges and Flanged Fittings.
- C. ASTM A36 – Standard Specification for Carbon Structural Steel.
- D. ASTM A53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- E. ASTM A105 – Standard Specification for Carbon Steel Pipe Forgings for Piping Applications
- F. ASTM A106 – Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
- G. ASTM A135 – Standard Specification for Electric-Resistance-Welded Steel Pipe.

- H. ASTM A139 – Standard Specification for Electric-Fusion (ARC) – Welded Steel Pipe (NPS 4 and Over).
- I. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- J. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- K. AWWA C200 – Standard for Steel Water Pipe, 6 in. and Larger.
- L. AWWA C206 – Standard for Field Welding of Steel Water Pipe.
- M. AWWA C207 – Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.
- N. AWWA C210 – Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
- O. AWWA C 604 – Installation of Buried Steel water Pipe – 4 In and Larger
- P. AWWA M11 – Steel Pipe – A Guide for Design and Installation
- Q. SSPC Good Painting Practice, Volume 1.
- R. SSPC SP 1 – Solvent Cleaning.
- S. SSPC SP 5 – White Metal Blast Cleaning.
- T. SSPC SP 6 – Commercial Blast Cleaning.
- U. SSPC SP 10 – Near-White Metal Blast Cleaning.
- V. SSPC VIS 1 – Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.
- W. AWWA C218 – Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings.
- X. NACE SPO188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- Y. ANSI/NFS Standard 61

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 – “Submittal Procedures”. For aerial crossings and above ground piping, include lay schedule of new pipe and fittings indicating alignment and grade, laying dimensions, lining and coating systems, proposed welding procedures, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Plans.
- B. Submit manufacturer’s certifications that pipe and fittings are new and unused.
- C. Submit manufacturer’s certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C200.
- D. Submit manufacturer’s affidavits that coatings and linings comply with applicable requirements of this Section and:
  - 1. Polyurethane coatings were applied in strict accordance with manufacturer’s recommendation and allowed to cure at temperature 5 degrees above dew point.
  - 2. Linings were applied and allowed to cure at temperature above 32°F.
- E. Submit certification from NACE Certified Coatings Inspector, having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected were properly repaired.

**1.05 RELATED REQUIREMENTS**

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02511 – “Hydrostatic Testing of Pipelines”
- D. Section 15155 – “Couplings and Coupling Adapters”
- E. Section 16061 – “Joint Bonding and Electrical Isolation”

**1.06 QUALITY ASSURANCE**

- A. Prior to start of Work, provide proof of certification of qualification for welders employed for type of work, procedures, and positions involved. Provide welder qualifications in accordance with AWWA C206.
- B. Shop-applied coatings and linings; provide services of an independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III

Certified Coatings Inspector verifying compliance with same requirements specified in paragraph 3.02.

- C. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.
- D. Final Inspection:
  - 1. Before shipment, inspect each finished pipe, fitting, special and accessory for markings, metal thickness, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness and compare to the appropriate referenced standard.
  - 2. Inspect for coating placement and defects. Test exterior coating for holidays.
  - 3. Inspect linings for thickness, pitting, scarring, and adhesion.
- E. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.

1.07 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Steel Pipe
  - 1. Manufacture pipe with nominal diameter 20 inches and less, but more than 2 inches to conform to ASTM A106 or A 53 Grade B, standard weight.
  - 2. Provide steel pipe and encasement sleeves designed and manufactured in conformance with AWWA C200 and AWWA M11 except as modified herein. Steel to be minimum of ASTM A36, ASTM A1011 Grade 36, ASTM A53 Grade B, ASTM A135 Grade B, or ASTM A139 Grade B.

3. Minimum Allowable Steel-Wall Thickness:

<b>CARRIER PIPE</b>			
<b>Nom. Pipe Size (in.)</b>	<b>Min. Wall</b>		<b>Approx. Wt. Per Lin. Ft. Uncoated (lb.)</b>
	<b>O.D. (in.)</b>	<b>Thick. (in.)</b>	
4	4.50	0.250	11.35
6	6.625	0.280	18.97
8	8.625	0.322	28.55
10	10.75	0.365	40.48
12	12.75	0.375	49.56
16	16.00	0.375	62.58
20	20.00	0.375	78.60

Notes – Carrier Pipe:

1. Review pipe and fitting design for conditions exceeding those specified herein.
2. Provide pipe with wall thickness of no less than listed in table above.

<b>MINIMUM DIAMETER CASING PIPE (ENCASEMENT SLEEVES)</b>			
<b>Corresp. Casing Pipe Size (in.)</b>	<b>Min. Wall</b>		<b>Approx. Wt. Per Lin. Ft. Uncoated (lb.)</b>
	<b>O.D. (in.)</b>	<b>Thick. (in.)</b>	
8	8.625	0.219	19.64
10	10.75	0.219	24.60
12	12.75	0.219	29.28
16	16.00	0.219	36.86
18	18.00	0.250	47.39
20	20.00	0.250	52.73
24	24.00	0.250	63.41

Notes – Casing Pipe:

1. Provide casing pipe with wall thickness of no less than listed in table above.
  2. Casing pipe: AWWA C200 new uncoated welded steel.
  3. Verify casing diameter required with dimensions of casing spacer.
4. Provide pipe sections in lengths of no less than 16 feet except as required for special sections, and no greater than 40 feet.

5. Provide short sections of steel pipe no less than 4 feet in length unless indicated on Plans or specifically permitted by Project Manager.
6. Fittings: Factory forged for sizes 4 inches through 20 inches; long radius bends; beveled ends for field butt welding; wall thickness equal to or greater than pipe to which fitting is to be welded unless otherwise shown on Plans.
7. Joints:
  - a. Standard field joint for steel pipe and encasement sleeve: AWWA C206. Single-welded, butt joint.
  - b. Provide mechanically coupled or flanged joints for valves and fittings, as shown on Plans. Flanges: AWWA C207, Class D; same diameter and drilling as Class 125 cast iron flanges ASME B16.1.
  - c. Elbows to be standard weight seamless elbows per ASTM A106, Grade A or B.
  - d. Flanges for pipe 20 inches in diameter and smaller shall be ANSI 150 lb. flat face, slip on or weld neck flanges, meeting ASTM A105 requirements. Where flanges are to join to valves with raised face flanges, use ANSI 150 lb. raised flange.
  - e. Provide same coating for exposed portions of nuts and bolts as flanges which they secure.
  - f. Maintain electrically isolated flanged joints between steel and cast iron by using flange isolation kits. See Specification Section 16061 – “Joint Bonding and Electrical Isolation”.
8. Fabricate flanges with over-size bolt holes, with flanges drilled in pairs, to accommodate insulating sleeves.

**B. Internal Lining Systems for Steel Pipe, All Installations**

1. Supply steel pipe with epoxy lining, capable of conveying water at temperatures not greater than 140°F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61 and certification to be from organization accredited by ANSI. Unless otherwise noted, coat exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, etc., with epoxy lining, as specified.

2. Epoxy Lining AWWA C210, white, or approved equal for shop and field joint applied, except as modified in this Section. Provide material from same manufacturer.

Surface Preparation as recommended by manufacturer	SSPC-S10P Near White Blast Clean
Finish Coat	AWWA C210. Provide Devoe Bar Rust 233H or approved equal. DFT as recommended by manufacturer

- a. Total allowable DFT for system as recommended by manufacturer<sup>1</sup>. Provide anchor profile and dry film thicknesses for approved alternate products in accordance with product manufacturer's recommendations. Do not exceed maximum DFT as recommended by manufacturer.
- b. Factory Testing in accordance with AWWA C210.
- C. External Coating System for Steel Pipe Installed Aboveground and in Vaults (Exposed)

1. Provide approved epoxy/polyurethane coating system as designated below. Provide material from same manufacturer.

Surface Preparations recommended by manufacturer	SSPC-SP10 Near White Blast Clean
Intermediate Coat	Chemical Resistant Epoxy, or approved equal, AWWA C210
Finish Coat	Polyurethane, or approved equal Blue Fed Std. No. 15102 color as approved by Project Manager

2. Total Allowable Dry Film Thickness (DFT) for System as recommended by manufacturer.
3. Factory and field testing in accordance with AWWA C210.
4. Clean bare pipe free from mud, mill lacquer, oil, grease, or other contaminant. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use only approved safety solvents which do



not leave residue. Use preheating to remove oil, grease, mill scale, water, and ice provided pipe is preheated in uniform manner to avoid distortion.

5. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges. Grind weld bead for proper coating application as recommended by coating manufacturer. Presence of metallic defects may be cause for rejection of pipe.

## PART 3 EXECUTION

### 3.01 – 3.02 NOT USED

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. Piping Installation

1. Conform to applicable provisions of Section 02511 – “Water Lines”, except as modified in this Section.
2. Comply with the following:

For pipes with coating: Do not roll or drag pipe on ground, move pipe in such a manner as not to damage pipe or coating. Carefully inspect pipe for abrasions and repair damaged coating before pipe is installed.

3. Static Electricity:
  - a. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.
  - b. Electrically test where required after installation is complete.

#### B. External Coating System for Steel Pipe Installed Above Ground and in Vaults (Exposed) and Epoxy Internal Lining System

1. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.
2. Workmanship:
  - a. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.
  - b. Paint Application Procedures: SSPC Good Painting Practices, Volume I.

3. Surface Preparation:
  - a. Prepare surfaces for painting by using abrasive blasting.
  - b. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.
  - c. Prior to blasting, clean surfaces to be coated or lined of grease, oil, and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.
  - d. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux, and spatter by grinding to 1/4-inch minimum radius.
  - e. Abrasive Material:
    - 1) Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to job site in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.
    - 2) After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Tex Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Project Manager.
    - 3) Do not blast if metal surface may become wet before priming commences, or when metal surface will be less than 5°F above dew point during blast cleaning, application or curing duration unless otherwise specified by manufacturer.
  - f. Evaluate degree of cleanliness for surface preparation with use of SSPC Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning, SSPC-VIS 1.
  - g. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing 3/4-inch by 4-inch piece of clear Scotch type tape on blasted surface, then removing and placing tape on 3 x 5 white index card. Reclean areas exhibiting dust or residue.
  - h. Blast only as much steel as can be coated same day of blasting.
4. Coating and Lining Application:
  - a. Environmental Conditions: Do not apply coatings or linings when metal surface temperature is less than 50°F; when ambient temperature

will be less than 5°F above dew point during curing duration; when expected weather conditions are such that ambient temperature will drop below 50°F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels, or maintain pipe temperature in a uniform manner to be at least 5°F above dew point. Heating shall conform to the recommendations of the epoxy manufacturer.

- b. Application Procedures:
    - 1) Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.
    - 2) Thin materials only with manufacturer's recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.
    - 3) Discard catalyzed materials remaining at end of day or work shift.
  - c. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.
  - d. Cure a minimum of 24 hours at 77°F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coatings are applied, provide forced air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.
5. Testing of Coatings and Linings:
- a. Inspect pipe for holidays and damage to coating:

If test indicates no holidays and coating is damaged, remove damaged layers of coating and repair in accordance with coating manufacturer's recommendations.

- b. Perform holiday test in accordance with NACE Standard Recommended Practice, SPO 188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- c. Begin testing of completed coating after coating has sufficiently cured, usually 1 to 5 days. Consult coating manufacturer for specific curing schedule.
- d. Perform adhesion test on pipe in accordance with ASTM D4541.
- e. For coating thickness of 20 mils or less, test with wet sponge low-voltage holiday detector. For coating thickness in excess of 20 mils, test with high-voltage holiday detector. Perform electrical holiday test with 60-cycle current audio detector. Select test voltage as suggested in table below.

**MINIMUM VOLTAGES FOR  
HIGH VOLTAGE SPARK TESTING**

<b>Total Dry Film Thickness (mils)</b>	<b>Suggested Inspection (V)</b>
20 to 40	3,000
41 to 55	4,000
56 to 80	6,000

**C. Joints and Jointing**

1. **Welded Joints:**
  - a. Conform to requirements of Section 02511 – “Water Lines”.
  - b. Field weld to be full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.
  - c. The Owner will employ an independent certified testing laboratory to perform weld acceptance tests on welded joints. Testing Laboratory will test by x-ray methods for butt welds, for 100 percent of joint welds. Program Manager has final decision as to suitability of welds tested.
2. **Flanged Joints:** Conform to requirements of Section 02511 – “Water Lines”.

3. Joint Grouting and Testing: Conform to requirements of Section 02511 – “Water Lines”.
4. Joint Coating and Lining: Conform to requirements of Section 02511 – “Water Lines”.

D. Coatings and Linings Inspection Responsibilities

Contractor is responsible for quality control of coatings and linings application and testing and inspection stipulated in this Section. Project Manager is responsible for quality assurance and reserves the right to inspect or acquire services of an independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at all phases of coatings and linings work, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Project Manager provides such inspection.

3.04 – 3.10 NOT USED

END OF SECTION

## Section 02506

## POLYVINYL CHLORIDE PIPE

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes:

- A. Polyvinyl chloride pressure pipe for water transmission and distribution, in nominal diameters 4 inches through 30 inches.
- B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 60 inches.
- C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 24 inches.

## 1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for Work included as specified in the following sections:
    - a. Section 02511 – “Water Lines”
    - b. Section 02531 – “Gravity Sanitary Sewers”
  - 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 REFERENCES

- A. ANSI A21.16 (AWWA C116) - Protective Fusion-Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey-Iron Fittings.
- B. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
- C. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- D. ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

- E. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
- F. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- G. ASTM D2412 – Standard Test Method for Determination of External Loading Characteristic of Plastic Pipe by Parallel Plate Loading
- H. ASTM D2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- I. ASTM D2680 – Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- J. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- K. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- L. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- M. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- N. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- O. ASTM F794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- P. ASTM F949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
- Q. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
- R. ASTM D618 - Standard Practice for Conditioning Plastics for Testing
- S. AWWA CANSI A21.10 (AWWA C110) - Ductile-Iron and Gray-Iron Fittings.
- T. AWWA CANSI A21.10 (AWWA C111) - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- U. ANSI A21.53 (AWWA C153) - Ductile-Iron Compact Fittings

- V. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
- W. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Distribution.
- X. AWWA C909 - Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. Through 24 In. for Water, Wastewater, and Reclaimed Water Service.
- Y. AWWA M23 – PVC Pipe – Design and Installation
- Z. PPI TR-3 - Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe.
- AA. Texas Administrative Code (TAC) Rule §290.44 – Texas Commission on Environmental Quality Rules and Regulations for Public Water Systems.

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit shop drawings showing design of new pipe, laying dimensions, fabrication, fittings, flanges, and special details.
- C. Submit manufacturer’s data on materials furnished for tracer wire system and locations of test stations unless indicated on the Plans.
- D. Calculations and limits of thrust restraint shall be based on AWWA M23.
- E. At time of delivery, submit affidavit of compliance from manufacturer that materials and finished pipe comply with applicable requirements of referenced standards, including AWWA C900, and these specifications.
- F. Submit manufacturer’s data on materials furnished for buried warning and identification tape.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02317 – “Excavation and Backfill for Utilities”
- D. Section 02501 – “Ductile Iron Pipe and Fittings”



- E. Section 02511 – “Water Lines”
- F. Section 02528 – “Polyethylene Wrap”
- G. Section 02531 – “Gravity Sanitary Sewers”

#### 1.06 QUALITY ASSURANCE

- A. Submit manufacturer’s certifications that PVC pipe and fittings meet requirements of this Section and AWWA C900 or AWWA C909 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.
- B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C900 and AWWA C909, and this Section.
- C. For 24-inch and larger, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory located in the United States. Certification from other source is not acceptable. Furnish copies of test reports to Project Manager for review. Cost of testing paid by Contractor. Material testing shall include:
  - 1. Dimensional test in accordance with AWWA C 900, Paragraph 4.3.2 . The dimensions and tolerances of the pipe barrel and bell ends shall conform with the applicable requirements listed in AWWA C 900, Table 1, when measured as specified in ASTM D2122.
  - 2. Flattening test in accordance with AWWA C 900 Paragraph 4.3.3.4 . When tested in accordance with ASTM D2412, the rate of flattening shall be uniform and such that the compression is completed within 2 to 5 minutes.
  - 3. For 24-inch and larger, hydrostatic proof test in accordance with AWWA C 900, Paragraph 4.3.3.3. The pipe, including any integral bell end or affixed coupling, shall not fail, balloon, burst, or weep when subjected to an internal pressure equal to 2.0 times its designated pressure class for a minimum dwell time of two minutes.
- D. Markings:
  - 1. PVC pipe shall be clearly marked in accordance with the pipe’s standard.
  - 2. Markings shall be of sufficient size to be legible from the top of the ground when the pipe is in the trench.
  - 3. Include manufacturer’s production code, including day, month, year, shift, plant and extruder of manufacturer for 24-inch and larger pipe.
  - 4. Pipe shall bear National Sanitation Foundation Seal of Approval (NSF-PW).

- 5. Include insertion or home marks on spigot end of pipe.
- E. Acceptance: Pipe may be rejected for failure to comply with any requirement of this specification.
- F. Prior to beginning pipe installation of 24-inch and larger, Contractor to conduct meeting to review PVC pipe installation procedures with pipe laying crew and supervisors. Pipe manufacturer's representative may conduct meeting, or conduct review using Uni-Bell Installation Guides and these Specifications. Project Manager's representative to be in attendance. Notify Project Manager minimum five business days prior to meeting. Meeting may be held at field office or other location designated by Contractor and approved by Project Manager

1.07 – 1.13 NOT USED

## PART 2 PRODUCTS

### 2.01 MANUFACTURER(S) (NOT USED)

### 2.02 MATERIALS AND/OR EQUIPMENT

- A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.
- B. Furnish PVC pressure pipe manufactured from Class 12454 virgin PVC compound as defined in ASTM D1784, latest version. PVC pipe conforming to AWWA C900 and AWWA C909 shall carry the National Sanitation Foundation (NSF) seal of approval and shall be listed with Underwriters Laboratories, Inc. (U.L.). Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR-3. Provide pipe which is homogeneous throughout, free of any significant voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks, scratches and gouges. Joining surfaces of spigots and joints must be free of gouges and imperfections which could cause leakage. Reject pipe older than 18 months from manufacturing.
- C. Gaskets:
  - 1. Gaskets shall meet requirements of ASTM F477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
  - 2. Flat Face Mating Flange: Full faces 1/8 inch thick ethylene propylene (EPR) rubber.
  - 3. Raised Face Mating Flange: Flat ring 1/8 inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

4. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated area.
- D. 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.
- E. Do not use PVC in potentially or known contaminated areas.
- F. Do not use PVC in areas exposed to direct sunlight.
- G. Water Distribution and Transmission Pipe
  1. Pipe 4-inch through 12-inch in diameter with nominal 20-foot lengths and cast-iron equivalent outside diameters:
    - a. AWWA C900, DR 18 or
    - b. AWWA C909, Pressure Class 165 psi minimum.
  2. Pipe 14-inch through 30-inch in diameter: AWWA C900; Pressure Rated 165 psi; DR 25 minimum; nominal 20-foot lengths; cast-iron equivalent outside diameter.
  3. Make curves and bends by offsetting (i.e. deflecting) joints. Maximum joint offset is 1 degree, or 4-inch offset per 20-ft joint, unless otherwise approved by pipe manufacturer. Do not exceed maximum offset recommended by pipe manufacturer. For deflections exceeding 1 degree, use ductile iron fittings. No joint offsetting allowed for restrained joints.
  4. Provide 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.
  5. Hydrostatic Test: Per AWWA C900, AWWA C909, ANSI A21.10 (AWWA CANSI A21.10 (AWWA C110)); at point of manufacture; submit manufacturer's written certification.
- H. Gravity Sewer Pipe
  1. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

Wall Construction	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
Solid	D3034	SDR 26 / PS 115	4" to 10"
	D3034	SDR 35 / PS 46	12" & 15"

Wall Construction	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
	F679	SDR 35 / PS 46	18" to 60"
	AWWA C900	DR 18 / N/A	4" to 12"
	AWWA C909	PC165 / N/A	4" to 12"
	ASTM D2241	DR 18 / N/A	14" to 36"
Truss (Gasketed)	D2680	N/A /200 psi	8" to 15"
Profile	F949	N/A / 46 psi	12" to 36"
	F949	N/A / 115 psi	8" to 10"
	F794	N/A / 46 psi	8" to 30"
	F794/F949	N/A / 46 psi	24" to 36"

- When solid wall PVC pipe 18 inches to 60 inches in diameter is required in PS 115, provide pipe conforming to ASTM F679, except provide wall thickness as required for SDR 26 and pipe stiffness of 115 psi.
- For sewers crossing water lines, conform to requirements of Texas Administrative Code (TAC) Rule § 290.44.
- Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D3212 and ASTM F477, or ASTM D3139 and ASTM F477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D2444.
- 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.
- Conditioning. Conditioning of samples prior to and during tests is subject to approval by Program Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.
- Pipe Stiffness. Determine pipe stiffness at 5% deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches

(152 mm) in length. For diameters 21 inches through 48 inches, test three specimens, each a minimum of 12 inches (305 mm) in length.

8. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.02.I.5, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.
9. Joint Tightness. Test for joint tightness in accordance with ASTM D3212, except that joint shall remain watertight at minimum deflection of 5%. Manufacturer shall be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.
10. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

I. Sanitary Sewer Force Main Pipe

1. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to ASTM F1674, for PVC pipe 24-inch diameter and less.
2. Fittings: Provide ductile iron fittings as per Section 02501 – “Ductile Iron Pipe and Fittings”, Paragraph 2.04, except furnish fittings with one of following internal linings:
  - a. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D1248, heat fused to interior surface of fitting
  - b. Nominal 40 mils (35 mils minimum) polyurethane
  - c. Nominal 40 mils (35 mils minimum) ceramic epoxy
  - d. Nominal 40 mils (35 mils minimum) fusion bonded epoxy
3. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 02528 – “Polyethylene Wrap”.
4. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02.G.5.

J. Bends and Fittings for PVC Pressure Pipe

1. Bends and Fittings: ANSI A21.10 or ANSI A21.53, ductile iron; ANSI A21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Certa-Lok PVC restrained joints, 250 psi, may be provided for up to 16 inches in diameter (water or sanitary).
2. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.
3. For ductile iron fittings, provide polyethylene wrap in accordance with Section 02528 – “Polyethylene Wrap”.
4. Provide devices for prevention of over-insertion of pipe spigots or plain ends into push-on bell joints for all pipe in tunnels or trenchless installation. Devices shall consist of the following:
  - a. Bell stop; manufactured of ductile iron conforming to ASTM A536, coated with fusion bonded epoxy, polyurethane or approved coating,
    - 1) EBAA Iron 5000 MEGA-STOP or equal
  - b. Shall allow for pipe expansion and contraction.

**K. Tracer Wire and Warning and Identification Tape**

1. Warning and identification tape, tracer wire and test stations shall comply with the requirements of this Section and Section 02317 – “Excavation and Backfill for Utilities”.
2. Tracer wire shall be AWG #8 solid strung soft drawn copper insulated with high molecular weight HDPE, suitable for direct bury application.
3. Warning and identification tape shall be polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic manufactured specifically for warning and identification of buried utility lines. Provide tape on roles, 4 inch minimum width, blue color for water line with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, “CAUTION, BURIED WATER LINE BELOW” or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

2.03 – 2.04 NOT USED

## PART 3 EXECUTION

## 3.01 GENERAL / MANUFACTURER(S) (NOT USED)

## 3.02 PROTECTION

Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer's recommendations.

## 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Conform to requirements of Section 02511 – “Water Lines” and Section 02531 – “Gravity Sanitary Sewers”, as applicable.
- B. Install PVC pipe in accordance with Section 02317 – “Excavation and Backfill for Utilities”, AWWA C605, ASTM D2321 for Sewer Pipe, and manufacturer's recommendations.
- C. Install PVC water service pipe to clear utility lines with minimum 6-inch separation and have minimum depth of 6 feet of cover below property line grade of street, unless otherwise required by Plans.
- D. Avoid imposing strains that overstress or buckle pipe when lowering pipe into trench.
- E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support. Ensure barrel is fully supported along entire length of pipe, prior to backfilling.
- F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.
- G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.
- H. Pipe Assembly Procedures:
  - 1. Do not remove gasket from pipe. Verify gasket is properly seated in bell groove and both bell and spigot are clean.
  - 2. For plain ends, use a factory finished pipe end as guide to establish angle and length of bevel. Use guide to make a reference mark prior for proper assembly. Remove any burrs from field operations prior to inserting.
  - 3. Do not assemble joint by swinging or stabbing.
  - 4. Do not assemble joint using machinery or equipment such as backhoe bucket.

5. For pipe in tunnels or trenchless installation, install over-insertion device on spigot or plain end of pipe, in accordance with manufacturer's recommendations.
6. Lay pipe by inserting spigot end unto bell flush with reference mark (insertion line). Brace bell while spigot or plain end are pushed under gasket to prevent completed joints from further insertion.
7. Assemble joint only to assembly mark provided on spigot end. At no time shall spigot go past insertion line or reference mark.
8. Continuously observe and check each reference mark for proper length, and install pipe with reference mark visible.
9. If undue resistance to insertion is encountered, or reference mark does not reach flush position, disassemble joint and verify position of gasket prior to re-inserting.
10. Prior to backfilling, verify reference mark is flush with end of bell.

I. PVC Restrained Mechanism

1. For low-profile coupling with spline-type joints:
  - a. Do not apply lubricant to spline or pipe or coupling spline grooves.
  - b. Do not use excessive force while inserting spline through coupling.
  - c. Insert spline until fully sealed around circumference of pipe.
2. Field Cutting of Pipe Ends:
  - a. Perform by workers certified by manufacturer.
  - b. Use a PVC pipe cutter and provide square ends.
  - c. For low-profile coupling with spline-type joints, use manufacturer-approved power routing and grooving tool to field fabricate required pipe groove.
  - d. Follow manufacture's recommendation to disassemble restrained joint after it has been locked in place.

J. Tracer Wire and Warning and Identification Tape

1. Trace wire shall be installed on all water mains. The wire shall be installed in such a manner as to be able to properly trace all water mains without loss or



deterioration of signal or without the transmitted signal migrating off the tracer wire.

2. Install in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe as required to insure that wire remains on top of pipe. Tape tracer wire to the top of pipe at a maximum spacing of every 10 feet. Tracer wire shall be installed such that there are no buried splices between test stations. Tracer wire shall be accessible at test stations.
3. After installation, all tracer wire shall be tested in the presence of Project Manager to verify continuity of the system and a report indicating continuity shall be submitted to Engineer as part of the as-built construction records. Any deficiencies in continuity shall be repaired at contractor's expense and retested in the presence of Engineer.
4. Warning and identification tape shall be centered above water main and buried 36-inches below finished grade.

3.04 – 3.10 NOT USED

END OF SECTION

Section 02507

**PRESTRESSED CONCRETE CYLINDER PIPE**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes prestressed concrete cylinder pipe (PCCP) and fittings for buried water lines sizes 24 inches and larger.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices.**

1. No separate payment will be made for PCCP under this Section. Include cost in price for water lines.
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 REFERENCES**

- A. AASHTO - Standard Specifications for Highway Bridges.
- B. AREA - Manual of Railway Engineering, Volume II, Chapter 15.
- C. ASTM A648 - Standard Specification for Steel Wire, Hard Drawn for Prestressing Concrete Pipe.
- D. ASTM A1032 – Standard Test Method for Hydrogen Embrittlement Resistance for Steel Wire Hard Drawn Used for Prestressing Concrete Pipe
- E. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- F. ASTM C35 - Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.
- G. ASTM C150/C150M - Standard Specification for Portland Cement.
- H. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
- I. ASTM C1107/C1107M C1107/C1107M (CRD C-621) - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- J. ASTM D512 - Standard Test Methods for Chloride Ion in Water.

- K. ASTM D1293 - Standard Test Methods for pH of Water.
- L. ASTM E165/E165M - Standard Practice for Liquid Penetrant Examination for General Industry.
- M. ASTM E340 - Standard Test Methods for Macroetching Metals and Alloys.
- N. ASTM E709 - Standard Test Methods for Magnetic Particle Testing.
- O. ASTM E1032 - Standard Test Methods for Radiographic Examination of Weldments.
- P. ANSI/AWS A3.0M/A3.0 - Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying.
- Q. AWWA C205 -
- R. AWWA C206 - Field Welding of Steel Water Pipe.
- S. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 in. through 144 in.
- T. AWWA C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
- U. AWWA C304 - Design of Prestressed Concrete Cylinder Pipe.
- V. AWWA M 9 - Concrete Pressure Pipe.
- W. NSF/ANSI 61 - Drinking Water System Components - Health Effects.
- X. SSPC SP 7 - Brush Off Blast Cleaning.

#### 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit shop drawings and certification signed and sealed by Professional Engineer registered in State of Texas showing following:
  - 1. Manufacturer’s pipe design calculations and thrust restraint calculations in accordance with AWWA M9, latest edition.
  - 2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Plans. Designate areas with earth load heights 16 feet and greater, requiring cement stabilized sand bedding material below the springline of the pipe on the lay schedule. Do not start production of pipe and fittings prior to review and approval by Project

Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (\*.PDF).

3. Include hot tapping procedure.
  4. Submit certification from manufacturer that design was performed for project in accordance with requirements of this section.
- C. Submit critical location report meeting the requirements of Section 02317 – “Excavation and Backfill for Utilities”.
- D. Within 30 calendar days following Notice to Proceed and before initiation of manufacture of prestressing wire, submit following:
1. Name and location of prestressing wire manufacturer.
  2. General description of quality control procedures used by wire manufacturer. Include physical and chemical property tests utilized, testing frequency and test records; and description of methods employed to assure compliance with AWWA C301 regarding wire surface temperature, type of thermometer, location of temperature measurement, frequency of temperature tests and test records.
  3. Approximate dates when wire will be manufactured for use in pipe.
  4. Hydrogen embrittlement sensitivity test report for wire.
- E. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding. Submit standard repair procedures that describe in detail shop and field work to be performed.
- F. Submit following within 45 days after manufacturing of pipe and fittings:
1. Prestressing wire records.
    - a. ASTM A648 for wire.
    - b. Records of testing accomplished as required in AWWA C301, Section 4.4.8.
    - c. Results of other tests of steel reinforcement required in AWWA C301, Section 4.4.
    - d. Wire tension records required in AWWA C301, Section 4.4.8. Indicate heat and coil of prestressing wire used.

2. Test results.
    - a. Hydrostatic testing, acid etching, dye penetration, magnetic particle, and x-ray weld test reports as required.
    - b. Compressive strength (28 day) test results for each type of coating, lining, and core mix design.
  3. Pipe manufacturer's certification that PCCP:
    - a. Cylinder assembly has been hydrostatically tested at factory for two (2) minutes minimum in accordance with Section 2.02.A.10 and AWWA C301.
    - b. Mortar coatings and linings were applied or allowed to cure at temperature above 32 degrees Fahrenheit.
- G. Submit following for nonshrink grout for special applications:
1. Manufacturer's technical literature including specifications for mixing, placing, and curing grout.
  2. Results of tests performed by certified independent testing laboratory showing conformance to ASTM C1107/C1107M C1107/C1107M Nonshrink Grout and requirements of this specification.
  3. Certification product is suitable for use in contact with potable water.
- H. Submit certification for welder and welding operator demonstrating their certification within past 6 months in accordance with AWWA C301. Indicate certified procedures and position each welder is qualified to perform.
- I. Submit certification showing calibration within last 12 months for equipment such as scales, measuring devices, and calibration tools used in manufacture of pipe. Each device used in manufacture of pipe is required to have tag recording date of last calibration. Devices are subject to inspection by Project Manager.
- 1.05 RELATED REQUIREMENTS
- A. Section 01270 – "Measurement and Payment"
  - B. Section 01330 – "Submittal Procedures"
  - C. Section 02317 – "Excavation and Backfill for Utilities"
  - D. Section 02502 – "Steel Pipe and Fittings"
  - E. Section 02511 – "Water Lines"

F. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”

G. Section 16061 – “Joint Bonding and Electrical Isolation”

1.06 QUALITY ASSURANCE

A. Manufacturer to have permanent quality control department and laboratory facility capable of performing inspection and testing required. Inspection procedures and manufacturing process are subject to inspection by Project Manager. Perform manufacturer tests and inspections required by AWWA C301 as modified by these Specifications. Repair defects such as substandard welds, excessive radial offsets (misalignment), pitting, gouges, cracks, other nonconforming conditions.

1. Cylinder and Joint Ring Assembly:

- a. Review mill certifications for conformance to requirements of Specifications.
- b. Perform physical testing of each heat of steel for conformance to applicable ASTM standards.
- c. Inspect physical dimensions and overall condition of joint rings and cylinder/joint ring assembly to verify compliance with requirements of AWWA C301.
- d. Test cylinder/joint ring weld for tensile strength. Test one specimen for each 500 cylinder/joint ring assemblies in addition to those tests required by AWWA C301.
- e. Reject pipe with dented steel cylinders.

2. Prestressing Wire:

- a. Inspect wire spacing during wire placement on core.
- b. Test wire splices for each production run or a minimum of once a week, whichever is less, for conformance with minimum strength criteria.

3. Pipe Cores and Coating:

- a. Review mill certificates for each load of cement for conformance to ASTM C150/C150M.
- b. Perform sieve analysis weekly for each source of coarse and fine aggregate for conformance to ASTM C33/C33M.
- c. Inspect kiln recorder charts daily to confirm proper curing environment.

- d. Prior to prestressing, inspect each core for voids, chips, cracks, deleterious surfaces and foreign matter.
  - e. Check outer core moisture of each pipe core immediately prior to applying mortar coating.
  - f. Check mortar batch proportions, moisture content, and slurry application rate. Check coating thickness over wire on each pipe.
  - g. Check physical integrity of cured mortar coating.
  - h. Reject pipe with cracks in mortar coating exceeding 0.01 inches wide.
4. Protective Coatings: Check daily application rate and resulting dry film thickness.
- B. Gaskets: Randomly test rubber cord for diameter, tensile strength, elongation, compression set, hardness, and specific gravity after oven aging on one out of 100 gaskets.
- C. Weld Testing:
- 1. Perform macroetching tests for full-penetration production welds on normal production weld tests. Complete joint penetration welds are defined in ANSI/AWS A3.0M/A3.0. Verify complete joint penetration by means of macroetch of joint weld cross section. Macroetch technique in accordance with ASTM E340.
  - 2. Perform ultra-sonic or x-ray testing of manual butt welds for fittings and special pipes. Perform dye penetration testing of manual lap welds for fittings and special pipes and for joint ring weld onto cylinder.
  - 3. Perform minimum of one set of weld test specimens in accordance with ANSI/AWS A3.0M/A3.0 on each size, grade and wall thickness at minimum of every 3,000 feet of pipe manufactured. Perform no less than one test per project by each welding machine and each operator.
- D. Cast four standard test cylinders each day for each 50 cubic yards of mortar coating or portion thereof for each coating and lining placed in day. Perform compressive strength test at 28 days. No cylinder test result shall be less than 80 percent of specified strength.
- E. Make available copy of Physical and Chemical testing reports for steel cylinders and provide reports at request of Project Manager.
- F. Check physical dimensions of pipe and fittings: Physical dimensions to include pipe lengths, pipe L.D., pipe O.D., and bend angles.

1.07 – 1.13 NOT USED

**PART 2 PRODUCTS**

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Prestressed Concrete Cylinder Pipe

1. Furnish pipe by same manufacturer.
2. Provide prestressed concrete cylinder pipe in conformance with AWWA C301, AWWA C304 and AWWA M 9 except as modified in this Section. Use of pipe from inventory is permitted only if specifications and certifications are met. Provide testing records for pipe.
3. Do not use prestressed concrete cylinder pipe in aerial crossings, exposed or other unburied areas.
4. Pipe Manufacturer:
  - a. Must have minimum of 5 years of manufacturer's pipe installations that have been in successful and continuous service.
  - b. Must maintain on site or in plant minimum of four 22.5 degree bends per 10,000 linear feet of water line. Any combination of bends may be substituted at manufacturer's option (i.e. two 11.25 degree bends are equivalent to one 22.5 degree bend and will be counted as one fitting). Must be capable of delivering bends to job site within 12 hours of notification. These fittings are in addition to fittings called out on Plans and must be available at all times.
5. Pipe Design Conditions:
  - a. Working pressure: 150 psi.
  - b. Hydrostatic field test pressure: 150 psi.
  - c. Maximum pressure due to surge: 150 psi.
  - d. Minimum Pressure due to surge: -10 psi.
  - e. Unit weight of soil: 120 pcf minimum, unless otherwise specified.
  - f. Minimum trench width: O.D. of pipe + four (4) feet.



- g. Pipe and Fittings: Designed to withstand most critical simultaneous application of external loads including construction loads and internal pressures.
  - h. Design: Based on minimum of AASHTO HS-20 loading, AREA Cooper E-80 loads when under railroads, and depths of bury as indicated. Design pipe with Marston's earth loads for transition width trench for all heights of cover.
    - 1) Calculate moments and thrusts in wall based on height of earth load.
    - 2) For earth load heights up to 16 feet, use bedding sand as bedding material and use ninety degree Olander coefficients for earth load and water weight contained in pipe along with 15 degree Olander coefficients for pipe weight.
    - 3) For earth load heights 16 feet and greater, use cement stabilized sand as bedding material below springline of pipe and use, one hundred and fifty degree Olander coefficients for earth load and water weight.
  - i. Groundwater level: Assume below pipe for pipe design. Assume equal to natural ground surface for other conditions.
  - j. Design pipe for transmitting potable water, unless otherwise shown on Plans.
  - k. Manufacture pipe for adverse environmental conditions in accordance with Section 7.5.5 of AWWA C304.
  - l. Design pipe for buried conditions and kept empty for up to 365 days.
  - m. Tunnel and Augered Sections. Provide constant outside diameter from bell to spigot end for pipe. Exclude structural benefits associated with primary liner. Design pipe and pipe joints to carry loads including but not limited to: Overburden and lateral earth pressures, subsurface soil, grouting, other conditions of service, thrust of jacks, and stress anticipated during handling and installation.
6. Coatings and Linings:
- a. Provide Portland cement; ASTM C150/C150M, Type I or II. Provide one type of cement for entire project.
  - b. Water Absorption Test: ASTM C497, Method A; perform on samples of cured mortar coating taken from each working shift. Cure mortar coating samples in same manner as pipe.

- 1) Test value: Average minimum of 3 samples taken from same working shift, no greater than 9 percent for average value, 11 percent for individual value.
  - 2) Test frequency: Perform tests each working shift until conformance to absorption requirements has been established by 10 consecutive passing test results, at which time testing may be performed weekly. Resume testing for each working shift when absorption test results fail until conformance to absorption requirements is reestablished by 10 consecutive passing test results.
- c. Apply one coat of primer to exposed steel parts of steel bell and spigot rings. Prior to coating, blast clean in accordance with SSPC-SP7 (Brush Off Blast Cleaning). Apply primer in accordance with manufacturer's recommendations.
  - d. Coat and line access inlets, service outlets, test inlets, and air release/vacuum relief riser pipe with same coating and lining of water line in accordance with AWWA C301, Section 4, unless otherwise indicated on Plans.
  - e. Do not exceed two hours between application of first and last course when cement mortar is applied in more than one course, otherwise do not defer placing of coating of any portion of pipe length. Verify cement mortar coating thickness on each size of pipe by nondestructive method before removing pipe from coating machine.
  - f. Remove and replace disbonded lining or coating. Reject pipe requiring patches larger than 100 square inches or 12 inches in greatest dimension. Allow no more than one patch on either lining or coating of pipe. Provide WELD-CRETE Probond Epoxy Bonding Agent ET-150, parts A and B; Sikadur 32 Hi-Mod, or approved equal bonding agent for pipe patching.
7. Fittings and specials:
- a. Design fittings to same internal and external loads as straight pipe.
  - b. Manufacture in accordance with Section 02518 – "Steel Pipe and Fittings for Large Diameter Water Lines".
  - c. Provide fabricated bends or fittings with minimum radius of 2-1/2 times pipe diameter.
  - d. Design test plugs to withstand forces generated by hydrostatic test and test pressure from either side. Do not exceed 50% of minimum yield

for design stresses due to hydrostatic pressure. Assume opposite side of plug does not contain water.

- e. Provide no specials less than 4 feet in length unless indicated on Plans or approved by Project Manager.
  - f. Butt Straps for Closure Piece: Provide at locations indicated on Plans or authorized by Project Manager. Minimum 12-inch-wide split butt strap; minimum plate thickness equal to thinnest member being joined; fabricated from material equal in chemical and physical properties to thinnest member being joined. Permit no angular deflection at butt-strap joints.
  - g. Provide minimum 6 inch welded outlet for inspecting each closure section, unless access manway is within 40 feet of closure section.
  - h. Provide Denso petrolatum based tape or approved equal for exposed portions of nuts and bolts.
8. Joints:
- a. AWWA C301 rubber-gasketed or welded bell-and-spigot type except where flanged joints are required for valves and fittings as shown on Plans. Refer to Section 02511 – “Water Lines” for requirements on joints and jointing.
  - b. Rubber-Gasketed Joints: Attach joint ring to steel cylinder with full-thickness fillet welds, welded inside and out (double welded). Bond as shown on Plans to provide electrical continuity along pipeline.
  - c. Restrained Joints: Restrain joints by welding or harnessing joints.
    - 1) Design pressure: 1.5 times working pressure.
    - 2) Harnessed joints: AWWA M 9, clamp or snap ring type, except where prohibited. Limit maximum size of snap ring joints to 36-inch diameter pipe.
    - 3) Groundwater level: Assumed to be equal to natural ground surface.
    - 4) Provide restrained joint pipe with adequate cylinder thickness to transmit full thrust generated by internal pressure across joints.
      - a) Calculate distance of restrained joints based on resistance along each leg of bend with thrust based on bend angle.

- b) Calculate cylinder thickness not to be less than that defined in following table:

<b>Inside Diameter (in)</b>	<b>Gauge Size</b>
Greater than 84"	6
72" to 84"	8
48" to 66"	10
Less than 48"	12

- c) Allow cylinder thickness to reduce linearly from maximum calculated thickness or from minimum cylinder thickness (as determined in Paragraph 2.02.A.8.c.4.a, whichever controls, to minimum thickness required by design over required length (as determined in Paragraph 2.02.A.8.c.4.a) of restrained joints.
- d. Use only fully circumferentially welded joints in areas considered potentially petroleum contaminated, within tunnels and under foreign pipelines. Perform welding in accordance with Section 02502 – “Steel Pipe and Fittings” and 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”.
- e. Pipe Flanges: AWWA C207 for standard steel flanges of pressure class corresponding to pipe class.
9. Pipe lengths: Provide pipe sections in standard lengths with minimum length of 16 feet and maximum length of 25 feet, and as indicated on approved shop drawings or approved by Project Manager. Gasketed joints are allowed on standard lengths of pipe. Non-standard pipe lengths must be approved by Project Manager and joints must be welded as specified herein to achieve equal to or greater than standard pipe length before gasketed joints can be used. Internally and externally mark pipe section with durable marking to show location and pipe pressure.
10. Hydrostatic Test of Cylinder: AWWA C301, Section 4.6.4.3, at point of manufacture. Hold test for minimum 2 minutes for thorough inspection of cylinder. Repair or reject cylinders revealing leaks or cracks.
11. Transport fittings 42 inches in diameter and larger with end caps and stulls. Remove end caps just prior to installation. Remove stulls after completion of backfill operation.
12. Provide radius of curve as indicated on Plans unless approved by Program Manager. Make curves and bends by deflecting joints, by use of beveled joints, or by combination of two methods, unless otherwise indicated on Plans.

Do not exceed deflection angle recommended by pipe manufacturer. Provide beveled pipe sections of standard length used in curved alignment, except when shorter sections are required to limit radius of curvature. In such case provide sections throughout curve of substantially equal length.

13. When manufacturing straight pipe sections manual welding is allowed for following:
  - a. Tack welding of coils and plates during continuous pipe making process.
  - b. Rewelding and repairing structural defects in plate and automatic machine welds.
  - c. Attaching new coil of steel to previous coil.
14. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe. Locate unique identifying mark minimum of 5 feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.
15. Prior to arrival on project site, identify pipe sections within limits of thrust restraint with permanent, brightly colored, and highly visible markings on outer pipe coating as approved by Project Manager.

**B. Prestressing Wire**

1. General
  - a. Conform to requirement of ASTM A648, AWWA C301 and this specification.
  - b. Furnish test results from independent manufacturer (i.e., manufacturer with no legal or financial ties to pipe manufacturer). Tests must have been performed within 12 months prior to submittal or when supplier changes.
  - c. Test foreign manufactured wire by local independent laboratory.
  - d. Prestressing wire surface temperature: Not more than 360 degrees at any point in drawing process. Audit surface temperature of wire throughout length of wire drawing process daily for each working shift producing ASTM A648 wire.
  - e. Do not use wire with visible pitting or rust that cannot be wiped off.

- f. Do not use wire that fails, for no observable mechanical reason other than tension force, during circumferential wrap. Do not splice, but reject this section of wire.
  - 2. Perform mechanical tests per AWWA C301 - Steel Reinforcement except as modified below:
    - a. Retest coil for which failed torsion test sample has radial, spiral (that is, longitudinal) split visible to unaided eye or evidenced by abrupt offset in wire surface detectable with fingernail.
    - b. Test sample, for mechanical requirements, from 1 of each 10 consecutively produced coils or fraction thereof in each lot. Pipe manufacturer to establish procedures so samples are randomly selected from entire length of wire coils.
  - 3. Perform hydrogen embrittlement sensitivity testing on samples of prestressing wire in accordance with ASTM A648 and A1032. Test one set of pre-qualified samples for each anticipated wire manufacturing source anticipated by pipe manufacturer for project. Perform tension, wrapping, and torsion on wire samples. Perform pre-qualification testing prior to pipe manufacturing and for each source of supply for wire. Do not use wire failing to conform to test requirements of specification. Acceptance criteria are according to ASTM A641, S1, and AWWA C301 4.4.8.1. Utilize only wire that meets both of following:
    - a. Passed aforementioned test.
    - b. Manufactured from same source and manufacturing procedures.
- C. Grout for Joints and Special Application
  - 1. Joint Grout
    - a. Cement Grout Mixture: One part cement to two parts of fine, sharp clean sand. Mix interior joint mortar with as little water as possible until very stiff but workable. Mix exterior joint mortar with water until it has consistency of thick cream.
    - b. Water: Potable water with total dissolved solids less than 1000 mg/l; ASTM D512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D1293 pH greater than 6.5. Use potable water with 250 ppm limit on chlorides and sulfates.
    - c. Portland Cement: ASTM C150/C150M, Type I or II. Provide one type of cement for entire project.
    - d. Sand:

- 1) Interior joints: ASTM C35 fine graded plaster sand.
- 2) Exterior joints: ASTM C33/C33M natural sand with 100 percent passing No. 16 sieve.
- e. Mix cement grout to specific gravity of 19 lb/gallon or greater as measured by grout/slurry balance. Use grout/slurry balance manufactured by Baroid or approved equal. Perform test in presence of and at request of Project Manager. Add additional cement grout or water to mixed cement grout to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.
2. Provide approved Nonshrink Grout for Special Applications, Patches, and Repairs.
  - a. Conform to requirements of ASTM C1107/C1107M REV AC1107/C1107M REV A, Nonshrink Grout.
  - b. Pre-blended factory-packaged material manufactured under rigid quality control.
  - c. Contain non-metallic natural aggregate, be non-staining and non-corrosive.
  - d. Meeting NSF/ANSI 61 Standard suitable for use in contact with potable water supply.
  - e. Exterior: Highly flowable to fill joint wrapper without leaving voids or trapped air. Interior capable of being placed with plastic consistency.
  - f. Non-bleeding and non-segregating at fluid consistency.
  - g. Contain no chlorides or additives which may contribute to corrosion of prestressed concrete cylinder pipe.
  - h. Free of gas-producing, gas-releasing agents.
  - i. Resist attack by oil or water.
  - j. Mix, place, and cure in accordance with manufacturer's recommendations. Upon 72 hours notice, provide services of qualified representative of nonshrink grout manufacturer to aid in use of product under job conditions.
  - k. Mix non-shrink grout to specific gravity of 17.7 lb/gallon or greater as measured by grout/slurry balance. Use grout/slurry balance manufactured by Baroid or approved equal. Perform test in presence of

and at request of Project Manager. Add additional cement grout or water to bring mix to proper moisture content or specific gravity. Discard grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

1. Compressive strength: ASTM C1107/C1107M REV AC1107/C1107M REV A 2,500 psi minimum 7-day unconfined; 5,000 psi minimum 28-day unconfined.
3. Finished surface of lining and interior joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat, and uniform-appearing finish.
4. Joint Wrapper: Minimum width of 9 inches for 33-inch diameter and smaller; minimum width of 12 inches for diameters greater than 33-inch hemmed at edge to allow threading with minimum 5/8-inch wide steel strap. Provide minimum 6-inch wide wire Ethafoam strip sized, positioned, and sewn circumferential in center of wrapper.

D. Cathodic Protection

1. Connect each joint of pipe with bonding straps or approved devices to maintain continuity of current. Provide bonding straps free of foreign material.
2. Electrically isolate water line from other connections. Use insulating type joints or nonmetallic pipe unless otherwise indicated on Plans.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Conform to requirements of Section 02511 – “Water Lines”. Do not install pipe without approved lay schedule.
- B. Manufacturer shall make available services of representative, throughout project duration when deemed necessary by Project Manager, to advise aspects of installation including but not limited to handling, storing, cleaning and inspecting, coatings and linings repairs, and general construction methods affecting pipe.
- C. Bedding and Backfilling:



1. Conform to requirements of Section 02317 – “Excavation and Backfill for Utilities” and this specification.
  2. Align pipe at proper grade prior to joint connection and do not shift after jointing operation has been completed.
  3. Do not move trench support system (trench safety system) once bedding material is compacted.
  4. Excavate outside specified trench section for bell holes, and for spaces sufficient to permit removal of slings. Provide bell holes at proper locations for unrestricted access to joint. Form bell holes large enough to facilitate joint wrapping and to permit visual examination of process. Enlargement of bell holes as required or directed by Project Manager. Subsequent backfilling thereof will not be considered as authorized additional excavation and backfill. Backfill bell holes and spaces to satisfaction of Project Manager.
  5. Remove blocking after placing sufficient backfill to hold pipe in position.
  6. Use cement-stabilized sand in areas of trench excavation 16 feet and greater, as bedding material up to springline of pipe.
- D. Follow nonshrink grout manufacturer’s specifications for nonshrink grouting.
- E. Deviation of installed pipe in any one pipe section from line and grade shown on approved shop drawing layout shall not exceed 2 inches from grade and 3 inches from line. No deviation from line and grade at contact interfaces are allowed.
- F. Install each pipe section in sequence identified on lay schedule. Deviations from lay schedule sequence shall be approved by Project Manager and denoted on final lay schedule.
- G. Use adequate surveying methods, procedures and employ competent surveying personnel to ensure pipe sections are laid to line and grade and within stipulated tolerances. Measure and record, in form approved by Project Manager, in-place survey data for pipe laid each day and submit copy of data to Project Manager at end of that day. Survey data to include unique pipe number, deflection angle at pipe joint and whether beveled ends were used, invert elevation at pipe joint, deviation of joint from project line, deviation of joint from project grade, inside pipe joint lap measured at top, bottom, and at springline (each side).
- H. Static Electricity:
1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.
  2. Electrically test where required after installation of pipeline is complete.

I. Closures and Approved Pipe Modifications

1. No modifications of standard pipe for closures will be permitted in field. No field cutting of pipe or exposure of prestressed wire is permitted without written approval from Project Manager.
2. Pipe manufacturer's representative and Project Manager to entirely witness closures and approved pipe modification efforts.
3. Provide minimum lap of 4 inches between member being joined and end of butt strap. Weld on both interior and exterior, unless otherwise approved by Project Manager.
4. Provide full circumferential welds on joints required to be welded. Employ independent certified testing laboratory, approved by Project Manager, to perform weld tests on field welds. Include cost of testing in contract unit price for water line. Use magnetic particle test method for lap welds or x-ray methods for butt welds, for 100 percent of joint welds. Maintain records of tests. When defective weld is revealed, repair defective weld, and retest. Use wire and flux from same manufacturer throughout entire project.
5. Fill wrapper in field and allow excess grout water to seep out. Refill wrapper as necessary. When joint mortar level has stabilized and begun to mechanically stiffen, lap Ethafoam wrapper over top of joint, and secure in place.
6. Stretch test each gasket splice to twice its unstretched length and inspect for defects.

3.04 REPAIR/RESTORATION

A. Visible Cracks

1. No visible cracks longer than 6 inches, measured to be within 15 degrees of line parallel to pipe longitudinal axis, are permitted except:
  - a. In surface laitance of centrifugally cast concrete,
  - b. In sections of pipe with steel reinforcing collars or wrappers, or
  - c. Within 12 inches of pipe ends.
2. Repair interior lining cracks that exceed 1/16-inch (0.0625 inches) wide.
3. Reject pipe with exterior coating cracks that exceed 0.01 inches wide.
4. Immediately remove pipe from site when pipe has cracks exceeding limitations and cracks are not repairable.

B. Field Repair Procedures for Coating/Lining

1. Areas less than or equal to 6 inches in diameter: Patch honeycomb and minor defects in concrete surfaces with non-shrink grout conforming to Section 2.02.C.2. Use only manual or small (low pressure) air chisels to chip away mortar coating or lining. Cut out unsatisfactory material and replace with nonshrink grout, securely bonded to existing coating or lining. Finish junctures between patches and existing concrete as inconspicuous as possible. Strike off nonshrink grout flush with surrounding surface after patch has stiffened sufficiently to allow for greatest portion of shrinkage. Finish surface in accordance with lining requirements.
2. Pipe with defective coating areas greater than 6 inches in diameter cannot be used. Immediately remove pipe from project.
3. Reject pipe when steel cylinder is dented while making field repair. Immediately remove pipe from project.

3.05 – 3.10 NOT USED

END OF SECTION

Section 02511

WATER LINES

PART 1 GENERAL

1.01 SUMMARY

This Section includes specifications that identify requirements for both small diameter water lines (20 inches and smaller) and large diameter water lines (24 inches and larger). When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for water lines installed by open-cut including pipe offset sections or within limits of Potentially Petroleum Contaminated Area (PCCA) is on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation.
  - a. Mains: Measure along axis of pipe and include fittings and valves.
  - b. Branch Pipe: Measure from axis of water line to end of branch.
2. Payment for "Furnish and Install by Trenchless Construction" is on linear foot basis for each size of carrier pipe installed and includes all costs for the installation of water line by dry auger, slurry auger, directional drill or tunnel method. No extra payment will be made for the cost of a primary liner if necessary to facilitate the Contractor's trenchless method. Unless specified on the Plans, the choice of trenchless method is at the Contractor's discretion.
3. Payment for "Furnish and Install by Trenchless Construction with Primary Liner" is on linear foot basis for each size of carrier pipe and includes all cost for the installation of water line inside primary liner by dry auger, slurry auger, or tunnel method. Unless specified on the Plans or prohibited elsewhere in the specifications, the choice of primary liner system and trenchless method is at the Contractor's discretion. Partial payments will be made as measured according to the schedule provided in Section 02517 – "Water Line in Tunnel".
4. Payment for interconnection is on lump sum basis for each interconnection identified on Plans. Payment will include tapping sleeve and valves piping, connections and other related Work necessary for construction as shown on Plans or specified herein.
5. Payment for removal of existing internal elliptical or dished head plug is on unit price basis for each internal elliptical or dished head plug removed. Payment will include deletion of plug, drainage or dewatering of water lines, repair of damaged linings, rechlorination and items incidental to operation.
6. Payment for plug and clamp is on a unit price basis for each size of pipe.

7. Payment for drainline connection with service manhole is on unit price basis for each drainline shown on Plans. Payment includes valve, access manhole, and connection.
  8. Payment for access manway with service manhole is on unit price basis for each access manway shown on Plans. Payment includes valve and access manhole.
  9. When directed by Project Manager to install extra fittings as required to avoid unforeseen obstacles, payment will be based on the following:
    - a. Each extra fitting requested by Project Manager and delivered to jobsite will be paid according to unit price for "Extra Fittings in Place."
    - b. Payment will include and be full compensation for items necessary for installation and operation of water line.
  10. Payment for pipe, pipe support structures, including pipe guards will be paid on a linear foot basis for each aerial crossing. Payment includes related Work performed in accordance with related Sections.
  11. No separate payment is to be made for pavement removal or replacement of surface improvements for augering, tunneling, or other trenchless methods of installation unless otherwise indicated in the Contract Documents.
  12. 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 REFERENCES

- A. ANSI A21.11/AWWA C111 –Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings.
- B. ANSI/NSF Standard 61 – Drinking Water System -Health Effects.
- C. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
- D. ASTM A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- E. ASTM A536 – Standard Specification for Ductile Iron Castings.
- F. ASTM B21/B21M – Standard Specification for Naval Brass Rod, Bar, and Shapes.
- G. ASTM B98/B98M – Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
- H. ASTM B301/B301M – Standard Specification for Free-Cutting Copper Rod, Bar, Wire, and Shapes.

- I. ASTM B584 – Standard Specification for Copper Alloy Sand Castings for General Application.
- J. ASTM E165/E165M – Standard Practice for Liquid Penetrant Examination for General Industry.
- K. ASTM E709 – Standard Guide for Magnetic Particle Testing.
- L. ASTM F1674 – Standard Test Method for Joint Restraint Products for Use with PVC Pipe.
- M. AWWA C206 –Field Welding of Steel Water Pipe.
- N. AWWA C207 –Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches.
- O. AWWA C217 - Petrolatum and Petroleum Wax Tape Coatings for the Exterior of Connections and Fittings for Steel Water Pipelines
- P. NACE SP0274 – High-Voltage Electrical Inspection of Pipeline Coatings.
- Q. NACE SP0188 – Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- R. ISO 9001: 2015 or latest - Quality Management Systems – Requirements
- S. City of Houston Spec 2558

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Conform to submittal requirements of applicable Section for type of pipe used.
- C. Photographs: Submit photographs conforming to requirements of Section 01321 – “Construction Photographs” prior to commencement of construction.
- D. Submit critical location report meeting the requirements of Section 02317 – “Excavation and Backfill for Utilities”.
- E. Submit Lone Star notification transmittal number prior to beginning excavation.
- F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:
  - 1. Disinfection; not to exceed 4,000 linear feet per section.
  - 2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.
  - 3. Site restoration; not to exceed limits specified; sequence in order of

disturbance.

- G. For water lines to be field welded, submit proof of certification of field welders per AWWA C206. Indicate certified procedures and position each welder is qualified to perform. Provide documentation of the most recent weld qualification test date and continuity of use in each process for which the welder or welding operator is required.

1.05 RELATED REQUIREMENTS

- A. Section 01110 – “Summary of Work”
- B. Section 01270 – “Measurement and Payment”
- C. Section 01321 – “Construction Photographs”
- D. Section 01330 – “Submittal Procedures”
- E. Section 01740 – “Restoration of Site”
- F. Section 02317 – “Excavation and Backfill for Utilities”
- G. Section 02320 – “Utility Backfill Materials”
- H. Section 02425 – “Tunnel Excavation and Primary Liner”
- I. Section 02477 – “Augering Pipe and Conduit”
- J. Section 02501 – “Ductile Iron Pipe and Fittings”
- K. Section 02502 – “Steel Pipe and Fittings”
- L. Section 02506 – “Polyvinyl Chloride Pipe”
- M. Section 02507 – “Prestressed Concrete Cylinder Pipe”
- N. Section 02514 – “Disinfection of Water Lines”
- O. Section 02515 – “Hydrostatic Testing of Pipelines”
- P. Section 02517 – “Water Line in Tunnel”
- Q. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”
- R. Section 02528 – “Polyethylene Wrap”
- S. Section 02588 – “Cleaning and Television Inspection [City of Houston Standard Specification]”
- T. Section 02613 – “Bar-Wrapped Steel Cylinder Pipe”
- U. Section 16061 – “Joint Bonding and Electrical Isolation”
- V. Section 16062 – “Corrosion Control Test Stations”

1.06 – 1.13 NOT USED

**PART 2 PRODUCTS**

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

**A. Pipe Materials**

1. Install pipe materials which conform to following:
  - a. Section 02501 – “Ductile Iron Pipe and Fittings”: For pipe sizes 6-inch in diameter and larger.
  - b. Section 02502 – “Steel Pipe and Fittings”: Use limited to above ground piping within plant sites and aerial crossings, in pipe sizes 20-inch diameter and smaller. Piping to be welded steel pipe with flange or approved restraint joint connections, unless otherwise shown on Plans.
  - c. Section 02506 – “Polyvinyl Chloride Pipe”: For pipe sizes 30-inch in diameter and smaller only.
  - d. Section 02507 – “Prestressed Concrete Cylinder Pipe”: For pipe sizes 20-inch in diameter and larger.
  - e. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”: For pipe sizes 24-inch in diameter and larger.
  - f. Section 02613 – “Bar-Wrapped Steel Cylinder Pipe”: For pipe sizes 20-inch in diameter through 60-inch.
2. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.
3. Type of pipe materials used is Contractor’s option unless specifically identified on the Plans. The type of pipe material used for a certain water line size must be the same material throughout the project for that specific size unless otherwise identified on the Plans.
4. Provide minimum of  $\frac{3}{8}$  inch inside joint recess between ends of pipe in straight pipe sections.
5. Pipe Manufacturer: Performance history shall be minimum 5 years of successful field installations with proposed pipe diameter and proposed type of pipe joint. In absence of 5-year performance history for proposed pipe diameter, the following items shall be required for review by Project Manager prior to approval:
  - a. Quality Assurance Program. Submit certified quality assurance program addressing all aspects of pipe manufacturing process, including coating and lining applications. Certified program shall be



ISO 9001; 2015 or other equivalent industry standard nationally recognized program.

- b. Hydrostatic Joint Test. Perform hydrostatic test of proposed joint at proposed pipe diameter in presence of Project Manager. Test duration shall be minimum 8 hours at 150 psi with no leakage, with pipe cylinder deflected at joint to 3 percent of nominal diameter, with maximum allowable joint engagement deflection.
- c. Provide minimum four (4) weeks' notice to Project Manager for hydrostatic joint test. Submit test procedures to Project Manager for approval.

Project Manager's decision as to acceptability of joint is final.

**B. Restrained Joints**

- 1. Ductile-Iron Pipe: See Section 02501 – "Ductile Iron Pipe and Fittings".
- 2. PVC Pipe: See Section 02506 – "Polyvinyl Chloride Pipe". Perform hydrostatic testing in accordance with ASTM F1674.
- 3. Prestressed Concrete Cylinder Pipe, Bar-Wrapped Pipe, and Steel Pipe: Welded joints (see paragraph 3.03.G.3).
- 4. As an alternative to pipe with an integral restrained joint system, restrained joint fittings may be provided where required on DIP and PVC pipe meeting the following requirements:
  - a. Restraint devices: Manufacture of high strength ductile iron, ASTM A536. Working pressure rating twice that of design test pressure.
  - b. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.
- 5. Ductile Iron Pipe in augered holes, provide restrained joints that are integral to both the bell and spigot ends, and do not extend beyond or increase the outside diameter of the bell.

**C. Couplings and Appurtenances for Large Diameter Waterline**

- 1. Flexible (Dresser-type) Couplings.
  - a. Install where shown on Plans or where allowed by Project Manager 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.
  - b. For steel pipe; sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.
  - c. Provide approved flanged adapter couplings for steel pipe.

- d. Use Type 316 stainless steel bolts, nuts, and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of bitumastic 300m as manufactured by Carboline or approved equal, or coat entire coupling with Denso petrolatum or approved equal.
- 2. Flap Valves: Provide on discharge of manhole drainline as shown on Plans.
  - a. Body and Flap: ASTM A126-B cast iron.
  - b. Seats: ASTM B21/B21M-CA482 or ASTM B301/B301M-CA145 bronze.
  - c. Resilient Seat: Buna-N.
  - d. Hinge Arms: ASTM B584-CA865 high tensile bronze.
  - e. Hinge pins: ASTM B98/B98M-CA655 silicon bronze.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

#### 3.01 GENERAL / MANUFACTURER(S) (NOT USED)

#### 3.02 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.
- C. Lay pipe to lines and grades shown on Plans.
- D. Confirm that 9 feet minimum separation from gravity sanitary sewers and manholes or separation of 4 feet minimum from force mains as specified in this Section in all directions unless special design is provided on Plans.
- E. Where above clearances cannot be attained, and special design has not been provided on Plans, obtain direction from Project Manager before proceeding with construction.
- F. Inform Project Manager if unmetered sprinkler or fire line connections exist which are not shown on Plans. Make transfer only after approval by Project Manager.
- G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing two pipe installation crews shall be permitted, unless otherwise approved by Project Manager.
- H. CONTRACTOR is responsible for handling necessary installations and removal of chlorination and testing taps and risers.
- I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in OSHA 29 CFR 1926.1101.

- J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe. Locate unique identifying mark minimum of 5 feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.
- K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.
- L. Do not remove plugs or clamps during months of peak water demands; June, July, and August, unless otherwise approved by Project Manager.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Handling:
  - 1. Place pipe along project site where storm water or other water shall 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 lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be 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.
    - e. Place pipe on timbers, tires or soil berms at the jobsite. Do not place pipe directly on the ground.

6. Repair damage to pipe or protective lining and coating before final acceptance.
  7. For cement mortar lined and coated steel pipe and PCCP, permit no visible cracks wider than 1/16 except
    - a. In surface laitance of centrifugally cast mortar.
    - b. In sections of pipe with steel reinforcing collars or wrappers.
    - c. Within 12 inches of pipe ends.
  8. Repair pipe with visible cracks that exceed project specifications. If cracks cannot be repaired to specification remove from project site.
- B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing, or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.
- C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.
- D. Earthwork
1. Conform to applicable provisions of Section 02317 – “Excavation and Backfilling for Utilities”, Section 02425 – “Tunnel Excavation and Primary Liner”, and Section 02447 – “Augering Pipe and Conduit”.
  2. Bedding: Use bedding materials in conformance with Section 02320 – “Utility Backfill Materials”.
  3. Backfill: Use bank run sand or earth or native soil as specified in Section 02320 – “Utility Backfill Materials”. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.
  4. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density. Water tamping is not allowed.
- E. Pipe Cutting
- Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Project Manager. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.
- F. Piping Installation
1. General Requirements:
    - a. Lay pipe in subgrade free of water.

- b. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
  - c. Properly form bedding to fully support bell without wedging or blocking up bell.
  - d. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of 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.
  - e. Auger Construction: Install pipe in augers in accordance with Section 02447 – “Dry and Slurry Augering of Pipe and Conduit”.
  - f. Tunnel Construction: Install pipe in tunnels in accordance with Sections 02425 – “Tunnel Excavation and Primary Liner” and 02517 – “Water Line in Tunnel”.
  - g. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.
- 2. Install pipe continuously and uninterrupted along each street on which Work is to be performed. Obtain approval of Project Manager prior to skipping any portion of Work.
  - 3. Before assembling couplings, lightly coat pipe ends and outside of gaskets with pipe lubricant, cup grease or liquid vegetable soap to facilitate installation. 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.
  - 4. Perform critical location Refer to Section 02317 – “Excavation and Backfill for Utilities” for additional requirements at critical locations.
  - 5. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Plans shall not exceed 0.10 feet. Measure and record “as-built” horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.
  - 6. Assessment of deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection or similar average measurements will not be deemed as meeting intent of standard. Refer to pipe material specifications for maximum allowable pipe deflection.
  - 7. Laying Large Diameter Water Line

- a. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.
  - b. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Project Manager. No additional payment will be made for higher class of pipe or improved bedding.
  - c. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.
  - d. Perform holiday test to detect coating voids in accordance with NACE SP0274.
  - e. Repair detected holidays in accordance with manufacturer's recommendations.
  - f. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
  - g. Prior to proceeding with critical tie-ins submit sequence of Work based on findings from "critical location" effort.
8. Perform following additional procedures when working on plant sites.
- a. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Project Manager. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Project Manager agrees key personnel, equipment, and materials are on hand to complete Work.
  - b. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.
  - c. Do not proceed with connections to existing piping and identified critical stages of Work unless approved by Project Manager.
  - d. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Project Manager.
  - e. Perform critical stages of Work identified on Plans at night or during low water demand months as specified in Section 01110 – "Summary of Work".
  - f. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.

- g. Submit to Project Manager Lone Star Notification transmittal number prior to beginning excavation.
  - h. Before each “dig” with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within 1 foot to existing piping by hand methods.
  - i. Provide 72 hour notice to pipe manufacturer’s representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.
  - j. Provide field surveyed (horizontal and vertical elevations) “as-builts” of new construction and existing underground utilities encountered. Submit in accordance with Section 01330 – “Submittal Procedures”.
  - k. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Project Manager by noon on Thursday of week. Contact person must be accessible during weekend, have cell phone, and be authorized to make emergency decisions.
9. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide a minimum of 2 weeks notice prior to shutting down existing water line.

**G. Joints and Jointing**

- 1. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe, PVC, Steel, and DIP:
  - a. 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.
  - b. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.
  - c. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
  - d. After 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.
  - e. Where preventing movement of pipe is necessary due to thrust, use restrained joints as shown on Plans.
    - 1) Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.

- 2) Do not include passive resistance of soil in thrust restraint calculations.
- f. Provide means to prevent full engagement of spigot into bell in accordance with Paragraph 2.02.A.4. For PVC pipe installed by trenchless, means may consist of an approved bell insertion protection system. Use feeler gauge to verify water-tightness of each steel or PCCP/Bar Wrapped pipe joint prior to application of joint grout. Perform feeler gauge test from interior of pipe, immediately after installation and after backfilling and compaction. Perform feeler gauge test in accordance with manufacturer's recommendations to determine if the joint is within tolerance. Provide results to Project Manager. Notify Project Manager immediately when a joint is found to be out of tolerance or fails feeler gauge test, and submit repair plan for approval by Project Manager.
2. Flanged joints where required on concrete cylinder pipe, bar wrapped pipe, ductile iron pipe, or steel pipe:
  - a. AWWA C207. 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.
  - b. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions. In PPCA areas, provide Viton (FKM) type gaskets, or approved equal, for water lines and appurtenances requiring gaskets.
  - c. Provide ASTM A193 Grade B7 high strength steel stud bolts with ASTM A194 heavy hex nuts. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Denso petrolatum based tape as manufactured by Carboline or approved equal for all exposed portions of nuts, bolts, and pipe.
  - d. Full length bolt isolating sleeves and washers shall be used with flanged connections.
  - e. For in-line flange joints 30 inches in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, Type E LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal conforming to ANSI A21.11 mechanical joint gaskets. For in-line flange joints sized between 12 inches in diameter and greater and 24 inches in diameter and smaller, provide Phenolic PSI with nitrite seal, Type E LineBacker gasket as manufactured by Pipeline Seal and Insulator, Inc., or approved equal conforming to ANSI A21.11 mechanical joint gaskets.



3. Welded joints (concrete cylinder pipe, bar wrapped pipe, steel pipe):
  - a. Prior to starting Work, provide certification of qualification for welders employed on project for type of Work procedures and positions involved.
  - b. Joints: Comply with AWWA C206 for welded joints. 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. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-inch and smaller.
  - c. For PCCP and bar wrapped, furnish welded joints with trimmed spigots and interior welds for 36-inch and larger pipe.
  - d. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to  $\frac{3}{4}$  inch as long as 1½-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.
  - e. Align piping and equipment so that no part is offset more than  $\frac{1}{8}$  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  $\frac{1}{16}$  inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.
  - f. 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.
  - g. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.
  - h. Deposit metal in successive layers to provide at least two passes or beads for automatic welding and three passes or beads for manual welding in completed weld.
  - i. Deposit no more than  $\frac{1}{4}$  inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag, or flux.
  - j. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless Work is properly protected.

- k. Make tack weld of same material and by same procedure as completed weld.
- l. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.
- m. Employ an independent certified testing laboratory, approved by Project Manager, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of all test reports to Project Manager for review. Project Manager has final decision as to suitability of all welds tested.

Weld acceptance criteria:

- 1) Conduct in accordance with ASTM E165/E165M- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.
- 2) Examine welded surfaces for the following defects:
  - a) Cracking.
  - b) Lack of fusion/penetration.
  - c) Slag which exceeds one-third (t) where (t) equals material thickness.
  - d) Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width.
  - e) Relevant linear indications in which length of linear indication exceeds three times its width.
  - f) Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge.
- n. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.
- o. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.
- p. Scaffolding: Do not drag scaffolding or other items along interior of

pipe.

- q. For steel pipe 30-inch diameter and greater, after welding of joint, provide mortar coating for internal joint surfaces of mortar lined pipe, and epoxy for internal surfaces of epoxy lined pipe.
4. Harnessed joints (concrete cylinder pipe, bar wrapped pipe):
- a. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.
  - b. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum ½-inch joint recess. Use joint "diapers" minimum of 12 inches wide.
  - c. For field adjustments with deflections beyond manufacturer's recommendations:
    - 1) Field trim spigot.
    - 2) Do not engage ring.
  - d. Harnessed joints are not permitted in areas defined on Plans as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.
  - e. Install harness type joints including snap rings at straight sections of pipe.
5. Restrained Joints
- a. For existing water lines regardless of diameter, and new water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks unless otherwise shown on Plans.
  - b. Thrust restraint lengths shown on Plans are minimum anticipated lengths. These lengths are based on deflections indicated and on the use of the following pipe materials as the basis of design: Dielectric coated steel pipe for pipe sizes 30 inches and larger, or PVC pipe for pipe sizes 30- inches and smaller. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Pipe manufacturer or representative to perform thrust restraint calculations in accordance with latest revision of applicable standard for pipe material chosen. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Project Manager. Make adjustments in thrust restraint lengths at no additional cost.
  - c. Passive resistance of soil will not be permitted in calculation of thrust restraint.

- d. Include buoyance conditions for soil unit weight when computing thrust restrained calculations.
  - e. For 16-inch lines and larger 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 Plans. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.
  - f. Installation
    - 1) Install restrained joints mechanism in accordance with manufacturer's recommendations.
    - 2) Examine and clean mechanism; remove dirt, debris and other foreign material.
    - 3) Apply gasket and joint NSF 61 FDA food grade approved lubricant.
    - 4) Verify gasket is evenly seated.
    - 5) Do not over stab pipe into mechanism.
  - g. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
  - h. Place 2500 psi concrete conforming to Section 03315 – "Concrete for Utility Construction", for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.
6. Joint grout (concrete cylinder pipe, bar wrapped pipe, mortar coated steel pipe):
- a. Mix cement grout mixture by machine except when less than ½ cubic yard is required. When less than ½ cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.
  - b. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without rettempering. Use grout for filling grooves of such consistency that it shall adhere to ends of pipe.
  - c. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.
  - d. Follow established procedures for hot and cold weather concrete

- placement.
- e. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.
  - f. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.
  - g. Interior joints for pipe 24 inches and smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Project Manager for 20-inch pipe and smaller.
  - h. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout.
  - i. Remove and replace improperly cured or otherwise defective grout.
  - j. Strike off grout on interior joints and make smooth with inside diameter of pipe.
  - k. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply flexible sealer, such as Flex Protex by Gifford-Hill America, or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.
  - l. Interior joints for water lines 30 inches and larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each Work day. Interior joints will be inspected by Project Manager by video inspection services and/or by physical inspection. Video inspection shall be in accordance with section 02558 – "Cleaning and Television Inspection [City of Houston Standard Specification]". During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.

- m. Work which requires heavy equipment to be over water line, must be completed before mortar is applied to interior joints.
  - n. Do not apply grout to joints that are out of tolerance until acceptable repairs are made.
7. Large diameter water main joint testing: In addition to testing individual joints with feeler gauge approximately ½ inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which shall help ensure watertight installation prior to backfilling. These tests shall be made at no additional cost.
8. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Project Manager. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.
- a. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Plans.
  - b. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
  - c. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
  - d. Replace, repair, or reapply coatings and linings as required.
  - e. Assessment of deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
  - f. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.
9. Closures sections and approved field modifications to steel, concrete cylinder pipe, bar wrapped pipe and fittings:
- a. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; ⅜ inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than ¾ inch.
  - b. Fill exposed interior and exterior surfaces with nonshrink grout.
  - c. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.
  - d. For large diameter water lines, provide minimum overlap of 4 inches on

each side of butt-strap closures.

**H. Cathodic Protection Appurtenances**

1. Where identified on, modify pipe for cathodic protection as detailed on and specified. Unless otherwise noted, provide isolation kits at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on. See Specification Section 16061 – “Joint Bonding and Electrical Isolation”.
2. At all cased crossings, install casing spacers and end seals as shown on. See Specification Section 16061 – “Joint Bonding and Electrical Isolation”.
3. Ensure electrical isolation between carrier pipe and primary tunnel liner prior to backfill of tunnel shaft.
4. Install test stations as shown on the. See Specification Section 16062 – “Corrosion Control Test Stations”.
5. Bond joints for pipe installed in tunnel or open cut, except where isolating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Project Manager.
6. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

**I. Securing, Supporting, and Anchoring**

1. Support piping as shown on Plans and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.
2. Where shown on Plans, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Plans, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).
3. Use adequate temporary blocking of fittings when making connections to existing systems and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

**J. Polyethylene Wrap for Ductile Iron Pipe**

Conform to requirements of Section 02528 – “Polyethylene Wrap”.

**K. Disinfection of Water Lines**

Conform to requirements of Section 02514 – “Disinfection of Water Lines”.

**3.04 REPAIR/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 water lines, backfill and surface restoration.
- B. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Section 01740 – “Restoration of Site”. Schedule paving crews so repaving Work shall not lag behind pipe laying Work by more than 1,000 feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

3.05 – 3.06 NOT USED

**3.07 CLEANING**

Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment, and labor for cleaning. Project Manager must inspect water line for cleanliness prior to filling.

**3.08 DEMONSTRATION / TESTING AND INSPECTION**

- A. Field Hydrostatic Tests

Conform to requirements of Section 02515 – “Hydrostatic Testing of Pipelines”.

3.09 – 3.10 NOT USED

**END OF SECTION**



Section 02514

DISINFECTION OF WATER LINES

PART 1 GENERAL

1.01 SUMMARY

This Section includes furnishing and performing of all operations in connection with disinfection of newly installed potable water lines on the initial filling of pipe prior to being placed into service.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for disinfection of water lines under this Section. Include cost in unit price of water lines being disinfected.
2. Refer to Section 01270 - "Measurement and Payment" for unit price procedures.

B. Adjusting Payment for Retesting:

Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction will be charged to Contractor. Charges will be deducted from retainage amounts when construction estimates are processed for final payment.

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. AWWA C651: Disinfecting Water Mains
- B. AWWA C655: Field Dechlorination
- C. Chapter 290 Sub-Chapter D: Rules and Regulations for Public Water Systems [Texas Commission on Environmental Quality (TCEQ)]
- D. Chapter 290 Sub-Chapter F: Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements for Public Water Supply (TCEQ)

- E. Should water lines being disinfected connect to, or be onsite, of water storage facilities, water treatment plants and/or water wells, the following standards shall be used as needed.

1. AWWA C652: Disinfection of Water-Storage Facilities
2. AWWA C653: Disinfection of Water Treatment Plants
3. AWWA C654: Disinfection of Wells

#### 1.04 SUBMITTALS

Submit the following in accordance with Section 01330 – “Submittal Procedures:”

- A. Submit list of chlorination chemicals and disinfection equipment.
- B. Sample and test requirements and include the information as further described under paragraph 3.04 of this Section.
- C. Submit plan and procedures for sample collection and testing as indicated in *Appendix A – “Chlorine Residual Testing”* of AWWA C651 and per the requirements of Chapter 290 Sub-Chapters D and F.

Submit plan for the disposal and dechlorination of heavily chlorinated water as indicated in AWWA C655 and in Section 02990 – “Dechlorination Activities.”

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 - "Testing Laboratory Services"
- D. Section 01755 - “Pipeline Start-Up”
- E. Section 02515 - “Hydrostatic Testing of Pipelines”
- F. Section 02516 - “Flushing of Pipelines”
- G. Section 02516 - “Flushing of Pipelines”
- H. Section 02990 – “Dechlorination Activities”

#### 1.06 – 1.13 (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS (NOT USED)

2.02 MATERIALS

- A. Chlorination chemicals, disinfection equipment, and ancillary materials and equipment necessary for disinfection and dechlorination of the water lines shall be in accordance with AWWA C651 and AWWA C655.

2.03 - 2.04 (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. For large diameter water lines, clean the interior of the water lines and remove any and all foreign matter prior to disinfection and hydrostatic testing. Disinfect all water lines before connecting to water distribution system.
- B. Water and chlorination chemicals for disinfection shall be furnished by the Contractor.
- C. Contractor shall conduct disinfection operations.

3.02 PREPARATION

- A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines.
- B. Use flushing hydrants as needed to complete disinfection of water lines where flushing hydrants are not available on water lines, install temporary blow-off valves as approved by Project Manager and remove upon successful completion of disinfection and testing.
- C. Furnish pump, pipe connections, and necessary apparatus, gauges, and meters. Furnish necessary labor, assistance, and chlorinating agent for disinfection. Prevent admission of contaminated water to previously disinfected lines. If contaminated water is admitted to previously disinfected lines, disinfect those lines at no additional cost.
- D. Slowly fill each section of pipe with water in manner approved by the Project Manager. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.
- E. Backfill excavations immediately after installation of risers or blow-offs.

- F. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to Plans.

### 3.03 DISINFECTION BY CONTRACTOR

- A. The following procedure shall be used for disinfection by Contractor:
  - 1. Disinfecting procedures to be in accordance with the requirements of AWWA C651 and as specified hereinafter. Minimal chlorine dosage to be 100 parts of chlorine per million parts of water.
  - 2. Introduce chlorinating material to water lines in accordance with AWWA C651 Table 4 for the size of pipe indicated.
  - 3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 part per million parts of water.
  - 4. Open and close valves in lines being sterilized several times during contact period.
  - 5. Chemical compound used for sterilizing agent is to be placed in pipes as directed by the Project Manager.

### 3.04 BACTERIOLOGICAL TESTING

- A. After disinfection of water lines is completed, perform bacteriological tests by testing laboratory in accordance with Section 01454 - "Testing Laboratory Services."
- B. Samples are to be taken in accordance with requirements of AWWA C651 and Chapter 290 Sub-Chapters D and F.
- C. Bacterial analysis and other specific test requirements are to be in accordance with AWWA C651 and Chapter 290 Sub-Chapters D and F. Final test results will be submitted for final analysis and approval to the TCEQ. . Locations where samples are taken should be purged prior to taking of test samples.
- D. Acceptance and placement in service will be based on the approval of test results by the TCEQ. If additional tests are required to comply with 290 Sub-Chapters D and F, the Contractor shall develop the procedure that is to be completed in accordance with paragraph 3.03. Additional testing is to be completed at no additional cost to the Owner.
- E. When test results indicate the need for additional disinfection of water lines based upon TCEQ requirements, additional disinfection operations shall be performed by the Contractor.

3.05 DECHLORINATION OF WATER

Dechlorination operations are to be carried out in accordance with requirements of Section 02990 – “Dechlorination Activities.”

3.06 COMPLETION

Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION

Section 02515

HYDROSTATIC TESTING OF WATER LINES

PART 1 GENERAL

1.01 SUMMARY

This Section includes furnishing and performing of all operations in connection with field hydrostatic testing of newly installed water lines..

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate measurement or payment will be made for hydrostatic testing of water lines under this Section. Include cost in unit price of water lines being tested.
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 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. 30 TAC §290.44: Subchapter D: Rules and Regulations for Public Water Systems - Water Distribution [Texas Commission on Environmental Quality (TCEQ)]
- B. AWWA C655: Standard for Field Dechlorination

1.04 SUBMITTALS (NOT USED)

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 - "Testing Laboratory Services"
- D. Section 01755 - “Water Line Start-Up”
- E. Section 02514 - “Disinfection of Water Lines”

F. Section 02516 - "Flushing of Water Lines"

G. Section 02990 – "Dechlorination Activities."

1.06 – 1.13 (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Disinfect water lines prior to hydrostatic testing per requirements of Section 02514 – "Disinfection of Water Lines."
- B. After pipe has been laid and backfilled, except prior to replacement of pavement, newly installed pipe shall be subjected to hydrostatic testing described herein.
- C. Hydrostatically test newly installed water lines before connecting to distribution system.
- D. Water for testing shall be supplied by the Contractor.
- E. Water lines shall be tested between adjacent valves and/or plugs. Sections containing more than two valves or plugs will not be accepted except where valves are located on each branch of a TEE, test TEE with adjacent section of water line. Sequence testing to ensure every valve has been hydrostatically tested.
- F. Conduct hydrostatic tests in presence of the Project Manager and Engineer.

3.02 PREPARATION

- A. Fill each valved section of pipe slowly with water and apply specified test pressure, measured at point of highest elevation, by means of pump connected to pipe.
- B. Furnish, install, and operate pipe connections, pump, meter, and necessary apparatus, gauges and meters necessary for hydrostatic testing.
- C. Furnish necessary labor and assistance for conducting test..
- D. Allow water line to sit a minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.
- E. Expelling air before test:

Before applying specified test pressure, expel air from pipe. To accomplish this, make taps in pipe, if necessary, at points of highest elevation. On completion of tests, taps are to be tightly plugged with brass fittings.

F. Test Pressure:

1. Any section being tested other than those stated below, apply pressure such that, at highest point in section, the minimum pressure is to be 150 pounds per square inch or pressure specified as shown on Plans.
2. Storm Sewer sections passing within 50' of the water well head are to be pressure tested such that, at the highest point in the section, the pressure is to be at 20 pounds per square inch.

G. Begin test by 9:00 a.m. unless otherwise approved by the Project Manager. When a large quantity of water is required to maintain pressure during the test, discontinue testing until cause of water loss is identified and corrected.

H. Duration of Pressure Test:

1. Exposed joints are to be tested for not less than 2 hours with no allowable leakage.
2. Covered joints to be tested for a minimum of 6 hours with no allowable leakage.
3. Durations may vary based on information shown on Plans or as called for by the Project Manager and Engineer.

I. Close valves to lines affected by hydrostatic test in adjacent metering stations during hydrostatic pressure test.

3.03 ALLOWABLE LEAKAGE FOR WATERLINES

A. Leakage Defined:

Leakage is quantity of water supplied into newly installed pipe, or any valved section thereto, necessary to maintain specified leakage test pressure after pipe has been filled with water and air expelled and the specified test pressure has been applied.

B. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

C. Permissible Leakage:

1. For water lines less than 24" in diameter:

Per 30 TAC §290.44, the hydrostatic leakage rate shall not exceed the amount allowed or recommended by formulas found in AWWA C600 and C605. Per

$$L = \frac{SD\sqrt{P}}{148,000}$$



AWWA, leakage is not to exceed that determined from the following formula:

Where L = Quantity of makeup water in gallons per hour

S = Length of the pipe section being tested, in feet; length being tested shall not exceed 3000 feet

D = Nominal diameter of pipe or valve, in inches

P = Average test pressure during the hydrostatic test, in pounds per square inch (psi - gage)

2. For water lines 24" or greater in diameter:

Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.

Length of pipe being tested shall not exceed 5000 feet.

- D. For meter run installation, when Work cannot be isolated and line fails pressure test, visual inspection of Work by the Project Manager and Engineer for leakage during the pressure test may be used to fulfill requirements of this section.

### 3.04 CORRECTION FOR FAILED TESTS

- A. At intervals during test, inspect route of pipe to disclose leakage greater than that specified.
- B. 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 cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.
- C. Contractor shall be required to disinfect failed water lines after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 02514 – "Disinfection of Water Lines."
- D. Repeat test until satisfactory results are obtained.

### 3.05 DECHLORINATION OF WATER

Dechlorination operations are to be carried out in accordance with requirements of Section 02990 – "Dechlorination Activities."

### 3.06 COMPLETION

Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION

Section 02517

WATER LINE IN TUNNELS

PART 1 GENERAL

1.01 SUMMARY

This Section includes handling, transporting, and installing water line in primary liner tunnels, including invert cleanup and blocking and water line in casings that will be backfilled with concrete or grout.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made under this section. Include payment in Unit Price for Section 02511 – “Water Lines”.
2. Payment for installation of water line constructed according to Section 02425 – “Tunnel Excavation and Primary Liner” will be authorized by Project Manager in three parts. Pay estimates for partial payments will be made as measured above according to following schedule:
  - a. 60 percent of installation will be authorized when excavation and primary liner installation is complete.
  - b. 95 percent of installation will be authorized when water line installation and grouting is complete.
  - c. 100 percent of installation will be authorized when section successfully hydrostatically tested.
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.

1.03 REFERENCES

ASME B40.100 - Pressure Gauge and Gauge Attachments.

1.04 SUBMITTALS

- A. Submit work plan including following information in accordance with Section 01330 – “Submittal Procedures”.
1. Method of transporting pipes into tunnel

2. Method of hoisting and positioning pipe in tunnel
  3. Method of jointing and aligning pipe
  4. Method of supporting and blocking pipe
  5. Tunnel ventilation while setting pipe and completing joints, when applicable
  6. Material, equipment and procedures for grout placement and other information required by Section 02431 – “Tunnel Grout”.
- B. Submit results of tunnel primary liner survey in accordance with Paragraph 3.03.E, Tunnel Survey.
- C. Submit results of installed water line survey in accordance with Paragraph 3.03.M, As-built Survey and Installation Tolerances.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02425 – “Tunnel Excavation and Primary Liner”
- D. Section 02431 – “Tunnel Grout”
- E. Section 02447 – “Dry and Slurry Augering of Pipe and Conduit”
- F. Section 02511 – “Water Lines”
- G. Section 03315 – “Concrete for Utility Construction”

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 SYSTEM DESCRIPTION

- A. Procedures
1. Joints: Prepare joints as recommended by pipe manufacturer and in accordance with Section 02511 – “Water Lines”.
  2. Handling: Handle, store, and transport pipe in accordance with pipe manufacturer’s recommendations and to prevent damage to pipe ends, pipe barrel, steel reinforcement, and pipe protective linings.
  3. Grouting: Perform grouting of annular space between water line and tunnel liner to fill voids with grout, without dislocating or damaging pipe.

1.08 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Annular Grout

Specified in Section 02431 – “Tunnel Grout”

B. Concrete

Meeting requirement of Section 03315 – “Concrete for Utility Construction”, Class B concrete.

C. Pipe Material and Fittings

Manufacture and deliver pipe material and fittings as described in Section 02511 – “Water Lines”.

D. Spacers

Unless otherwise noted on Plans, use casing spacers between water line and casing tunnel liner for water lines less than 36 inches in diameter. See Section 02447 – “Dry and Slurry Augering of Pipe and Conduit” for spacer requirements and installation.

## PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Grout in place tunnels for water lines with diameters of 36 inches or greater.

B. When tunnel liner plate is used, grout water line in place regardless of water line diameter.

C. Grout water lines in accordance with Section 02447 – “Dry and Slurry Augering of Pipe and Conduit”, Paragraph 3.03.K Material Applications for Tunnel & Auger Construction.

D. Tunnel Survey

Prior to installing water line in tunnel: Perform survey of tunnel in accordance with Paragraph 3.03.M.2. Verify tunnel has been constructed within specified tolerances for line, grade, and roundness and water line to be placed in tunnel can be placed in

conformance with tolerances specified. Should misalignment of tunnel preclude proper installation of water line, notify Project Manager of proposed correction method. Project Manager will make final decision on acceptability of correction.

E. Pipe Transport in Tunnel

Transport pipe in tunnel for final placement so that no damage occurs to pipe ends or pipe barrel and interior lining or exterior coating due to contact with primary liner or point loading from pipe blocking system. Repair pipe damaged during transport or final placement in tunnel in manner acceptable to Project Manager prior to joining. Remove damaged pipe from tunnel and replace, when directed by Project Manager, at no additional cost.

F. Tunnel Cleanup

1. Remove temporary tunnel utilities, loose material, dirt, and debris prior to pipe placement. Broom clean concrete invert. Control seepage and remove standing water in invert.
2. Temporary construction tracks or pipe skids may be left in place when they do not interfere with alignment of water line, short circuit cathodic protection system, or interfere with final placement of annular grout.

G. Invert Pipe Support

Construct invert pipe support of screeded concrete or other method, as approved, to final grade of outside of water line. Secure invert support to primary liner to prevent movement. Cure concrete support minimum of 48 hours prior to setting pipe. Maintain minimum of 4 inches clearance between outside of water line and primary liner.

H. Joining Pipe in Tunnels

Lay pipe in accordance with pipe manufacturer's recommendations, and as specified in this Section. Join pipe segments so as to properly compress gaskets and allow for correct final positioning of pipe for line and grade. Closely align pipe and bring loosely together by means of hydraulic jacks, locomotives, pipe mobiles, or winches. Once pipes have been loosely joined, pull home by means of hydraulic tugger or other similar methods suitably protecting pipe and joints against damage. Impact joining, such as ramming with locomotives or other mechanical equipment, is not permitted.

I. Blocking Pipe in Tunnel and Bulkheads

1. Develop and submit pipe blocking system that shall prevent water line from floating and deforming beyond specified limits. Loads imposed on pipe, primary liner and surrounding soil during grouting shall be determined by Registered Professional Engineer in State of Texas. Show essential details in

plan for supporting system. Position water line in tunnel to allow minimum of 4 inches of grout to be placed between water line and tunnel primary liner or casing.

2. Prevent pipe from floating during backfill operations by properly installed blocking. Remove and replace segment of pipe which is distorted or moved from final line and grade.
3. Secure blocking in place so that it cannot be dislodged during adjacent pipe laying and during grouting operations.
4. Construct bulkheads of material, compatible with grout, to withstand imposed grout pressure without leakage. Provide bulkheads at frequency to allow completion of grouting in continuous operation and to permit timely removal of pipe and grout which may be needed as result of pipe distortion or movement. Modifications to bulkhead spacing will be reviewed by Project Manager. Provide adequate venting for bulkheads.

J. Annular Grout

1. Fill annular void between water line and tunnel primary liner or casing with grout, in accordance with Section 02431 – “Tunnel Grout”.
2. Delay grouting until all significant differential movement has stopped as determined by monitoring.
3. Test annular grout material, equipment, and procedures in accordance with approved submittal. Perform test on first 200 feet of water line to be backfilled. When grout does not totally fill annular space or other problems occur, correct defects in first test section and adjust method or mix and rerun test on next 200 feet. Repeat procedure as necessary.
4. Placement:
  - a. 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 at grout port continue longer than period of time for mix to take initial set. Locate grout hole spacing and locations according to number of stages necessary to backfill tunnel liner. Do not install another lift until proper set has been attained. Placement procedures shall be approved by admixture or additive manufacturers.
  - b. Equipment - Pumps: Pumping equipment must be of sufficient size and capacity to place grout to distances, velocities and volumes compatible with batching and mixing equipment. Maintain equipment and clean thoroughly each day. No hydrocarbons shall enter pumping chamber.

Under no circumstances shall grout be pumped in excess of 1000 linear feet without prior approval by Project Manager. Pumping test and verification testing of resulting grout quality shall be required for approval.

- c. Slickline: Convey grout to point of placement in clean steel or rubber hoses designed to handle safely pump pressure and volumes during placement. Do not allow hardened grout or concrete to obstruct or coat steel pipe or hose internally.
- d. Grout Connections: Grout connections shall be sized minimum of 2-inch inside diameter, consisting of grout hose attached immediately to pressure gauge. Ensure gauges are in proper working order prior to commencing grouting operations. Gauged pumping pressure shall not exceed water line manufacturer's recommendations. Monitor grout pressure.
- e. Gauges:
  - 1) Type: Instrument oil-filled and attached to saddle-type diaphragm seal (gauge saver) to prevent clogging with grout.
  - 2) Calibration: Certified and calibrated in accordance with ASME B40.1.
  - 3) Range: Provide gauge with 100 percent greater than pipe manufacturer's design collapse pressure.
  - 4) Accuracy: No more than one-half percent error over full range of gauge.
  - 5) Fitting: Attach gauge to valve immediately attached to grout port in tunnel liner. Provide T-fitting in injection line for sampling.
- f. Limit pressure on annular space to prevent damage to pipe or liner. Define limiting and estimated required pressure range. Provide and monitor open ended, high point tap or equivalent vent at bulkhead opposite point of grouting.
- g. Pump grout until grout within 5 percent of specified density discharges from end opposite injection point to ensure grout is not diluted by extraneous water in annulus.
- h. Drilling of access holes from surface to facilitate grouting shall not be allowed.

- i. Communication: There shall be constant communications via telephone between headerman at point of injection and pump, batch plant, and supervisor. Under no circumstance shall grouting continue without continuity of communications.
  - j. The headerman at point of placement shall advise batch plant of variations of density and make corrections as necessary. Record and submit to Project Manager for each days pour variations and corrections.
- 5. Remove bulkheads unless constructed of masonry.
- 6. Repair or replace damage or distortion to water line.
- K. Grouting Joints

Materials and procedures for filling interior joint recesses shall conform to Section 02511 – “Water Lines”.
- L. As-Built Survey and Installation Tolerances
  - 1. Perform as-built survey on installed water line. Determine horizontal and vertical location for invert of each pipe joint.
  - 2. Acceptable tolerances: Within plus or minus 3 inches of horizontal alignment, within plus or minus 2 inches of vertical alignment.
  - 3. Correct pipe section outside acceptable tolerances.

3.04 – 3.06 NOT USED

#### 3.07 CLEANING

Clean interior of pipe after interior work is completed. Remove loose material, dirt, and debris from completed pipeline. Maintain the condition of the pipe free of dirt, water, and other debris after the completion of Work inside the pipe for the internal inspection and until the time that the pipe is ready to be filled for testing and placing in service.

3.08 – 3.10 NOT USED

END OF SECTION



Section 02518

**STEEL PIPE AND FITTINGS  
FOR LARGE DIAMETER WATER LINES**

**PART 1   GENERAL**

**1.01     SUMMARY**

This Section includes large diameter (24 inches and greater) steel pipe and fittings for water lines and pumping facilities.

**1.02     MEASUREMENT AND PAYMENT**

**A.     Unit Prices**

1.     No payment will be made for steel pipe and fittings under this Section. Include cost in unit price for water lines, pumping facilities, and encasement sleeves.
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     REFERENCES**

- A.     AASHTO - Standard Specifications for Highway Bridges.**
- B.     AREMA - Manual for Railway Engineering, Volume II, Chapter 15.**
- C.     ASME Boiler & Pressure Vessel Code Section VIII – Rules for Construction of Pressure Vessels, Division 1.**
- D.     ASTM A36/A36M - Standard Specification for Carbon Structural Steel.**
- E.     ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.**
- F.     ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe.**
- G.     ASTM A139/A139M - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).**

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY STANDARD SPECIFICATION	<b>STEEL PIPE AND FITTINGS FOR LARGE DIAMETER WATER LINES</b>
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- H. ASTM A 1011/A1011M – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- I. ASTM A1018/A1018M – Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- K. ASTM C35 - Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.
- L. ASTM C150/C150M - Standard Specification for Portland Cement.
- M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
- N. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
- O. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- P. ASTM C1107/C1107M REV A - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- Q. ASTM D 512 - Standard Test Methods for Chloride Ion in Water.
- R. ASTM D 1293 - Standard Test Methods for pH of Water.
- S. ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test.
- T. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- U. ASTM D 4752 - Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub.
- V. AWWA C 200 - Steel Water Pipe 6 In. and Larger.
- W. AWWA C 205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe 4 In. and Larger – Shop Applied.
- X. AWWA C 206 - Field Welding of Steel Water Pipe.
- Y. AWWA C 207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In.

**STEEL PIPE AND  
NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY FITTINGS FOR LARGE  
STANDARD SPECIFICATION DIAMETER WATER LINES**

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- Z. AWWA C 208- Dimensions for Fabricated Steel Water Pipe Fittings
- AA. AWWA C 209- Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections, and Fittings.
- BB. AWWA C 210- Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipe and Fittings.
- CC. AWWA C 214- Tape Coating Systems for Steel Water Pipe.
- DD. AWWA C 215 – Extruded Polyolefin Coatings for the Exterior of Steel Water Pipelines
- EE. AWWA C 216- Heat-Shrinkable Cross-Linked Polyolefin Coatings for Steel Water Pipe and Fittings.
- FF. AWWA C 218– Liquid Coating Systems for the Exterior of Aboveground Steel Water Pipelines and Fittings.
- GG. AWWA C222 Polurethane Lining and Coating for Steel Water Pipe
- HH. AWWA C 602- Cement-Mortar Lining of Water Pipelines - 4 In. (100 mm) and Larger.
- II. AWWA C 604 – Installation of Buried Steel Water Pipe – 4 In. and Larger.
- JJ. AWWA M 11 - Steel Pipe-A Guide for Design and Installation.
- KK. NACE RP 0274 – High-Voltage Electrical Inspection of Pipeline Coatings
- LL. SSPC Good Painting Practice, Volume 1.
- MM. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.
- NN. SSPC SP 5 - Joint Surface Preparation Standard: White Metal Blast Cleaning.
- OO. SSPC SP 6 – Joint Surface Preparation Standard: Commercial Blast Cleaning.
- PP. SSPC SP 10 – Joint Surface Preparation Standard: Near-White Blast Cleaning.
- QQ. SSPC VIS 1 – Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.
- RR. NSF/ANSI 61 – Drinking Water System Components – Health Effects
- 1.04 SUBMITTALS
  - A. Conform to requirements of Section 01330 – “Submittal Procedures”.

**STEEL PIPE AND  
NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY FITTINGS FOR LARGE  
STANDARD SPECIFICATION DIAMETER WATER LINES**

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- B. Submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing following:
1. Manufacturer's pipe design calculations and thrust restraint calculations based on AWWA M11, latest edition.
  2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Plans. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (\*.PDF).
  3. Include hot tapping procedure.
  4. Submit certification from manufacturer that design was performed for project in accordance with requirements of this section. Certification to be signed and sealed by professional Engineer registered in State of Texas.
- C. Submit critical location report meeting the requirements of Section 02317 – "Excavation and Backfill for Utilities".
- D. Submit manufacturer's certifications demonstrating that pipe has been hydrostatically tested at factory in accordance with AWWA C 200, Section 5.2.
- E. Submit certification from NACE Certified Coatings Inspector, under supervision of inspector having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected properly repaired.
- F. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding. Submit at least 30 days prior to repair work, procedures detailing shop and field work to be performed. Repair defects such as substandard welds, excessive radial offsets (misalignment), pitting, gouges, cracks, etc.
- G. Submit following for nonshrink grout for special applications:
1. Manufacturer's technical literature including specifications for mixing, placing, and curing grout.
  2. Results of tests performed by certified independent testing laboratory showing conformance to ASTM C1107/C1107M Nonshrink Grout and requirements of this specification.

3. Certification certifying product is suitable for use and contact with potable water.
- H. Submit proof of certification for welders. Indicate certified procedures and position each welder is qualified to perform. Provide documentation of the most recent weld qualification test date and continuity of use in each process for which the welder or welding operator is required
- I. Within 45 calendar days after manufacturing of all pipe, submit affidavit of compliance that materials and Work furnished comply with applicable requirements of referenced standards and these specifications. Make available copy of physical and chemical testing reports.
- J. Within 45 days of manufacturing of all pipe, submit manufacturer's affidavits that coatings and linings comply with applicable requirements of this Section and:
  1. Polyurethane coatings were applied in accordance with manufacturer's recommendation and allowed to cure at temperature 5 degrees above dewpoint.
  2. Mortar coatings and linings were applied and allowed to cure at temperature above 32°F.
  3. Test Results
    - a. Compressive strength (7 and 28 day) test results for mortar coating.
    - b. Hydrostatic testing, magnetic particle, ultra sonic, liquid penetrant, and x-ray weld test reports as required
- K. Prior to start of field-applied cement mortar lining operation, submit comprehensive plan which identifies and describes as minimum:
  1. Equipment used for batching, weighing, mixing transporting and placing mortar.
  2. Qualifications and specific experience of machine operators.
  3. Source and type of cement, pozzolan, sand and admixtures used and certifications from suppliers that materials meet specifications.
  4. Mix proportions to be used and slump limits (max. and min.).
  5. A quality control plan which identifies quality control material tests and documented inspections necessary to ensure compliance with specified requirements.

**STEEL PIPE AND  
FITTINGS FOR LARGE  
DIAMETER WATER LINES**

**NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY**  
**STANDARD SPECIFICATION**

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- L. Submit certification showing calibration within last 12 months for equipment such as scales, measuring devices, and calibration tools used in manufacture of pipe. Each device used in manufacture of pipe is required to have tag recording date of last calibration. Devices are subject to inspection by Project Manager.

**1.05 RELATED REQUIREMENTS**

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02317 – “Excavation and Backfill for Utilities”
- D. Section 02425 – “Tunnel Excavation and Primary Liner”
- E. Section 02502 – “Steel Pipe and Fittings”
- F. Section 02511 – “Water Lines”
- G. Section 02527 – “Polyurethane Coatings on Steel Pipe”
- H. Section 16061 – “Joint Bonding and Electrical Isolation”

**1.06 QUALITY ASSURANCE**

- A. Provide pipe as the product from a single manufacturer who has a minimum of 5-year period manufacturing, and has successfully produced one hundred thousand lineal feet of like diameter, thickness, and coated pipe.
- B. Manufacturer to provide permanent quality control department and laboratory facility capable of performing inspections and testing as required by Specifications. Material testing, inspection procedures, and manufacturing process are subject to inspection by Project Manager. Perform manufacturer’s tests and inspections required by referenced standards and these Specifications, including the following. Correct nonconforming conditions.
  - 1. Steel Plate and Coils: Review mill certifications for conformance to requirements of Specifications; perform physical and chemical testing of each heat of steel for conformance to applicable ASTM standards.
  - 2. Pipe:
    - a. Inspect thickness, circumference, roundness, strength, and size of seam welds (spiral or longitudinal), and squareness of pipe ends to verify compliance with AWWA C 200.
      - 1) Pipe roundness to be within  $\pm 1\%$ .

- 2) Frequency of production weld tests in accordance with AWWA C200 Section 4.10.4.6. Conduct weld tests at a maximum interval of once per 3,000 feet of weld.
    - 3) Provide certified test reports for factory welds on fittings from a certified welding inspector that may be in-house or third- party.
  - b. Inspect physical dimensions and overall conditions of all joints for compliance with AWWA C 200, approved submittals, and Specifications.
  - c. Hydrostatically test finished pipe section to 75 percent of specified minimum yield strength of steel being used with zero leakage.
  - d. For wall thickness greater than ½-inch perform Charpy V-Notch (CVN) Test in accordance with AWWA C 200.
- 3. Linings:
  - a. Inspect unlined pipe for overall condition of inside barrel. Maintain inside barrel free of corrosive products, oil, grease, dirt, chemical, and deleterious material.
  - b. Inspect lined pipe for physical dimensions and overall condition of lining, visible surface defects, thickness of lining, and adhesion to steel surface (for polyurethane or epoxy lining).
  - c. Review certifications by manufacturers of lining components for conformance to AWWA standards and these Specifications.
- 4. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.
- 5. Final Inspection:
  - a. Before shipment, inspect finished pipe, fittings, specials and accessories for markings, metal, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness.
  - b. Inspect for coating placement and defects. Test exterior coating for holidays.
  - c. Inspect linings for thickness, pitting, scarring, and adhesion.

- C. Shop-applied coatings and linings; provide services of independent or in house coating and lining inspection service or testing laboratory with qualified coating inspectors. Qualified coating inspectors shall be NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector.
- D. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.
- E. Cast four standard test cylinders each day for each 50 cubic yards of mortar coating or portion thereof for each coating and lining placed in a day. Perform compressive strength test at 7 and 28 days. No cylinder test result shall be less than 80 percent of specified strength.
- F. Dented steel cylinders shall result in rejection of pipe.
- G. Make available copy of physical and chemical testing reports for steel cylinders and provide reports at request of Project Manager.
- H. Check physical dimensions of pipe and fittings. Physical dimensions to include at least pipe lengths, pipe I.D., pipe O.D. and bend angles.
- I. Test special sections via non-destructive testing methods in accordance with AWWA C 200. Acceptable weld test methods include magnetic particle, liquid penetrant, ultrasonic, and radiographic.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURER(S) (NOT USED)**

### **2.02 MATERIALS AND/OR EQUIPMENT**

- A. Steel Pipe
  - 1. Furnish pipe, fittings, coating and linings all by one manufacturer. Do not ship over salt water.
  - 2. Furnish pipe smaller than 24-inch in accordance with Section 02502 – “Steel Pipe and Fittings”.
  - 3. Fabricate and supply miscellaneous steel pipe and fittings with nominal diameter of 24 inches and larger in accordance with AWWA C 200, C 207, C 208 and AWWA M 11 except as modified herein. Steel to be a minimum of ASTM A36/A36M, ASTM A1011/A1011M Grade 36, ASTM A53/A53M Grade B, ASTM A135/A135M Grade B, or ASTM A139/A139M Grade B, or ASTM A1018/A1018M Grade 36.



4. Provide pipe sections in lengths no greater than 50 feet and no less than 10 feet unless otherwise requested by project manager or as required for special fittings or closure sections.
5. Provide shop-coated and shop-lined steel pipe with minimum of one coat of shop-applied primer approved for use in potable water transmission on all exposed steel surfaces. Primer for tape-coated steel pipe to be used for field-applied coatings shall have no less than 5 percent solids. Provide primer compatible with coating system and in accordance with coating manufacturer's recommendations.
6. Provide closure sections and short sections of steel pipe not less than 4 feet in length unless indicated on Plans or specifically permitted by Project Manager.
7. Square flanges with pipe with bolt holes straddling both horizontal and vertical axis. Provide ½ -inch gap between pipe ends to be coupled with sleeve coupling unless otherwise indicated on Plans.
  - a. Provide standard ring conforming to AWWA C 207, Class D.
  - b. Apply Densco petrolatum-based tape or approved equal to exposed portions of nuts and bolts.
8. Pipe Design Conditions:
  - a. Design: Design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Plans. Design pipes with Marston's earth loads for transition width trench for all heights of cover.
  - b. Groundwater Level: Design for most critical ground water level condition,
  - c. Working pressure = 150 psi.
  - d. Hydrostatic field test pressure = 150 psi.
  - e. Maximum pressure due to surge = 150 psi.
  - f. Minimum pressure due to surge = -5 psi.
  - g. Modulus of elasticity (E) = 30,000,000 psi.
  - h. Maximum deflection from specified diameter: 2 percent for mortar coating; 3 percent for flexible coatings and 3 percent for mortar lining.

**STEEL PIPE AND  
NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY FITTINGS FOR LARGE  
STANDARD SPECIFICATION DIAMETER WATER LINES**

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- i. Design stress due to working pressure to be no greater than 50 percent of minimum yield, and stress not to exceed 18,000 psi for mortar coated pipe.
- j. Design stress due to maximum hydraulic surge pressure to be no greater than 75 percent of minimum yield, and stress not to exceed 27,000 psi.
- k. Modulus of soil reaction ( $E' < 1,500$  psi. If  $E' > 1,000$  psi, do not use silty sand (SM) for embedment.
- l. Unit weight of fill ( $w > 120$  pcf.
- m. Deflection lag factor ( $D1 = 1.2$ .
- n. Bedding constant ( $K = 0.1$ .
- o. Fully saturated soil conditions:  $hw = h =$  depth of cover above top of pipe.
- p. Do not allow diameter ( $D$ ) over thickness ( $t$ ) ratio to be greater than 230.
- q. Provide minimum inside clear diameter for tunnel liners or casing in accordance with Section 02425- "Tunnel Excavation and Primary Liner".
- r. Exclude structural benefits associated with primary liner in design of pipe in tunnel installations.
  - 1) Design pipe and joints to carry loads including overburden and lateral earth pressures, subsurface soil and water loads, grouting, other conditions of service, thrust of jacks, and stresses anticipated during handling and construction loads during installation of pipe.
  - 2) Do not use internal removable stiffeners for pipe in tunnel, unless approved by Project Manager.
  - 3) External welded steel stiffeners shall be permitted in design calculations for steel pipe, provided wall thickness is a minimum of ½ inch. Minimum clearances specified between exterior pipe wall and tunnel liner applies to distance between outside diameter of external welded stiffener and tunnel liner.
- s. Nominal Allowable Steel-Wall Thickness for Water Lines: Provide in accordance with following table for HS-20 live loads and depths of cover of up to 16 feet. Net internal diameter (including inside linings)

<b>NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY</b> <b>STANDARD SPECIFICATION</b>	<b>STEEL PIPE AND FITTINGS FOR LARGE DIAMETER WATER LINES</b>
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to be no less than net inside diameter listed. Contractor to review design for conditions more extreme than those indicated by this specification and design accordingly. Pipe wall shall not to be less than that defined in following table.

Net Inside Diameter (Inches)	Nominal Wall Thickness (Inches)	
	Flexible Coating	Mortar Coating
96	0.484	0.464
90	0.454	0.430
84	0.423	0.395
78	0.393	0.359
72	0.362	0.320
66	0.333	0.295
60	0.301	0.268
54	0.271	0.250
48	0.235	0.215
42	0.207	0.189
36	0.178	0.163
30	0.149	0.136
24	0.149	0.136

9. Fittings for Water Lines: Fabricate in accordance with AWWA M 11, and AWWA C 208.
  - a. Wall Thickness: Equal to or greater than pipe to which fitting is to be welded.
  - b. Elbows: 2-piece for 0 degrees to 22½ degrees; 3-piece for 23 degrees to 45 degrees; 4-piece for 46 degrees to 67½ degrees; and 5-piece for 68 degrees to 90 degrees, unless otherwise shown on Plans.
  - c. Outlets: Reinforced in accordance with AWWA M 11, AWWA C 200, and AWWA C 208. Provide interior lining and exterior coating in accordance with paragraphs on coating and lining and matching pipe to access inlets, service outlets, test inlets, and air-vacuum valve and other outlets, including riser pipes.
  - d. Radius: Minimum radius of two and one-half times pipe diameter.
  - e. Butt Straps for Closure Piece: Minimum 12-inch-wide split butt strap; minimum plate thickness equal to thinnest member being joined; fabricated from material equal in chemical and physical properties to thinnest member being joined. Provide minimum lap of 4 inches between member being joined and edge of butt strap, welded on both inside and outside, unless otherwise approved by Project Manager.

Provide minimum 6-inch welded outlet for inspecting each closure section, unless access manway is within 40 feet of closure section.

- f. Reducers: Provide in accordance with AWWA M11 and AWWA C208.
  - g. Dished Head Plugs: Design in accordance with ASME Boiler & Pressure Vessel Code, Section VIII, Division 1, latest edition. Design to withstand field hydrostatic test pressure from either side of plug. Design stress due to hydrostatic pressure to be no greater than 50 percent of minimum yield. Pipe on opposite side of hydrostatic test may or may not contain water.
  - h. Use flanged joints at valves.
  - i. Provide double-welded lap field joints or full penetration butt-welded joints for tee fitting supported on pier foundation, aboveground piping and field welds for risers including vertical portion of crossover piping.
10. Joints:
- a. Standard field joint for steel pipe: AWWA M11, AWWA C200 and AWWAC206. Rubber gasket Carnegie shape joint or rolled-groove rubber gasket and O-ring joint, 66-inch maximum diameter. Joints may be lap-welded slip type in accordance with AWWA C200, except where flanged joints or butt strap joints are required. Carnegie spigot shall NOT be used with expanded bell. Use Carnegie bell only with Carnegie spigot.
  - b. Provide welded butt joints on above-ground piping, tee fitting supported on pier foundation, field welds for risers including vertical portion of crossover piping, and where noted on Plans.
  - c. Pipe Manufacturer: Refer to Specification Section 02511 – “Water Lines” for performance history requirements. In lieu of passing Hydrostatic Joint Test, Contractor may opt to provide all welded joints.
  - d. Pipe to be installed via tunnel to be capable of withstanding jacking forces.
  - e. Design restrained joints for test pressure or maximum surge pressure as specified, whichever is greater. Only minimum restrained joint lengths for prestressed concrete cylinder pipe are shown on Plans.
  - f. Provide full circumferential welds at joints required to be welded.
  - g. Use wire and flux from same manufacturer throughout entire project.

h. Rubber Gasketed Bell-and-Spigot Joints:

- 1) Bells: Formed by either expansion of pipe end, which stretches steel past its elastic limit, or by attaching sized weld-on bell rings. Weld-on bell rings shall comply with AWWA M 11 and AWWA C 200, attached with full-thickness fillet welds, and welded inside and out (double welded). Minimum thickness of completed bell ring is equal to thickness of pipe wall in barrel of pipe between joint ends.
- 2) Spigot ends: Sized prior to rolling gasket groove. Joints: Interchangeable and match up during installation, even if used out of sequence.
- 3) Weld-on bell rings: AWWA M11; AWWA C200; attached with single or double, full thickness fillet welds (double weld in areas of thrust restraint).
- 4) Provide bells and spigots with dimensions and tolerances in accordance with AWWA C 200, as modified herein. Difference in circumference between ID of bell and OD of spigot shall be between 0.00 inch to 0.04 inch as measured with steel circumference tape. Minimum thickness of completed bell ring is equal to thickness of pipe wall in barrel of pipe between joint ends.
- 5) Furnish joint suitable for safe working pressure equal to class of pipe. Joint shall operate satisfactorily with pull-out, tangent of which is not to exceed  $0.75 \text{ inch}/D$ , where  $D$  is outside diameter of pipe in inches or with pull-out of  $3/4$  inch.
- 6) Design clearance between bells and gasketed spigots so joint shall be self-centered and gasket shall be restrained or confined to annular space in such a manner than movement of pipe or hydrostatic pressure cannot displace it. Compression of gasket when joint is completed shall provide watertight joints under operating conditions when properly installed. Compression of gasket shall not be dependent upon water pressure in pipe.

**STEEL PIPE AND  
NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY FITTINGS FOR LARGE  
STANDARD SPECIFICATION DIAMETER WATER LINES**

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11. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

Line Diameter	Required Bends*
20 and 24 inches	Four, 45 degree bends per 5,000 LF of water line
> 24 inches	Four, 22.5 degree bends per 10,000 LF of water line
*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer's option (i.e., two, 22.5 degree bends are equivalent to one 45 degree bend) and shall be counted as one fitting.	

12. Manufacturer must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of Project Manager where unforeseen obstacles are encountered during construction. These fittings are in addition to fittings called out on Plans and must be available at all times. Use same product throughout entire project.
13. Perform x-ray, ultrasonic testing or magnetic particle of manual welds on special pipe and fittings.
14. Hydrostatic Test of Pipe:
- AWWA C 200 Section 5.2.1, at point of manufacture. Hold test for minimum 2 minutes and conduct thorough inspection of pipe. Repair or reject pipe revealing leaks or cracks.
  - Calibrate pressure gauges within one year prior to testing as specified in Section 1.04 L.
15. Provide forged steel threaded outlets of approved design where required for use in passing hose or lead wires into pipe. Tap plugs with standard pipe threads and weld to pipe in approved manner and use solid forged steel plugs for closure.
16. Flanges:
- Fabricate flanges with oversize bolt holes, with flanges drilled in pairs, to accommodate insulating sleeves.
  - Test, coat, line, and ship each shop-assembled insulated flange assembly to field as fitting. Use no less than two snug-fitting alignment pins to assist in aligning flanges during assembly. Do not remove pins until bolts have been installed in all remaining holes and have been

drawn up tight. After insulating joints have been assembled, subject each assembly (fitting) to shop hydrostatic test pressure of 150 psi and electrically test to ensure that insulated sections are effective. After assembly has been tested, coat isolation joint with Denso petroleum based tape manufactured by Carboline or approved equal. Coat isolation joint and adjacent steel pipe as specified for below-ground installation. Line assembly as specified for interior surfaces and in accordance with details shown on Plans.

17. Make curves and bends by deflecting joints, or by using beveled joints, or by combination of two methods, unless otherwise indicated on Plans or permitted by Project Manager. Do not exceed deflection angle at joint as recommended by pipe manufacturer. Make penetration of spigot into bell at all points of circumference at least equal to minimum required penetration shown on Plans. Beveled pipe sections used in curved alignment to be of standard length except when shorter sections are required to limit radius of curvature, in which case all sections throughout curve are to be of equal length. Do not allow bevel to exceed 5 degrees.

**B. Internal Lining Systems for Steel Pipe, All Installations**

1. Supply steel pipe with either epoxy lining or cement-mortar lining, capable of conveying water at temperatures not greater than 140°F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61, and certification to be from organization accredited by ANSI. Unless otherwise noted, coat all exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, with epoxy lining, as specified.

**2. Epoxy Lining:**

- a. AWWA C 210, color White, or approved equal for shop and field joint applied, except as modified in this Section. Provide materials from same manufacturer.

Protect interior surface with liquid two-part chemically cured epoxy primer specified for interior surfaces.

Surface Preparation	SSPC-SP10Near White Blast Clean
Finish Coat	AWWA C210. Provide Devoe Bar-Rust 233H White or approved equal

- b. Total allowable dry film thickness for system as recommended by manufacturer.
  - c. Provide anchor profile and dry film thicknesses for approved alternate products in accordance with product's manufacturer recommendations.
  - d. Perform adhesion test on pipe 48 inches in diameter and larger in accordance with AWWA C210. Minimum field adhesion: 700 psi. Perform test on pipe for project at frequency of one for every 1,000 square feet of epoxy lining. Adhesion tests shall be performed on the first and last pipe coated each shift. Perform cure test in accordance with ASTM D 4752 (solvent rub test) and ASTM D 3363 (pencil hardness) for each section of pipe. Repair tested areas with approved procedures.
  - e. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges. Grind weld bead for proper coating application as recommended by coating manufacturer. Presence of metallic defects may be cause for rejection of pipe.
3. Shop-Applied Cement-Mortar Lining:
- a. AWWA C 205; except as specified herein:  $\frac{3}{4}$ -inch minimum thickness for pipe diameters 96-inches and larger;  $\frac{1}{2}$ -inch minimum thickness for pipe diameters 42 inches and larger;  $\frac{3}{8}$ -inch minimum thickness for pipe diameters 36 inches and smaller. Cut back lining from joint ends no more than 2 inches to facilitate joining and welding of pipe.
  - b. Apply cement-mortar lining to inside of pipe by centrifugally spinning. For special sections (shape of which precludes application by spinning method) accomplish by mechanical placement or pneumatic placement and finish to produce smooth, dense surface comparable to centrifugally spinning.
  - c. Use galvanized wire mesh when shop-applied mortar is not applied by machine. Do not extend wire mesh across welded portion of mitered fittings. Crimp mesh to provide integral "chair" so wire does not fully rest against steel cylinder.
  - d. Make repairs of cement-mortar lining for widths exceeding 6 inches by bonding to steel and adjacent faces of lining with bonding agent conforming to ASTM C 881, Type II.
  - e. Restrict usage of sprinkler heads during moist curing to prevent over spraying onto lining. No alternative curing methods are allowed as described in Section 4.4.7.4 of AWWA C 205.



- f. Satisfy Project Manager that above requirements can be accomplished by manufacturer prior to shipment of pipe.
- 4. Field-Applied Cement-Mortar Lining (for pipe > 66 inches in diameter): Provide field-applied internal cement-mortar linings in accordance with AWWA C 602, latest edition, except as modified in this Section.
  - a. Lining: Applied in one-course application of cement-mortar by machine that centrifugally places mortar against wall of pipe and mechanically trowel lining to smooth finish.
  - b. Steel pipe, fittings, receives cement-mortar lining.
  - c. Cement-mortar for lining.
    - 1) Cement-mortar: Dense, smooth, and of uniform quality and consistency to assure efficient machine operation and uniform cement-mortar lining on pipe wall.
    - 2) Water-cement ratio: Kept as low as possible; consistent with proper plasticity for application, allowing slight variations dependent upon temperature, length of haul for mortar, and moisture condition in pipe.
    - 3) Mortar: Mixture of one part cement with not less than one or more than 1½ parts of dry screened sand, by volume. After determining mixture, control materials to within plus or minus 2½ percent by weight throughout entire Work.
    - 4) Comply with following materials for cement-mortar:
      - a) Provide Type II low-alkali Portland cement conforming to ASTM C 150, or Type IP (MS) Portland-Pozzolan cement conforming to ASTM C595/C595M, unless otherwise specified. Conform to low alkali requirements of Table IA of ASTM C150/C150M. Type IP (MS) cement to contain no more than 20 percent Pozzolan, to be inter-ground with clinker.
      - b) Use suitable facilities approved by Project Manager when available for handling and weighing bulk cement. Otherwise, deliver cement in original unopened sacks that have been filled by manufacturer. Plainly mark sacks with manufacturer's name or brand, cement type lot number and weight. Discard unused cement. Use unopened bags of cement for each new batch.

<b>NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY</b> <b>STANDARD SPECIFICATION</b>	<b>STEEL PIPE AND</b> <b>FITTINGS FOR LARGE</b> <b>DIAMETER WATER LINES</b>
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- c) Material storage: Store cement to permit ready access for inspection and sampling. Protect cement and sand against contamination or moisture. Do not use and remove from site cement delivered with evidence of contamination or otherwise unsuitable. Store admixtures in accordance with manufacturer's directions.
- d) Use Portland cement of same brand and type unless otherwise approved by Project Manager.
- e) Pozzolanic material: AWWA C 602, Paragraph 4.3.3.
- f) Sand: AWWA C 205, Section 2.3, except gradation of sand to yield fineness modulus of approximately 1.7; having no material coarser than that passing No. 16 sieve. Submit certification for compliance of sand with these specifications at least 10 calendar days before start of lining placement.
- g) Water: Clean; free of deleterious amounts of acids, alkalis or organic materials; total dissolved solids less than 1,000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5.

**C. External Coating System for Steel Pipe Installed Aboveground and in Vaults (Exposed)**

1. Provide approved epoxy/polyurethane coating system as designated below. Provide materials from same manufacturer.

Surface Preparation	SSPC SP 10 Near White Blast Clean
Intermediate Coat	Chemical Resistant Epoxy, or approved equal
Finish Coat	Polyurethane, or approved equal Barr blue color or as approved by Project Manager

2. Total allowable dry film thickness for system as recommended by manufacturer.
3. Perform adhesion test on pipe in accordance with AWWA C210. Minimum field adhesion: 1,000 psi. Perform test on pipe for project at frequency of one for every 1000 square feet of polyurethane coating. Adhesion tests shall be performed on the first and last pipe coated of each shift. Perform cure test in

accordance with ASTM D 4752 (solvent rub test) and ASTM D 3363 (pencil hardness) for each section of pipe. Repair tested areas with approved procedures.

**D. External Coating Systems for Buried Steel Pipe**

1. Supply pipe with one of the following coatings specified.
  - a. Tape Coating: Provide approved tape for external tape coating. Apply in accordance with AWWA C 214 and requirements of this section; 80-mil.
    - 1) Components: Primer, one 20-mil layer of inner-layer tape for corrosion protection and two, 30-mil layers of outer-layer tape for mechanical protection.
    - 2) Where sleeve type or victaulic couplings are required, bond coupling to adjacent pipes with bonding cables as shown on Plans.
    - 3) Use approved filler putty type insulating putty to fill in gap and create smooth sloped transition between top of reinforcing plate and pipe, before tape coating is applied.
    - 4) Primer: Compatible with tape coating, supplied by coating-system manufacturer.
    - 5) Provide pipe with shop coatings cut back approximately 4 to 4½ inches from joint ends to facilitate joining and welding of pipe. Taper successive tape layers by 1-inch staggers to facilitate field wrapping and welding of joints.
    - 6) Inner and outer tape width: 12 or 18 inches.
    - 7) Do not expose tape coating to direct sunlight for more than 60 days.
  - b. Cement-mortar Coating: AWWA C 205; shop-applied, cement-mortar coating except as modified in this Section; 1-inch minimum thickness; cut back coating from joint ends no more than 2 inches to facilitate joining and welding of pipe.
  - c. Polyurethane Coating: See Section 02527 – “Polyurethane Coatings on Steel Pipe” for requirements for use of polyurethane coating system. Refer to Paragraph 2.02.C.3 of this Section for field testing requirements. Provide inspections by NACE trained inspectors under

supervision of NACE Certified Coatings Inspector having Level III Certification.

2. Heat Shrink Joint Sleeves for Tape and Polyurethane Coating: Provide Canusa Aqua Shield or approved equal. For repairs to heat shrink joint sleeves, use Canusa Aqua-Shield repair kit or approved equal. Pipe manufacturer to hold back coatings at joints as per shrink sleeve manufacturer's recommendations.
- E. External Coating System for Steel Pipe in Tunnel, Casing
1. Provide exterior coating system of pipe in tunnel, without annular grout, as specified in Cement Mortar Coating for Buried Steel Pipe, or provide minimum 80 mils of polyurethane coating in accordance with Specification Section 02527 – “Polyurethane Coatings on Steel Pipe”.
  2. For water lines in tunnel where annular grout will be used, shop prime external surfaces of steel pipe with 4.0 to 6.0 mils DFT of approved Inhibited Epoxy Primer, or approved equal, unless pipe has cement-mortar coating.
    - a. Surface Preparation: SSPC-SP 10(64); Near White Blast Clean
    - b. Prime Coat: Inhibitive Epoxy Primer
    - c. Use coating procedures and dry film thicknesses for approved alternate product in accordance with product manufacturer's recommendations.
- F. Grout for Joints and Special Applications
1. Cement Grout Mixture: One part cement to two parts of fine, sharp clean sand. Mix interior joint mortar with as little water as possible until very stiff but workable. Mix exterior joint mortar with water until it has consistency of thick cream. Mix cement grout to specific gravity of 19 lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of and at request of Project Manager. Add additional cement grout or water to mixed cement grout to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.
    - a. Portland Cement: ASTM C150/C150M, Type II. Provide one type of cement for entire project.
    - b. Sand:
      - 1) Interior joints: ASTM C 35 fine graded plaster sand.

**STEEL PIPE AND  
NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY FITTINGS FOR LARGE  
STANDARD SPECIFICATION DIAMETER WATER LINES**

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- 2) Exterior joints: ASTM C33/C33M; natural sand with 100 percent passing No. 16 sieve.
- c. Water: Potable water with total dissolved solids less than 1,000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5. Use potable water with 250 ppm limit on chlorides and sulfates.
- 2. Provide approved Nonshrink Grout for Special Applications, Patches, and Repairs.
  - a. Conform to requirements of ASTM C1107/C1107M, Nonshrink Grout.
  - b. Pre-blended factory-packaged material manufactured under rigid quality control, suitable for use in joints of prestressed concrete cylinder pipe.
  - c. Contain non-metallic natural aggregate and be nonstaining and noncorrosive.
  - d. Meeting NSF 61 Standard suitable for use in contact with potable water supply.
  - e. Exterior: Highly flowable to fill joint wrapper without leaving voids or trapped air. Interior capable of being placed with plastic consistency.
  - f. Compressive strength: ASTM C1107 2,500 psi minimum 7-day unconfined; 5,000 psi minimum 28-day unconfined.
  - g. Non-bleeding and non-segregating at fluid consistency.
  - h. Contain no chlorides or additives which may contribute to corrosion of steel pipe.
  - i. Free of gas-producing, gas-releasing agents.
  - j. Resist attack by oil or water.
  - k. Mix, place, and cure in accordance with manufacturer's instructions and recommendations. Upon 72 hours' notice, provide services of qualified representative of nonshrink grout manufacturer to aid in assuring proper use of product under job conditions. Representative to be on site when product is first used.
  - l. Mix cement grout to specific gravity of 17.7 lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of

and at request of Project Manager. Add additional cement grout to mixed cement grout or water to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

- m. Compressive strength: ASTM C1107/C1107M 2,500 psi minimum 7-day unconfined; 5,000 psi minimum 28-day unconfined.
  - 3. Finished surface of lining and interior joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat, and uniform-appearing finish.
  - 4. Joint Wrapper: Minimum width of 9 inches for 33-inch diameter and smaller; minimum width of 12 inches for diameters greater than 33-inch hemmed at edge to allow threading with minimum 5/8-inch wide steel strap. Provide minimum 6-inch wide Ethafoam strip sized, positioned, and sewn such that two circumferential edges of Ethafoam are 1½-inches from outer edge of wrapper.
- G. Cold-Applied Tape Coating
- 1. Shop-applied Tape Wrap Coating
    - a. Use primer furnished by tape manufacturer.
    - b. Wrap, specials and fittings that cannot be machine wrapped due to configuration with primer layer and two layers of prefabricated tape each 35 mils thick.
    - c. Overlap machine-applied tape with hand applied tape by minimum of 2 inches and bind to it.
    - d. Apply Polyken 30 mil filler tape 931, or approved equal parallel to spiral weld seams if weld height measures greater than or equal to 1/8 inch.
  - 2. Surface Preparation
    - a. Clean bare pipe from mud, mill lacquer, oil, grease, or other contaminants. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use approved safety solvents which do not leave residue. Preheating to remove oil, grease, mill scale, water, and ice may be used provided pipe is preheated in uniform manner to avoid distortion.

- b. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges by hand filling or grinding to prevent excessive number of holidays. Presence of metallic defects may be cause for rejection of pipe.
- c. In accordance with AWWA C 215 prepare the pipe surfaces to be coated by preheating the pipe to 45°F and at least 5°F above the dew point, and then blast clean to achieve a commercial surface conforming to SSPC-SP6. Achieve a surface anchor pattern or profile of 1.5 to 4 mils.

H. External Tape Coating Shop Application

- 1. Separate tape dispensing equipment far enough apart to visually inspect continuous steps.
- 2. Make cutbacks straight and for total thickness of coating.
- 3. State of dryness of primer prior to application of weld filler and inner layer of tape to be in accordance with written recommendation of manufacturer.
- 4. Apply weld filler tape over primer and extend minimum of 1 inch on each side of weld seam. Filler tape may contact rollers as long as release liner is in place and adhesion requirements are met. Remove release liner before applying inner layer tape.
- 5. Spirally apply inner layer of tape in direction of helix weld. Overlap each spiral of tape 1 inch or greater with next successive spiral of tape applied.
- 6. Overlap end of new roll on top of previous roll minimum of 6 inches.
- 7. Tape roll body temperature to be greater than 70°F; pipe surface temperature to be greater than 60°F.
- 8. Spirally apply outer layer tapes in direction of helix weld and use overlap width and application tensions as recommended by manufacturer.

I. Inspection and Testing of Coatings

- 1. Perform electrical inspection on inner layer of tape before intermediate layer of tape is applied.
- 2. If holidays are detected, repair holidays immediately before applying outer layer of tape. Clear holiday area of material and reprime if necessary. Recoat area with inner wrap tape. Overlap inner wrap tape onto surrounding inner wrap coating by at least 2 inches. Perform electrical retest at repaired area after repairing holiday, and before outer wrap is continued.

3. Shrink Wrap: Perform electrical inspection on shrink wrap to check for holidays. Perform peel tests over heat affected zone. Minimum acceptable result: 15 lbs-ft/in.

## 2.03 FABRICATION

### A. Inspection

Owner may witness manufacture and fabrication of pipe and appurtenances. Independent testing laboratory under contract to Owner may perform tests at direction of Project Manager to verify compliance with these specifications. Provide assistance to accomplish such testing, including equipment and personnel, at no additional cost.

## 2.04 SOURCE QUALITY CONTROL (NOT USED)

## PART 3 EXECUTION

### 3.01 – 3.02 NOT USED

## 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Conform to applicable provisions of Section 02511 – “Water Lines”, except as modified in this Section.
- B. Comply with following:
  1. Make available services of manufacturer’s representative when deemed necessary by Project Manager. Representative to advise in aspects of installation, including but not limited to handling and storing, cleaning and inspecting, coating and lining repair, and general construction methods as applicable to pipe.
  2. Install stulls prior to placement of pipe, bends, and fittings to prevent deflection during installation. Provide stulls consisting of timber struts with end blocks shaped to fit curvature of interior surface of pipe or other appropriate configuration and material. Firmly edge and secure stulls to blocks so that they shall remain intact position during handling and installation. Provide stulls to adequately resist loads during installation and protect integrity of coatings and linings. Secure stulls so as not to damage pipe.
  3. Handling and Storage: Install padded struts or stulls prior to shipping, horizontally and vertically at 10-foot intervals, or as proposed by manufacturer and approved by Project Manager. Spiders: Installed in joint ends of fittings. Stulls to remain in place, horizontally and vertically positioned under following conditions:



- a. During storage and shipping.
- b. Until welding is complete.
- 4. Repair and/or reject and remove from site pipe that arrives at site with defects in lining, including sand pockets, voids, and oversanded areas. Repairs must be made to the satisfaction of the Project Manager to be accepted.
- 5. Store pipe at job-site with securely-fastened plastic endcaps to maintain moist pipe interior. Promptly replace damaged endcaps to avoid shrinkage or cracking of cement-mortar lining.
- 6. Immediately replace damaged plastic end caps. Do not leave uncapped for more than 4 hours.
- 7. Bedding and Backfilling:
  - a. Conform to requirements of Section 02317 – “Excavation and Backfill for Utilities”.
  - b. Align pipe at proper grade prior to joint connection and do not shift after jointing operation has been completed.
  - c. Take necessary precautions during bedding and backfilling operations to prevent deformation or deflection of cylindrical shape of pipe by more than allowable pipe deflection. Do not move trench support system (trench safety system) once bedding material is compacted.
  - d. Excavate outside specified trench section for bell holes, and for spaces sufficient to permit removal of slings. Provide bell holes at proper locations for unrestricted access to joint. Form bell holes large enough to facilitate joint wrapping and to permit visual examination of process. Enlargement of bell holes as required or directed by Project Manager. Subsequent backfilling thereof will not be considered as authorized additional excavation and backfill. Backfill bell holes and spaces to satisfaction of Project Manager.
  - e. Blocking may be removed 24 hours after placing backfill to top of pavement or natural ground level.
- 8. Pipe Deflection: After backfill is complete, test pipe for excessive deflection by measuring actual inside vertical diameter. For maximum deflection allowable, see Section 2.02.A.
  - a. Deflection may be measured by Project Manager at any location along pipe. Arithmetical averages of deflection are not acceptable.

- b. If deflection exceeds that specified, do one of the following:
  - 1) Remove backfill and side support. Reround the pipe and properly replace compacted backfill and side support. Review cement mortar lining to assure that no harmful damage has occurred.
  - 2) Remove entire portion of deflected pipe section and install new pipe as directed by Project Manager at no additional cost.
- 9. Move pipe in such manner not to damage pipe or coating. Do not roll pipe nor drag on ground. Use a minimum of two wide non-abrasive slings or belts to lift and lower pipe. Handle pipe using a spreader bar. Provide adequate spacing of pipe supports to prevent cracking or damage to lining or coating. Inspect and repair coating abrasions before pipe is lowered into trench.
- 10. Use of dogs, clips, lugs, or equivalent devices welded to steel pipe for purpose of forcing it into position will not be permitted unless approved by Project Manager. Remove foreign matter and protective material from surfaces that are to be in contact at joints. Leave surfaces of joint areas thoroughly clean for metal-to-metal contact of field joints.
- C. Static Electricity:
  - 1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.
  - 2. Electrically test where required after installation of pipeline is complete.
- D. Use adequate surveying methods, procedures, and employ competent surveying personnel to ensure pipe sections are laid to line and grade and within stipulated tolerances. Measure and record, in form approved by Project Manager and submit copy of data to Project Manager at end of that day. Survey data to include unique pipe number, deflection angle at pipe joint and whether beveled ends were used, invert elevation at pipe joint, deviation of joint from project line, deviation of joint from project grade, inside pipe joint lap measured at top, bottom, and at springline (each side).
- E. Any time that laying of additional pipe is stopped for more than 8 hours, plug ends of installed pipe and take proper precautions against flotation of pipe segments.
- F. Identification of Pipe and Fittings

For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe. Locate unique identifying mark minimum of 5 feet away from either end of each section of pipe. Provide one unique identifying

mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

- G. External Coating System for Steel Pipe Installed Above Ground and in Vaults (Exposed) and Epoxy Internal Lining System
1. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.
  2. Workmanship:
    - a. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.
    - b. Paint Application Procedures: SSPC Good Painting Practices, Volume 1.
  3. Surface Preparation:
    - a. Use abrasive blasting to prepare surfaces to SSPC-SP10.
    - b. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.
    - c. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.
    - d. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by grinding to 1/4-inch minimum radius.
    - e. Abrasive Material:
      - 1) Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to jobsite in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.
      - 2) After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Text Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Project Manager.

- 3) Do not blast if metal surface may become wet before priming commences, or when metal surface will be less than 5°F above dew point during blast cleaning, application or curing duration unless otherwise specified by manufacturer.
  - f. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis 1.
  - g. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing ¾-inch by 4-inch piece of clear Scotch-type tape on blasted surface, then removing and placing tape on 3 x 5 white index card. Reclean areas exhibiting dust or residue.
4. Coating and Lining Application:
- a. Environmental Conditions: Do not apply coatings or linings when metal temperature is less than 50°F; when ambient temperature will be less than 5°F above dew point during application or curing duration; when expected weather conditions are such that ambient temperature will drop below 50°F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels, or maintain pipe temperature in a uniform manner to be at least 5°F above dew point. Heating shall conform to the recommendations of the epoxy manufacturer.
  - b. Application Procedures:
    - 1) Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.
    - 2) Thin materials only with manufacturer's recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.
    - 3) Discard catalyzed materials remaining at end of day or work shift.

- c. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.
- d. Cure minimum of 24 hours at 77°F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coats are applied, provide forced-air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

H. External Coating System for Buried Steel Pipe

1. Tape Coating System:

a. Heat Shrink Joint Sleeves:

Provide field-applied shrink-wrap coating system for coating field joints, tie-ins and other field welded joints. Apply heat-shrink sleeves prior to internal welding of pipe using approved procedure compatible with coating system. Install heat-shrink joint sleeves in accordance with manufacturer's recommendations. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to advise Contractor and Project Manager regarding installation, repairs, and general construction methods.

b. Heat-Resistant Tape Coating System:

In accordance with AWWA C 209. Polyken or approved equal. Apply manufacturer-approved insulating putty at bell step-offs. Surface Preparation: Clean exposed metal with solvent, wire brush and blast clean in accordance with AWWA C 209 and manufacturer's specifications. Follow with primer, and then tape coating in accordance with manufacturer's specifications. Visually inspect finished coating for damages, flaws, holidays, or mislaps. Repair as necessary in accordance with AWWA C 209 and manufacturer's recommendations.

- c. Tape manufacturer's technical representative shall be available on site at beginning of pipe laying operations, and advise Contractor and

Project Manager regarding installation, repairs, and general construction methods.

- d. Field Application: AWWA C 209 around joint cutbacks except as modified:
  - 1) Field-welded joints: Clean shop-primed ends of weld splatter, damaged primer, and rust to achieve required surface preparation prior to field repair of coatings.
  - 2) Extend joint cleaning 4 inches onto existing coating. Completely remove damaged and loose end-coatings.
  - 3) Prior to placing pipe in trench, remove shop-applied primer by abrasive blasting, solvent, or other method as approved by Project Manager. Avoid damage to adjacent existing coatings.
  - 4) Clean surfaces to achieve surface preparation at least equivalent to SSPC SP 6 in accordance with AWWA C 209. Provide solvent that is environmentally safe and compatible with coating system primer.
  - 5) Apply insulating putty onto bell step-off as shown on Plans. Remove release liner during application.
  - 6) Apply primer immediately prior to application of first layer of tape to achieve maximum bond. Apply tape while primer is still “tacky” with 3-inch minimum overlap over shop-applied coating.
- e. Joint Tape
  - 1) Extend inner wrap minimum of 2 inches onto existing coating on each side of joint. Extend outer wrap minimum of 4 inches onto existing coating each side of joint. Stagger end laps minimum of 6 inches. Overlap adjacent tape wraps at least 1 inch, and overlap seam of outer wrap. Do not allow to be coincident with overlap seam of inner wrap. Wash with Xylol area that will be overlapped.
  - 2) Apply joint wrap tape to uncontaminated primer at proper roll body temperature. If necessary, store joint wrap material in heated box up to point of application.
  - 3) Apply joint wrap material to pipe in either spiral or cigarette fashion dependent upon specification. Begin wrapping process

- 2 to 4 inches onto mill-applied pipe wrap and proceed wrinkle-free up over bell and across joint to spigot side pipe wrap.
- 4) Apply joint wrap under machine tension of 5 to 10 pounds per inch width. Joint wrap width should narrow (neck down) as material is applied tightly around pipe.
  - 5) Apply first 1/3 and last 1/3 turn of joint material around pipe with less tension to prevent wrap crawlback. Overlap of joint wrap material and system's total thickness as specified in this specification section.
  - 6) End joint wrap process such that its final edge is directed downwards when pipe is placed in ditch to prevent backfill from pulling exposed joint wrap edge.
- f. Do not expose tape coatings or heat-shrinkable joint sleeves to harmful ultraviolet light for no more days than recommended by manufacturer, but no greater than 90 days. Discard (remove) and replace outer layer of tape coating when exposure exceeds allowable limits. In case of factory-applied coatings, remove pipe from site for removal and reapplication of outer layer of tape coatings.
- g. At option of Project Manager, coating system and application may be tested and inspected at plant site in accordance with AWWA C 214.
2. Test for holidays:
- a. Inspect pipe for holidays and damage to coating.
    - 1) If test indicates no holidays and outer wrap is torn, remove damaged layers of outer wrap by carefully cutting with sharp razor-type knife. Wash with Xylol area to be patched and at least 4 inches of undamaged tape where hand-applied tape wrap will overlap. AWWA C 209 cold-applied tape compatible with tape-wrapping system applied for each layer of outer-wrap tape that has been removed.
    - 2) If test indicates holiday, remove outer layers and expose inner wrap. Prime exposed area and overlaps with light coat of primer. Firmly press into place patch of two, 35-mil inner wrap tape (Polyken 930 or approved equal) extending 4 inches from affected area in all directions. Second patch to overlap first patch by 2 inches. Perform holiday test of patch to verify satisfactory installation. Wash exposed outer wrap tape with Xylol and prime.

- 3) For severe outer wrap tape tears or damage, and holiday is not detected, remove outer wrap to boundaries of damaged area, taking care not to damage inner wrap coating. Before replacing outer wrap, apply holiday detector to exposed area to determine that no damage has been made to primary coating. After verification that no holidays exist in underlying tape, clean damaged area and use patch of 35-mil outer wrap tape (Polyken 930 or approved equal). Apply as specified herein for repair of areas where bare pipe is exposed.
- b. Do not allow bubbles in tape coating system regardless of holiday test results, cut out bubbles, and patch as described above as directed by Project Manager.
- c. Perform test procedure in accordance with NACE Standard RP 02 74. Perform electrical holiday test with 60-cycle current audio detector. Use test voltage below:

<u><b>Total Coating Thickness</b></u> (Mils)	<u><b>Test Voltage</b></u> (Volts)
20	6,000
30/35	7,500
50	9,000
70	11,500
80	12,000

3. Remove areas having physical damage and recoat. After repairing area, apply holiday detector as stated above to verify area is adequately repaired.
  4. Cement mortar coating. AWWA C 205; 1-inch minimum thickness; cut back from joint ends no more than 2 inches to facilitate joining and welding of pipe.
  5. Polyurethane Coating. Comply with requirements of Paragraph 3.03.G.
- I. Joints and Jointing
1. Rubber Gasketed Bell-and-Spigot Joints.
    - a. Use O-ring gasket with sufficient volume to approximately fill area of groove and gasket material in accordance with AWWA C 200. Check each splice in gasket by stretching gasket to at least twice original length of gasket. Visually check stretched splice by rotating 360 degrees. Reject splices showing visible separation or cracks.



- b. Equalize rubber gasket cross section after rubber gasket is placed in spigot groove of pipe by inserting tool or bar such as large screwdriver under rubber gasket and moving it around periphery of pipe spigot. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined. Fit pipes together in manner to avoid twisting or otherwise displacing or damaging rubber gasket. Check gaskets after pipe sections are joined with feeler gauge to ensure that no displacement of gasket has occurred at point around circumference after joining. If displacement has occurred, remove pipe section and remake joint as if for new pipe. Remove old gasket and replace before remaking joint.
  - 2. Welded Joints:
    - a. Conform to requirements of Section 02511 – “Water Lines”.
    - b. Field weld to be double-welded lap field joints or full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.
    - c. Employ independent certified testing laboratory, approved by Project Manager, 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 Project Manager for review. Test by magnetic particle test method for lap welds and fillet welds or by X-ray methods for butt welds, for 100 percent of all joint welds. Project Manager has final decision as to suitability of welds tested.
  - 3. Flanged Joints: Conform to requirements of Section 02511 – “Water Lines”.
  - 4. Joint Grouting and Testing: Conform to requirements of Section 02511 – “Water Lines”.
  - 5. Do not allow steel plugs for threaded outlets to project beyond inner surface of pipe shell and seal weld by at least two passes. Apply weld around outside of plug after it has been inserted in final position. Coat outlets and plugs inside and outside as required at field joints on pipe.
- J. Field-Applied Cement-Mortar Lining
- 1. Entrances Into Pipeline:
    - a. Establish means to permit entry and exit of labor, materials and equipment necessary for progress of Work, as approved by Project Manager.

- b. Provide dikes and channeling for diversion of flood and drainage waters away from these openings in pipeline. Use temporary airtight covers over openings to provide proper curing conditions in completed sections of lined pipe. Where operation of equipment requires that end of pipe be left open, install temporary bulkhead inside pipe to eliminate direct draft through pipe over completed sections.
  - c. Brace closure sections of pipeline left out to facilitate field lining above ground to conform as nearly as possible to shape of pipe in ground and then place cement-mortar lining by machine or hand trowel to same thickness as in adjoining machine-lined sections. Bulkhead sections immediately after being lined to maintain proper curing conditions for period of not less than 48 hours before sections are installed in pipeline. Install these sections of steel pipe.
  - d. Coat exterior surface of buttstraps and uncoated exterior surface area of steel pipe within excavations in accordance specifications. Place cement-mortar lining inside areas of joints in accordance with specifications.
2. Mixing of Cement-mortar: Mix ingredients for cement-mortar for not less than 1½ and not more than 6 minutes; use mortar promptly after mixing for lining pipe. Do not use mortar that has attained its initial strength for lining. Do not retemper mortar. Add water to mix last.
3. Placing Cement-mortar Lining:
- a. Complete joint work, backfill, and welding before cement-mortar lining begins. After cement-mortar lining has cured hydrostatic testing of pipe can begin.
  - b. Provide provisions necessary for Project Manager to conduct inspections of Work in safe and thorough manner during and after initial application of mortar and after necessary repairs made. Include, as minimum, space on application machine, and adequate lighting to inspect gross surface areas
  - c. Comply with ASTM C 494 and with manufacturer's recommendations when using chemical admixtures, bonding agents, accelerators, and other additives.
  - d. Remove dirt, debris, oil, grease and loose mill scale and rust from interior surfaces of pipe, and scrape or brush surface with stiff bristle brush and/or water blast as may be necessary, and approved by Project Manager, to ensure clean surfaces for successful application of cement-

mortar lining. Interior surfaces to be approved by Project Manager prior to placing lining.

- e. Provide cement-mortar lining uniform in thickness along entire length of pipe. Provide cement-mortar no less than ½ inch over all surfaces with tolerance of plus ⅛ inch, and no allowance for minus tolerance.
- f. Mechanically control travel of machine and rates of discharge of mortar to produce uniform thickness of lining without segregation around perimeter and along length of pipe.
- g. Check finished surface by placing 12-inch straightedge parallel to axis of pipe along surface of straight section of lining. At no point shall space between lined surface and straightedge be greater than 1/16 inch.
- h. Provide smooth finished surface, within tolerances specified. Repair or replace surface irregularities including corrugations, ripples, or pits in any direction, to satisfaction of Project Manager. Remove defective lining material, including, sand pockets, voids, oversanded areas, blisters, delaminations, or unbounded areas, cracked areas, irregular surfaces, and unsatisfactory thin spots. Remove to pipe wall and area repaired to full thickness of mortar lining.
- i. Repair cracks 1/16 inch and larger to satisfaction of Project Manager.
- j. Place cement-mortar lining by machine having following features:
  - 1) An applicator head which can be centered within pipe and which shall centrifugally project mortar against wall of pipe at high velocity producing dense, uniformly distributed mortar on wall of pipe.
  - 2) Equipped with mechanically driven, rotating steel trowels that immediately follow applicator, providing smooth, hard surface without spiral shoulders. Compensate for torque so that machine shall sit true in pipe and trowel faces shall not vary in angle with mortar face during complete 360-degree cycle. Clean trowels at frequent intervals to prevent accumulated mortar from obtaining initial set resulting in sanded or unglazed finish. Continuously operate trowels during application of cement-mortar and forward progress of lining machine.
  - 3) Design applicator so that nothing shall come in contact with troweled surface until it has attained final set, and so that forward progress of machine and mechanical placing of mortar can be controlled to assure uniform thickness of lining.

- k. Immediately prior to application of cement-mortar lining, sweep and clean off slime, dirt, loose rust, loose mill scale, and other foreign materials. Free interior surface of pipe after cleaning of accumulated water on pipe wall or at joints. Cement-mortar Lining: Adhere to steel at all points; provide consistent thickness except that lining of bell end of pipe where lining is to be thicker in order to fill depression and make smooth surface.
  - l. After receiving its finish troweling, do not roughen lining by rebound material or by mortar direct from machine.
  - m. Temporarily close outlets in pipeline with easily removable stoppers to prevent spun mortar from being thrown into such openings. After lining is applied, remove stoppers from outlets and repair lining damaged by removal of stoppers. Point outlet openings up to provide smooth flow.
4. Hand Finishing:
- a. Repair defective areas in machine-applied lining and unlined joints by hand patching to yield lining equal to that required for machine-applied troweled lining.
  - b. Provide nonshrink grout for patching or lining joints as specified in this Section.
  - c. Clean defective areas of loose foreign material and moisten with water just prior to application of hand-applied mortar.
  - d. Use steel finishing trowels for hand application of cement-mortar.
  - e. Complete hand finishing required in given pipe section not later than day following machine application of mortar lining to that particular pipe section, whether normal working day or otherwise. Slow down or stop machine application of mortar lining to allow time for hand patching.
5. Curing of Lining: Begin curing operations immediately after completing any portion of mortar lining. Close pipe by airtight bulkheads, and maintain moist atmosphere in completed section of pipe to keep lining damp and to prevent evaporation of entrained water from mortar lining. Humidify air introduced into pipe for ventilating or curing purposes and maintain moist atmosphere inside pipe until Project Manager accepts Work.

3.04     REPAIR/RESTORATION

A.     Field Repair Procedures and Special Fittings Application for Cement Mortar Lining

1.     Areas less than or equal to 6 inches in diameter: Patch honeycomb and minor defects in concrete surfaces with nonshrink grout. Repair defects by cutting out unsatisfactory material and replacing with nonshrink grout, securely bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off grout flush with surrounding surface.
2.     Areas greater than 6 inches in diameter:
  - a.     Remove defective lining down to bare steel by chipping, making sure care is taken to prevent further lining damage. Ends of lining where defective lining is removed are to be left square and uniform not feathered.
  - b.     Clean bare steel with wire brush to remove loose or other foreign matter.
  - c.     Remove existing wire reinforcement and replace. Overlap new reinforcement to existing reinforcement by ½ inch. Secure reinforcement, against wall of pipe, at frequent intervals, by tack welding to pipe.
  - d.     Prepare cement mortar mixture. Mixture to compose of Portland Type II cement, sand, and water. Proportions of sand to cement not to exceed three parts sand to one part cement, by weight. Use only enough water to obtain proper placement characteristics. Set up time before mixture is to be discarded is to be no longer than ½ hour. Nonshrink grout may also be used. Do not use combination of cement mortar and nonshrink grout within same repair.
  - e.     Apply WELD-CRETE, or approved equal, concrete bonding agent to bare steel and interface of existing lining. After bonding agent is applied to steel and lining new mix must be applied within 10 minutes.
  - f.     Apply cement mortar to repair area ½ inch thick then hand trowel to achieve smooth dense finish, making sure wire is not left exposed. To ensure proper thickness while placing new mortar, check thickness with ½ inch long wire gauge.

- g.      Curing: Place plastic sheeting over repair area, use tape to adhere plastic to area surrounding repair area. Let cure for 4 days then remove plastic sheeting.

3.05 – 3.07 NOT USED

3.08      DEMONSTRATION / TESTING AND INSPECTION

A.      Inspection (Except Mortar Coated Pipe)

- 1.      Include cost of inspection described in Paragraph 2.03.A, Inspection, in contract unit price for water line. Furnish copies of certified inspection reports to Project Manager for review.
- 2.      Holiday Test and Adhesion Test: Provide services of independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Provide inspections by NACE trained inspectors under supervision of NACE Certified Coatings Inspector having Level III Certification.

B.      Coatings and Linings Inspection Responsibilities

- 1.      Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. Project Manager is responsible for quality assurance and reserves right to inspect or acquire services of independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at phases of coatings and linings, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Project Manager provides such inspection.
- 2.      Cement Mortar Lining and Joint Finish: Finished surface of lining and joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat, and uniform-appearing finish.

3.09 – 3.10 NOT USED

END OF SECTION

Section 02520

**FLUSHING HYDRANTS**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes:

- A. Flushing hydrants.
- B. Adjustment of flushing hydrants and gate valves.

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices.
  - 1. Payment is on a unit price basis for each flushing hydrant assembly, including; TEE, 6-inch gate valve and box, hydrant installed regardless of barrel depth, branch, and appurtenances.
  - 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 REFERENCES**

- A. AWWA C 502 - Dry-Barrel Fire Hydrants
- B. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants
- C. SSPC SP2 - Hand Tool Cleaning
- D. SSPC SP3 - Power Tool Cleaning
- E. SSPC SP10 - Near-White Blast Cleaning
- F. SSPC SP11 - Power Tool Cleaning to Bare Metal
- G. SSPC 36 – Two-Component Weatherable Aliphatic Polyurethane Topcoat, performance based
- H. SSPC 42 – Epoxy Polyamide/Polyamidoamine Primer, performance based

- I. SSPC-Paint 104 - White or Tinted Alkyd Paint
- J. Federal Standard A-A-2962A - Enamel, Alkyd, Solvent Based Low VOC

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01576 – “Waste Material Disposal”
- D. Section 02501 – “Ductile Iron Pipe and Fittings”
- E. Section 02502 – “Steel Pipe and Fittings”
- F. Section 02506 – “Polyvinyl Chloride Pipe”
- G. Section 02511 – “Water Lines”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. Provide hydrants in conformance with AWWA C 502, Standard for Dry Barrel Fire Hydrants (Latest Edition). The following hydrants are currently approved. Alternate hydrants will not be considered.

MANUFACTURER	MODEL / TRADE NAME	SIZE
U.S. Pipe and Foundry Company	U.S. Pipe and Foundry Co. M-94 Metropolitan A495	5 ¼”
Mueller Company	Mueller Company Super Centurion 250 A423	5 ¼”



American AVK Company	American AVK Company AVK Series 2780 Nostalgic	5 ¼"
East Jordan Iron Works, Inc.	WaterMaster 5CD250	5 ¼"
American Flow Control	American-Darling B84B-5	5 ¼"

## 2.02 MATERIALS AND/OR EQUIPMENT

### A. Hydrants

The Project Manager may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at Owner's expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that shall provide three hundred sixty degree (360) rotation of upper barrel.

### B. Leads

Branches (Leads): Conform to requirements of Section 02501 – "Ductile Iron Pipe and Fittings", Section 02502 – "Steel Pipe and Fittings", and Section 02506 – "Polyvinyl Chloride Pipe".

### C. Hydrant Painting

1. New hydrants and refurbished hydrants shall be shop coated as specified herein.
2. Exterior Above Traffic Flange (Including Bolts & Nuts). Bolts and nuts (both above and below ground) shall conform to AWWA C-502 Section 4.11 and shall be stainless steel, cadmium plated, or zinc coated.
  - a. Surface preparation to be in accordance with SSPC-SP 10 (NACE 2) near white blast cleaned surface.
  - b. Coat with a liquid or powder epoxy primer and two part polyurethane or TGIC polyester top coat system with total dry film thickness (DFT) of not to exceed 20 miles as follows:

- 1) Prime Coat - Liquid or powder epoxy primer with a total dry film thickness (DFT) of 4-6 mils, OR cathodic epoxy electro-coat (e-coat) with a (DFR) 0.5-1.0 mils.
  - 2) Intermediate Coat – Intermediate coat not required.
  - 3) Finish Coat – Two part polyurethane enamel to be in general conformance with SSPC Paint Specification No. 36 or TGIC polyester system, with a total dry film thickness (DFT) 1.5-3.0 mils.
- c. Colors – Prime and Intermediate Coat: Manufacturers standard color. Finish coat of hydrant body: Gloss Black. Connection caps: Gloss Black.
3. Field Maintenance Painting (Exterior Above Traffic Flange)
  - a. Surface preparation to be in accordance with SSPC-SP 10 (NACE 2) near white blast cleaned surface.
  - b. When surface is cleaned to bare metal (SSPC-SP I 1), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.02.C.2.b as for new hydrants. When surface is cleaned to SSPC-SP2 or SSPC-SP3, coat hydrant with Silicone Alkyd Resin Enamel in general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3-6 mils.
  - c. Colors – Prime and Intermediate Coat: Manufacturers standard color. Finish coat of hydrant body: Gloss Black. Connection caps: Gloss Black.
4. Exterior Below Traffic Flange (including lower barrel extensions)
  - a. Surface preparation in accordance with SSPC-SP10 (NACE 2) Near White Blast Cleaned Surface.
  - b. Primer and intermediate coat: coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8-10 mils each for total DFT of 16-20 mils.
  - c. Finish coat: Water based vinyl acrylic mastic. Apply one coat with dry film thickness of 6-8 mils. Color of finish coat to be same as finish coat for exterior above traffic flange, i.e., Gloss Black.

5. Interior Surfaces Above and Below Water Line Valve (including lower barrel extensions)
  - a. Material used for internal coating of hydrant interior ferrous surfaces must be NSF certified as suitable for contact with potable water as required by Chapter 290, Rules and Regulations for Public Water Systems, Texas Commission on Environmental Quality
  - b. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied in two or three coats, according to manufacturer's recommendations, for total dry film thickness of 12-18 mils.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

3.01 – 3.02 NOT USED

#### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Set flushing hydrant plumb and brace at locations and grades as shown on Plans. When barrel of hydrant passes through concrete slab, place 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 by 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Project Manager) on pumper nozzles of new or relocated flushing hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by Project Manager. After testing, install a 12-inch yellow indicator on pumper nozzle and label "For Flushing Only."
- D. Do not cover drain ports when placing concrete thrust block.
- E. Obtain Project Manager's approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Plans. Unit price adjustments will not be allowed for changes in water line flow line or flushing hydrant barrel length caused by obstructions.
- F. Plug branch lines to valves and flushing hydrants shown on Plans to be removed. Deliver flushing hydrants designated for salvage to Owner.
- G. Install branches (leads) in accordance with Section 02511 – "Water Lines".
- H. Coating Requirements:

1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
  2. Furnish affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.
- I. Remove and dispose of unsuitable materials and debris in accordance with requirements of Section 01576 – “Waste Material Disposal”.

3.04 – 3.10 NOT USED

END OF SECTION

Section 02521

GATE VALVES

PART 1 GENERAL

1.01 SUMMARY

This Section includes the furnishing and installation of gate valves for isolation and dead-end service as shown on Plans and as specified herein.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for gate valves is on a unit price basis. Unit price includes cost of required box for gate valves.
2. Payment for 2-inch blow-off valve with box is on a unit price basis for each installation.
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.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. ASTM A307: Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
- B. ASTM B62: Standard Specification for Composition Bronze or Ounce Metal Castings
- C. ASTM B763/B763M: Standard Specification for Copper Alloy Sand Castings for Valve Applications
- D. ASTM D429: Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates
- E. AWWA C500: Standard for Metal-Seated Gate Valves for Water Supply Service
- F. AWWA C509: Standard for Resilient-Seated Gate Valves for Water Supply Service

- G. AWWA C515: Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service
- H. AWWA C550: Standard for Protective Interior Coatings for Valves and Hydrants
- I. NSF/ANSI 61: Standards for Drinking Water Systems Components

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures.”
- B. Submit manufacturer's product data for proposed valves for approval.
- C. Shop drawings, including construction features, assembly drawings, weight information, and materials of construction for valves 3 inches and larger and for valves with electric motor or gear operators.
- D. Certification that each valve has been hydrostatically tested at 200 percent of rated working pressure.
- E. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.
- F. Operation and Maintenance Data in accordance with Section 01782 – "Operation and Maintenance Data"

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01782 – “Operations and Maintenance Data”
- D. Section 02085 – “Valve Boxes, Meter Boxes, and Meter Vaults”
- E. Section 02317 – “Excavation and Backfill for Utilities”
- F. Section 02514 – “Disinfection of Water Lines”
- G. Section 02515 – “Hydrostatic Testing of Pipelines”
- H. Section 09902 – “Painting and Protective Coating”
- I. Other related Work as called for on Plans or specified elsewhere in this or other Specification Sections.

1.06 QUALITY ASSURANCE

- A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C500, AWWA C509, AWWA C515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C500, AWWA C509, and AWWA C515.
- B. All valves to have make, size, working pressure, and the letters "AWWA" cast into the valve bodies.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE AND HANDLING

- A. All valves to be drained and closed prior to shipment
- B. Package valves to prevent damage in handling or transit. Store valves in a protective environment from the elements until installed into the Work.
- C. Ship with flange protectors

1.09 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. American Flow Control, Mueller
- B. American Darling
- C. U.S. Pipe and Foundry Company
- D. Clow
- E. Or Approved Equal

2.02 MATERIALS

- A. Gate Valves 1½ Inches in Diameter and Smaller:  
125 psig; bronze; Rising-Stem (RS); single-wedge; disc type; screwed ends.
- B. Gate Valves 2 Inches in Diameter:  
Iron body, double disc, Non-Rising Stem (NRS), 150-pound test, 2-inch square nut operating clockwise to open.
- C. Gate Valves 3 Inches to 12 Inches in Diameter:

Provide non-directional, standard-wall resilient seated (AWWA C509), parallel seat double disc (AWWA C500), or reduced-wall resilient seated gate valves (AWWA C515), 200 psig working pressure rating, bronze mounting, push-on bell ends with rubber joint rings, NRS and nut-operated for exposed valves unless otherwise shown or specified, NRS only for buried valves. Comply with following requirements unless otherwise specified in Plans:

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:

Cast or ductile iron, flange bonnet and stuffing box together with ASTM A307 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 B763/B763M bronze, alloy number UNS C99500 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, Non-Rising.

5. O-rings:

For AWWA C500, Section 4.2.4.8, for AWWA C509, Section 4.2.3.7 and for AWWA C515, Section 4.2.4.9.

6. Stem Seals:

Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

7. Stem Nut: Independent or integrally cast of ASTM B62 bronze

8. Resilient Wedge:

Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D429 Method B; seat against epoxy-coated surface in valve body.



9. Bolts:

AWWA C500 Section 4.4.2, AWWA C509 Section 4.4.4 or AWWA C515 Section 4.4.4; stainless steel for below ground; cadmium plated, or zinc coated for above ground.

D. Gate Valves 14 inch and larger in Diameter: Provide AWWA C500; parallel seat double disc gate valves or push-on bell ends with rubber rings and NRS nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig working pressure rating. Comply with following requirements unless otherwise specified on Plans:

1. Body:

Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.

2. O-rings: For AWWA C500, Section 4.2.4.8.

3. Stems:

ASTM B763/B763M bronze, alloy number UNS C99500 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, Non-Rising.

4. Stem Nut:

Machined from ASTM B62 bronze rod with integral forged thrust collar machined to size; Non-Rising.

5. Stem Seals:

Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

6. Bolts:

AWWA C500 Section 4.4.2; stainless steel for below ground; cadmium plated, or zinc coated for above ground.

7. Discs:

Cast iron with bronze disc rings securely peened into machined dovetailed grooves.

8. 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.

9. 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.

10. 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.

11. Stuffing Boxes:

Located on top of bonnet and outside gear case

E. Gate Valves: Provide AWWA C515; reduced-wall, resilient seated gate valves with 250 psig pressure rating, NRS. Furnish with spur or bevel gearing.

1. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.

2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.

3. Ensure wedge is symmetrical and seals equally well with flow in either direction.

4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.

5. Bolts:

AWWA C515, Section 4.4.4, Stainless Steel for below ground; cadmium plated or zinc coated for above ground.

6. Provide high strength bronze stem and nut.

7. O-rings:

AWWA C515, Section 4.2.4.9 pressure O-rings as gaskets.

8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.

9. Provide thrust washers to the thrust collar for easy valve operation.
- F. Coatings for Gate Valves 2 Inches and Larger:
- AWWA C550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.
1. Resiliently Seated Gate Valve:  
  
Internal and external surfaces to have a fusion bonded epoxy coating system suitable (NSF/ANSI 61 Listed) for use with potable water.
  2. Double-Disc and Solid Wedge Gate Valves:  
  
Valve bodies to be factory coated inside and out with an epoxy coating system to provide corrosion resistance for intended service. Interior coatings in contact with potable water shall meet NSF/ANSI 61 standards. For buried service provide shop applied exterior coating suitable for direct burial.
  3. All coatings in contact with potable water must be NSF/ANSI 61 Listed.
- G. Gate Valves Extension Stem:
- When shown on Plans, 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 or as shown on Plans. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.
- H. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations:
- Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.
- I. Gate Valves for Tapping Steel Pipe:
- Provide AWWA C515 resilient wedge gate valve or AWWA C500 rotating disc gate valves. Mount gate valve in the horizontal position. Furnish with bevel gearing and valve stem extension with operation supports.
- J. Provide flanged joints when valve is connected to steel or PCCP.
- K. Operators
1. Outside Stem and Yoke (OS&Y) to have handwheels

2. NRS valves to have wrench nuts for buried service, handwheels for aboveground service
3. Bevel or spur gears to be steel with bronze pinion shaft and bronze bearings
4. Enclosed gear cases required for all geared valves
5. Buried valves to have greased packed gear case enclosing gears and stuffing box
6. Geared valves to have opening to atmosphere between packing and gear box

L. Valve Boxes:

Provide Standard Type “A” valve boxes conforming to requirements of Section 02085 – "Valve Boxes, Meter Boxes, and Meter Vaults."

- M. Provide fusion-bonded epoxy coating on all interior and exterior surfaces of valves. Epoxy shall be applied in accordance with AWWA C550 and be NSF61 Certified.

- N. Gate valve shall accept a full size tapping cutter

### PART 3 EXECUTION

#### 3.01 – 3.02 NOT USED

#### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Earthwork:

For buried valves, conform to applicable provisions of Section 02317 – “Excavation and Backfilling for Utilities.”

B. Operation:

Do not use valves for throttling without prior approval of manufacturer.

- C. If type of valve is not indicated on Plans, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed

D. Setting Buried Valves and Valve Boxes

1. Direct bury valves and those in subsurface vaults open clockwise; aboveground valves open counterclockwise.
2. 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.

3. Prior to hydrostatic testing of water line and valve:
  - a. Test valve by opening and closing valve a minimum of two times to verify valve seats properly.
  - b. Remove foreign matter from within valves.
4. Install valves in accordance with manufacturer's recommendations. Install valves and valve boxes where shown on Plans. 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 when less than 4 feet. Install valves completely closed when placed in water line.
5. For pipe section of each riser, use only 6-inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve. Assemble and brace box in vertical position as indicated on Plans.

E. Painting of Valves

Paint valves in vaults, stations, and above ground with approved paint per Section 09902 – "Painting and Protective Coating"

3.04 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

A. Disinfection and Testing

1. In the presence of the Project Manager, perform disinfection of valves and appurtenances as required by Section 02514 – "Disinfection of Water Lines" and test as required by Section 02515 – "Hydrostatic Testing of Pipelines."
2. Operate each valve through at least one complete cycle.
3. After installation, inspect each valve for adequate tightness. No leakage allowed.
4. Valves shall be factory hydrostatically tested by the manufacturer per AWWA C500, AWWA C509, and AWWA C515. Field testing shall be according to Specification Section 02515 – "Hydrostatic Testing of Pipelines." Valves shall not be subjected to a test pressure greater than twice rated working pressure. If test pressures are greater than the rated working pressure of the valve, then possible additional allowable leakage rates greater than AWWA Standards must be taken into account.
5. Repair or replace valves which exceed leakage rate.

3.09 – 3.10 NOT USED

END OF SECTION

Section 02522

**BUTTERFLY VALVES**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes the furnishing and subsequent installation of butterfly valves as shown on Plans and specified herein.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices**

1. Payment for butterfly valves 20-inches in diameter and smaller is on a unit price basis for each. Unit price includes cost of box (when required).
2. Payment for butterfly valves 24-inches in diameter and greater is on a unit price basis for each. Unit price includes cost of box (when required for butterfly valves 24-inches in diameter), manhole (when required for butterfly valves 30-inches in diameter and greater), actuator, and appurtenances necessary for complete installation of the valve.
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.

**1.03 REFERENCES**

- A.** This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
- B.** ASME B16.1: Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
- C.** ASTM A48/A48M: Standard Specification for Gray Iron Castings
- D.** ASTM A126: Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
- E.** ASTM A 536 – Standard Specification for Ductile Iron Castings
- F.** ASTM A 564 – Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes

- G. AWWA C504: Standard for Rubber-Seated Butterfly Valves, 3 In. (75 mm) through 72 In. (1,800 mm).
  - H. AWWA C 516 – Large-Diameter Rubber-Seated Butterfly Valves, Sizes 78 in. (2,000 mm) and Larger.
  - I. AWWA C542: Standards for Electric Motor Actuators for Valves and Slide Gates
  - J. AWWA C550: Standard for Protective Interior Coatings for Valves and Hydrants
  - K. NEMA 250: Enclosures for Electrical Equipment (1,000 Volts maximum)
  - L. NAPF 500-03-05: Abrasive Blast Cleaning for Cast Ductile Iron Fittings
  - M. NSF/ANSI 61: Drinking Water Systems Components – Health Effects
- 1.04 SUBMITTALS
- A. Submit the following to the Engineer, in accordance with Sections 01330 – “Submittal Procedures” and 01782 – “Operations and Maintenance Data:”
  - B. Submit manufacturer’s product data for proposed valves and actuators for approval.
  - C. For valves 8-inch and larger and all valves with geared, cylinder, or electric operators. Include size, class, operator, orientation, valve and operator dimensions, and materials by ASTM designations.
  - D. Submit manufacturer’s affidavit for proposed valves and actuators certifying compliance with specifications.
  - E. Submit manufacturer’s affidavit that butterfly valves were manufactured in the United States, and conform to applicable requirements of AWWA C504 or AWWA C516 and that they have been satisfactorily tested in the United States in accordance with AWWA C504 or AWWA C516 using test pressure of 150 psi in both directions. Submit Proof-of-Design and hydrostatic testing procedure in accordance with AWWA C504 or AWWA C516.
  - F. Submit manufacturer’s affidavit that coating for interior surfaces of valves conform to applicable requirements of AWWA C550. Submit results of holiday test and thickness measurements of coatings.
  - G. Furnish, at time of delivery, affidavit of compliance, as specified in Section 6.3 of AWWA C504 certifying compliance with applicable portion of AWWA C504 and modification or supplements herein. Furnish certified drawings and material test records by manufacturer covering items included in Section 4.3 of AWWA C504, for review. Furnish certified copies of test reports covering items in Sections 4.5.8.5.5, 4.5.8.5.8, and 5.2.1 through 5.2.4.3 of AWWA C504 for review.



- H. Submit data indicating maximum torque required to open valve, maximum torsional strength of shaft and torque output of actuator.
- I. Provide submittal information on CD-ROM in Adobe portable document format (\*.PDF).
- J. Include number of turns to operate valves to fully open/closed.
- K. Submit Operation and Maintenance (O&M) Manuals to include special maintenance and adjustment instructions and expanded or detailed drawings with parts descriptions, numbers, and material specifications.

1.05 RELATED REQUIREMENTS

- A. Sizes, end connections, class, type operator, operating conditions, acceptable manufacturers, special features, and valve tag numbers where required are shown on Plans.
- B. Section 01270 – “Measurement and Payment”
- C. Section 01330 – “Submittal Procedures”
- D. Section 01782 – “Operations and Maintenance Data”
- E. Section 02082 – “Precast Concrete Manholes”
- F. Section 02085 – “Valve Boxes, Meter Boxes, and Meter Vaults”
- G. Section 02317 – “Excavation and Backfill for Utilities”
- H. Section 02514 – “Disinfection of Water Lines”
- I. Section 02515 – “Hydrostatic Testing of Pipelines”
- J. Section 09902–“Painting and Protective Coating”
- K. Other related Work as called for on Plans or specified elsewhere in this or other Specification Sections.

1.06 QUALITY ASSURANCE

- A. Valve, operator, and accessories to be furnished as a complete unit by valve manufacturer and conform fully to requirements of AWWA C504 with limitations included herein.
- B. Perform valve leakage tests in both directions at 150 psi in factory and field. Hydrostatic field tests of 150 psi shall be made against dished head plug or similar arrangement.

- C. For purposes of interpreting referenced AWWA tests, the following shall apply:  
Shutoff pressure is 150 psi; cycle consists of rotating disc from fully opened to fully closed position. When proof of design tests are performed on valve delivered to job site, replace disc, bushing, shaft and seals with new and unused items, and test and certify as described above.
- D. Hydrostatic Testing by Manufacturer:
1. Hydrostatic testing is to be performed prior to shipment of valves. Provide minimum 4 weeks' notice to the Project Manager for optional witness testing. When possible, maximize number of valves to be tested during a plant visit. Expenses for visits by the Project Manager for defective valves, improper scheduling, or valve failures are to be paid by Contractor. Witness of hydrostatic testing by the Project Manager will only be in regards to compliance with this specification and will not constitute approval by the Project Manager nor relieve Contractor of obligations to comply with contract documents.
  2. Document serial number on valve at time of testing and reflect in certified test records furnished to the Project Manager. Identification plate must be permanently affixed to valve and actuator prior to hydrostatic testing.
  3. Hydrostatic testing to conform to AWWA C504 except as modified below:
    - a. Install actuator prior to hydrostatic testing. Test actuator to verify actual number of turns match manufacturer's published number of turns. Verify valve stops are in correct positions.
    - b. Fully open and close valve prior to performing shell test and prior to each leakage test
    - c. Perform shell test first
    - d. When tested with water, adequately dry seat and disc
    - e. When tested with air, fill top of valve with water to aid in viewing possible leakage.
    - f. Pressure Gauges:
    - g. Calibrated within past 12 months; 0-500 psi range in increments of 5 psi, present calibration certificates prior to hydrostatic testing.
    - h. If seat adjustment is required during hydrostatic testing, perform valve leakage test again in both directions. Once seat adjustment is made, fully open and fully close valve three (3) times, and repeat leakage test.

4. Field Testing

- a. When valve arrives at the job site, Contractor is to operate valve fully open and closed twice in presence of the Project Manager. Document number of turns to open and close each time.
- b. Install operator nut plum
- c. After valve is installed, repeat the operation test and document number of turns in presence of the Project Manager
- d. Manufacturer's representative must be present to witness the operation test again at the substantial walk thru. Verify valve operate fully open/closed twice at the appropriate number of turns

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, unload, and store products on site in manner that prevents damage. Use special care to prevent damage from temperature and condensation.
- B. Protect electric operators in storage by weatherproofing for humidity control.
- C. Store butterfly valves out of direct sunlight.

1.09 - 1.13 (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. DeZurik Co.
- B. Pratt
- C. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

A. General

1. Butterfly Valves and Actuators:

Conform to AWWA C504, for 72-inch and smaller diameters. Conform to AWWA C516 for 78-inch and larger diameters. Compliance with NSF 61 is required for all parts in contact with finished water.

2. If type of valve is not indicated on Plans, use butterfly valves for line valve sizes 24-inch and larger. .
3. Butterfly valves shall be installed at locations as shown on Plans.
4. Direct-bury valves and valves in subsurface vaults shall open clockwise. Above-ground valves shall open counterclockwise.
5. Provide flanged joints when valve is connected to steel or PCCP. Provide ASTM A193 Grade B7 high strength steel stud bolts with ASTM A194 heavy hex nuts. Refer to flange bolting requirements in Section 02511 – “Water Lines”.
6. Butterfly Valves and Actuators (Additional Requirements for Large Diameter Water Lines):
  - a. Provide all valves for single project, from same manufacturer.
  - b. Valves larger than 72-inches in diameter design: Allowable stresses at rated pressure not to exceed one-third of yield strength or one-fifth of ultimate strength of material used.
  - c. Provide manual actuators for single project, from same manufacturer.
  - d. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension is to be fully enclosed and watertight.

**B. Valves**

Butterfly valves shall be constructed per the following requirements:

1. AWWA C504 or AWWA C516, Class 150B
2. Body Type:
  - a. Aboveground
    - 1) 20-inch and smaller
      - a) Wafer, unless otherwise designated
      - b) Flanged for valves with geared, cylinder, or electric motor operators
    - 2) 24-inch to 96-inch: Short-body flanged per ASME B16.1, Class 125.

- 3) For larger than 96-inch: AWWA C207, Class D with bolt holes ¼-inch larger than nominal bolt diameter for larger than 96-inch diameters
    - 4) Dead-end Service: Flanged
  - b. Buried: Push – on, mechanical joint or flanged, or as shown on Plans
- 3. Body:
  - a. 72-inches and smaller: Cast iron, ASTM A126, Class B or ASTM A48/A48M Class 40
  - b. 78-inches and larger diameters: ASTM A536 Grade 65-45-12
- 4. Flanges: ASME B16.1, Class 125 lb.
- 5. Discs:
  - a. Cast iron or ductile iron fastened to shaft with stainless steel pins or bolts.
  - b. For 24-inches in diameter and greater, valves require a minimum of two (2) taper pins used for attaching valve shaft to valve disc. Disc to shaft connection is to be with Type 316 stainless steel tapered pins secured with nuts or shrink fit stainless steel pins. Use of torque plug for purposes of attaching valve shaft to valve disc is not permitted.
  - c. Valves greater than 54-inches in diameter must utilize flow through disc
  - d. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position.
- 6. Bushings: Self - lubricating bronze, Grade A, D, or E; nylon; or reinforced Teflon
- 7. Seats:
  - a. Buna-N, neoprene or EPDM, and may be applied to disc or body
  - b. Seats shall be mechanically secured or may rely solely on adhesive properties of epoxy or similar bonding agent to attach seat to body
  - c. Seat may be bonded into valve body for valves 20-inch and smaller per the approval of the Project Manager and/or Engineer, or as shown on Plans

- d. Seats on disc shall be mechanically retained with corrosion resistant stainless steel (18-8) retaining ring held in place by stainless steel (18-8) cap screws that pass through rubber seat for added retention
  - e. When seat is on disc, seat shall be retained in position by shoulders located on both disc and stainless-steel retaining ring.
  - f. Mating surfaces for seats:  
  
Type 304 or 316 stainless steel and secured to disc by mechanical means. Sprayed-on or plated mating surfaces will not be allowed.
  - g. For valves 24-inch and larger, use valves with 360 degree seating, whereby shaft does not pass through seat surface.
  - h. Seat must be replaceable in field for valves greater than 24-inches in diameter.
  - i. Valves with segmented retaining rings will not be accepted.
8. Retaining Hardware for Seats:
- a. Type 304 or 316 stainless steel
  - b. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitational effects.
9. Coat interior wetted ferrous surfaces of valve, including disc, with epoxy suitable for potable water conditions and NSF/ANSI 61 approved. Epoxy, surface preparation, and epoxy application: In accordance with AWWA C550 and coating manufacturer's recommendations. Provide three coats of two component, high-build epoxy with minimum dry film thickness of 12 mils. Provide approved epoxy coating. Coatings shall be holiday tested and measured for thickness.
10. Additional requirements of external coating system for valves installed aboveground and in exposed vaults shall be as follows:
- a. Surface preparation shall be in accordance with NAF 500-03-05 Blast Clean method #1. Manufacturer's technical data sheet shall be consulted and should be followed if a recommendation is given for ductile iron surface preparation.
  - b. Exterior surfaces on non-buried valves shall be coated with a metal primer to a minimum dry film thickness of 3 mils or an epoxy conform to the requirements of AWWA C550 to a minimum dry film thickness of 8 mils. The primer shall be compatible with the anticipated field

coating when the field coatings are identified in the purchase documents.

- c. Intermediate coat: Chemical resistant epoxy, or approved equal.
- d. Finish coat: Polyurethane, or approved equal Barr blue color or other as approved by Project Manager.
- e. Total allowable dry film thickness for system shall be as recommended by coating manufacturer.
- f. Provide all coating materials from same manufacturer.
- g. Total allowable dry film thickness for system as recommended by coating manufacturer.

11. Valve shaft and keys:

a. Shaft Material:

- 1) 72-inches and smaller: Type 304 stainless steel for treated (potable) water applications. Type 316 stainless steel for raw water applications.
- 2) 78-inches and larger: ASTM A564, Type 630 (17-4 PH), Stainless Steel, Condition 1150.

- b. For 24-inches in diameter and greater, valves require a minimum of two (2) taper pins used for attaching valve shaft to valve disc. See Paragraph 2.02.B.5.b for minimum requirements.

c. Shaft Bearings:

Stainless steel, bronze, nylon, or Teflon (supported by fiberglass mat or backing material with proven record of preventing Teflon flow under load) in accordance with AWWA C504 or C516. Sinter stainless steel bearing material.

- d. Design valve shaft to withstand 3 times amount of torque necessary to open valve.
- e. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow, except where shown otherwise on Plans.

12. Shaft Seals:

- a. Upper seal to consist of self - adjusting and wear compensating full or split “V” type packing or a stuffing box with pulldown packing and bronze gland
  - 1) Packing:
    - a) Material to be Buna - N or TFE impregnated Teflon
    - b) To be replaceable without removing actuator assembly
  - 2) Seals to be replaceable without removing valve shaft or operator
- 13. End Cover:

Cast iron, gasketed or with Buna-N O-ring
- 14. Cover Plate Cap Screws for Buried Service:

Stainless steel, AISI Type 316
- 15. For valves utilizing retaining rings, tighten bolts to a uniform torque. Measure torque prior to testing valve.

**C. Valve Operators**

- 1. Valve Operators shall conform to the requirements of AWWA C504 or AWWA C516 and be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators to be factory mounted and tested.
- 2. Provide actuators for valves with size based on line velocity of 12 feet per second and uni-directional service, and, unless otherwise shown on Plans, equip with geared manual actuators. For electric operators, see Paragraph 2.02.C.9. Provide fully enclosed and traveling-nut type, rack-and-pinion type, or worm-gear type for valves 20-inches and smaller. Provide worm-gear type for valves 24-inches and larger.
- 3. Provide actuator designed for installation with valve shaft horizontal unless otherwise indicated on Plans.
- 4. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements.
- 5. Provide oil-tight and watertight actuator housings for valves, specifically designed for buried service or submerged service when located in valve vaults, and factory packed with suitable grease.



6. Install valve position indicator on each actuator housing located above ground or in valve vaults. Valves shall be equipped with 2-inch actuator nut only.
7. Indicate direction of opening of valve on exposed visible part of assembly and cast direction of open on 2-inch nut on top of valve operator extension. Paint 2-inch actuator nut and extension shaft black when counter clockwise open and red when clockwise to open.
8. Design worm-gear or traveling-nut actuators to be self-locking and designed to transmit twice the required actuator torque without damage to faces of gear teeth or contact faces of screw or nut.
9. Electric Motor Operator
  - a. General
    - 1) Comply with AWWA C542
    - 2) Size to 1-1/2 times required operating torque starting with valve wide open at maximum port velocity and ending with a differential equal to the specified maximum shutoff pressure. Motor stall torque not to exceed torque capacity of valve.
    - 3) Controls integral with the actuator and fully equipped as specified in AWWA C542
    - 4) Stem protection for rising stem valves
    - 5) Complete with motor, gearing, handwheel, limit and torque switches, lubricants, space heaters, wiring, and terminals.
    - 6) Self-contained unit with cast iron weatherproof housing
    - 7) Integrally assembled on valve by valve Manufacturer
  - b. Open-Close Service
    - 1) Size motors for two complete "OPEN-CLOSE-OPEN" cycles that occur in immediate succession without overheating at full differential pressure.
    - 2) Integral "OPEN-STOP-CLOSE" pushbutton controls
    - 3) "OPEN" and "CLOSED" indicating lights
    - 4) Combination starter and circuit breaker type with reversing motor starter with built-in overload protection, three-pole heavy-duty F frame circuit breaker, and cover with quick release screws.

- 5) Opening and closing cycle time:
  - 6) 60 seconds minimum unless otherwise noted in Plans or the Attachment.
- c. Actuator Power Supply
- 1) 208-volt, three-phase unless otherwise indicated
  - 2) Control power transformer, 120-volt secondary
  - 3) Remotely located, externally operable power disconnect switch
- d. Enclosure
- 1) As defined in NEMA 250, Type 4
  - 2) Contain continually energized space heaters rated for 230-volts and connected to 120 volts
  - 3) Oversized to permit adequate and convenient clearance to all internally mounted devices
- e. Motors
- 1) Totally enclosed, high torque
  - 2) In accordance with NEMA standards
  - 3) Operate at any voltage within 10 percent above or below rated voltage
  - 4) Permanently lubricated motor bearing
- f. Gearing
- 1) Hardened steel spur or helical gears
  - 2) Alloy bronze or hardened steel worm gear
  - 3) Designed for 100 percent overload
  - 4) Hardened steel gears not less than 350 Brinell
  - 5) Sealed against entrance of foreign matter
  - 6) Self-locking so that actuation of a torque switch by a torque overload condition will not allow the operator to restart until the torque overload is eliminated

- 7) Planetary or cycloidal gearing; aluminum, mild steel, or nonmetallic gearing will not be acceptable
- 8) Contain continually energized space heaters rated for 230 volts and connected to 120 volts
- g. Handwheel Mechanism
  - 1) Prevent handwheel rotation during motor operation and prevent effect of motor rotation during handwheel operation.
  - 2) Geared so that force required to operate does not exceed 80 pounds.
- h. Torque Switches
  - 1) Provide for torque and thrust loads in both opening and closing directions.
  - 2) Provide with micrometer adjustment and reference setting indicator.
  - 3) Adjustment with approximately 40 percent torque setting variation.
  - 4) Rated for not less than 6 amperes at 120 volts ac.
- i. Selector Switch, Pushbuttons, and Indicator Lights
  - 1) Heavy duty, oil tight/watertight construction for outdoor use with NEMA A600 modular contact blocks.
  - 2) Two-stage, three-position maintenance contact selector switch.
  - 3) Momentary spring return, non-illuminated, recessed type, pushbuttons.
  - 4) "Push-To-Test" indicating lights, both lamps shall illuminate in intermediate valve position.
- j. Terminals
  - 1) Provided in motor starter enclosure for all external control connections.
  - 2) Provide sufficient terminals so that no more than two conductors are connected to a single terminal.

- 3) Provide permanent designations which agree with wiring diagrams.
    - 4) Heavy duty, phenolic strap-screw type, 300-volt, 30-amp rating.
  - k. Wiring
    - 1) Flame retardant switchboard type
    - 2) Minimum No. 14 AWG, copper, stranded
  - l. Limit Switch
    - 1) Single-pole, double-throw (SPDT) type, field adjustable cam-operated, with contacts rated for 5 amps at 120 volts AC.
    - 2) Each valve actuator to have a minimum of two transfer contacts at end position, one for valve "FULL OPEN" and one for valve "FULL CLOSED."
    - 3) Housed in actuator control enclosure
  - m. Control Features:
  - n. Furnish electric actuators with features noted in the Electric Operator Schedule.
  - o. Manufacturers and Products:
    - 1) EIM Controls - Model 2000/MG
    - 2) AUMA - Models SA07.1 through SA48.1
    - 3) Limitorque - Models SMB or HBC with T-Series actuator
    - 4) Rotork Actuator
- D. Valve Boxes

Provide Standard Type "A" valve boxes conforming to requirements of Section 02085 – "Valve Boxes, Meter Boxes, and Meter Vaults".
- E. Valve Service Manholes

For large diameter water lines, provide manholes as shown, and to dimensions shown on Plans conforming to requirements of Section 02082 – "Precast Concrete Manholes."

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Earthwork

Conform to applicable provisions of Section 02317 – “Excavation and Backfill for Utilities.”

B. Setting Valves and Valve Boxes

1. Prior to Hydrostatic testing of water line and valve:
  - a. Test valve by opening and closing valve at a minimum of two times to verify valve seats properly.
  - b. Verify number of turns from fully open to fully closed position is same as identified in manufacturer’s submittal.
  - c. Adjust valve as required if number of turns do not match
  - d. Remove foreign matter from within valves
2. Install valves where shown on Plans or as located by the Project Manager. Use valve boxes for 16-inch and 24-inch valves. 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 when less than 4 feet. Install for maximum operator access and convenience.
3. Avoid disturbing or overstressing valve body when installing valves. Perform field adjustment of valves under pressure to ensure shutoff occurs in number of rotations as described in valves operation and maintenance manual.
4. Attach two four (4) foot lengths of pipe to each side of valve prior to installation in line.
5. Submit certification that large diameter valve was installed, adjusted, and exercised in accordance with manufacturer’s instructions. Manufacturer’s certification shall state that all performance characteristics of large diameter valves, as installed, have been met. Adjustments made to valve, for any reason, must be made by manufacturer’s representative.

C. Above Ground Valves

Above ground installation of valves shall support the pipe on both lengths of pipe adjacent to the valve. Flanged joints shall be used for all above ground butterfly valve installations.

3.04 DEMONSTRATION / TESTING AND INSPECTION

A. Disinfection and Testing

1. Contractor to disinfect valves and appurtenances as required by Section 02514 – “Disinfection of Water Lines” and test as required by Section 02515 – “Hydrostatic Testing of Pipelines.” Do not use valves for throttling without prior approval of manufacturer. Operate satisfactorily through at least three cycles.
2. Furnish services of qualified factory trained technical representative to check installation and assist Contractor in making adjustments to mechanical stop - limiting devices.

END OF SECTION

Section 02524

**AIR RELEASE AND VACUUM RELIEF VALVES**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes air release and vacuum relief valves

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices.**

1. Payment for air release and vacuum relief valves is on unit price basis for each valve installed.
2. Payment includes manhole or vault (when required), fittings, vent piping and bollard(s), and appurtenances necessary for complete installation of the valve.
3. Payment for valve assembly on aerial crossing includes fittings, anti-vandalism protection, freeze protection, vent piping and appurtenances necessary for complete installation of valve.
4. 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 REFERENCES**

- A.** AWWA C512 - Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
- B.** ASTM A536 Grade 65-45-12 Standard Specification for Ductile Iron Castings.
- C.** ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.
- D.** ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
- E.** ASTM A313/A313M - Standard Specification for Stainless Steel Spring Wire.
- F.** ASTM B 584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit manufacturer's product data for proposed valves for approval.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02082 – “Precast Concrete Manholes”
- D. Section 02317 – “Excavation and Backfill for Utilities”
- E. Section 02514 – “Disinfection of Water Lines”
- F. Section 02515 – “Hydrostatic Testing of Pipelines”
- G. Section 09902 – “Painting and Protective Coatings”

1.06 QUALITY ASSURANCE

Provide manufacturer's affidavit that air release and vacuum relief valves purchased for Work, were manufactured and tested in United States, and conform to requirements of this Section.

1.07 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. General
  - 1. Provide combination air valves designed to fulfill functions of air release (permit escape of air accumulated in line at high point of elevation while line is under pressure) and vacuum relief.
  - 2. Provide inlet and outlet connections, and orifice as shown on Plans.
  - 3. Valve exterior: Painted with shop-applied and NSF approved liquid 2 part epoxy or fusion bonded epoxy.
  - 4. Valves shall have material of casting cast into the valve body, or shall be temporarily marked with the material of the casting before shipping



**B. Materials**

1. Air Release Valves: Shall meet AWWA C512 requirements. Provide approved air release valves ASTM A536 Grade 65-45-12. Float and leverage mechanism ASTM A 240 type 316. Body and cover, ASTM A 240 type 316 stainless steel. Orifice and seat, stainless steel against Buna-N or Viton mechanically retained with ASTM A 240 type 316 hex head nut and bolt. Other valve internals shall be ASTM A 240 type 316 stainless steel.
2. Air Release and Vacuum Relief Valves: Shall meet AWWA C512 requirements. Provide single-body, standard combination valves or duplex-body custom combination valves as indicated on Plans.
  - a. For 2 inch and 3 inch, single-body valves, provide inlet and outlet size as shown on Plans and orifice sized for 100 psi working pressure at 5 fps.
    - 1) Valve materials: body, cover, and baffle, ASTM A536 Grade 65-45-12; plug or poppet, ASTM A 240 type 316 stainless steel; float, ASTM A 240 type 316 stainless steel; seat, Buna-N; other valve internals, ASTM A 240 type 316 stainless steel.
  - b. For 3 inch and larger duplex body valves as shown on Plans, provide approved air release valve.
    - 1) Air and vacuum valve materials: body and cover, ASTM A536 Grade 65-45-12; float, ASTM A 240 type 316 stainless steel; seat, Buna-N; other valve internals, Type ASTM 240 type 316 stainless steel.
    - 2) Air release valve: Constructed as specified in paragraph 2.02.B.1 on Air Release Valves.
3. Vacuum Relief Valves: Provide approved air inlet vacuum relief valves with flanged inlet and outlet connections as shown on Plans. Provide air release valves in combination with inlet and outlet, and orifice as shown on Plans. Valve shall open under pressure differential not to exceed 0.25 psi.
  - a. Materials for vacuum relief valves: valve body, ASTM A536 Grade 65-45-12. Seat and plug, bushing, and retaining screws Type A 276 type 304 or ASTM 240 Type 316 stainless steel.
4. Manholes: As shown on Plans conforming to requirements of Section 02082 – “Precast Concrete Manholes”.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Earthwork

Conform to applicable provisions of Section 02317 – “Excavation and Backfill for Utilities”.

B. Setting Valves in Manholes and Vaults

1. If required by Project Manager, provide services of technical representative of valve manufacturer available on site during installation of valves.
2. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.
3. Install valves and valve manholes and vaults where indicated on Plans or as located by Project Manager. Set manholes and vaults plumb and as detailed. Center manholes on valves. Compact cement-stabilized sand around each manhole and vault for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Provide above-ground vents for manholes and vaults as indicated on Plans.

C. Painting of Piping and Valves

Paint piping and valves located in manholes, stations, and above ground per Specification 09902 – “Painting and Protective Coatings”.

3.04 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

A. Disinfection and Testing

Disinfect valves and appurtenances as required by Section 02514 – “Disinfection of Waterlines” and test as required by Section 02515 – “Hydrostatic Testing of Pipelines”.

3.09 – 3.10 NOT USED

END OF SECTION

Section 02527

POLYURETHANE COATINGS AND LININGS ON STEEL PIPE

PART 1 GENERAL

1.01 SUMMARY

This Section includes two-component polyurethane coating and lining systems for use as external coating for steel pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for Work performed under this Section. Include cost of polyurethane coatings in contract unit prices for steel pipe.
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 REFERENCES

- A. ASTM D522/D522M - Standard Test Method for Mandrel Bend Test of Attached Organic Coatings.
- B. AWWA C 210 - Standard for Liquid-Epoxy Coatings and Linings for Steel Water Pipe and Fittings.
- C. AWWA C 222 – Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.
- D. SSPC-PA 2 – Procedure for Determining Conformance to Dry Coating Thickness Requirements.
- E. E. SSPC-PA Guide 10 - Guide to Safety and Health Requirements E. SSPC-SP1 - Solvent Cleaning
- F. F. SSPC-SP10 - Near-White Blast Cleaning.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.

- B. Submit coating manufacturer's catalog sheets and technical information for approval, prior to delivery of pipe.
- C. Obtain from coating manufacturer and submit coating "affidavit of compliance" to requirements of this Section stating that coatings were applied in factory and in accordance with manufacturer's minimum requirements.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01270 – "Measurement and Payment"
- B. Section 01330 – "Submittal Procedures"
- C. Section 02501 – "Ductile Iron Pipe and Fittings"
- D. Section 02502 – "Steel Pipe and Fittings"
- E. Section 02518 – "Steel Pipe and Fittings for Large Diameter Water Lines"
- F. Provide full access to Project Manager for all facilities and documentation regarding surface preparation, environmental conditions and coating applications.
- G. Observation by Project Manager or waiver of observation does not relieve Contractor of his responsibility to perform Work in accordance with Specifications.
- H. Project Manager may retain services of independent, third-party NACE CIP Level III-Certified Inspector for partial or full-time inspection of the Work.
- I. Safety Requirements
  - 1. Secure, from manufacturer, Material Safety Data Sheet (MSDS) for polyurethane coatings and repair materials listed in this Section.
  - 2. Safety requirements stated in this specification and in related sections apply in addition to applicable federal, state, and local rules and regulations. Comply with instructions of coating manufacturer and requirements of insurance underwriters.
  - 3. Follow handling and application practices of SSPC-PA Guide 10;; Coating Manufacturer's Material Safety Data Sheet.

#### 1.06 QUALITY ASSURANCE

- A. Shop and Field Coating Applicator's Experience and Certification:
  - 1. Minimum 2 years' practical experience in application of the specified products required for Coating Applicator and the coating application supervisor (Certified Applicator).

2. Minimum 2 years' practical experience in application of the specified coating system required for Coating application personnel whom have direct coating application responsibility.
3. Certification by coating manufacturer as an approved coating applicator required for Coating Applicator.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Use standard containers to prevent gelling, thickening deleteriously or forming of gas in closed containers within period of 1 year from date of manufacture.
- B. Label each container of separately packaged component clearly and durably to indicate date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name or formula specification, number of coatings together with special instructions. Do not use coating components older than 1 year.
- C. Deliver coating materials to pipe manufacturer in sealed containers showing designated name, batch number, color, date of manufacture, and name of coating manufacturer.
- D. Store material on site in enclosures, out of direct sunlight in warm, ventilated and dry area, or protect as recommended by manufacturer.
- E. Prevent puncture, inappropriate opening, or other action which may lead to product contamination.

1.09 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Coating Material:
- B. Polyurethane (two-component) or approved equal; mix in accordance with coating manufacturer's recommendations.
  1. For areas less than or equal to 6 inches in diameter, brush apply.
  2. For areas greater than 6 inches in diameter, spray apply.

- C. Coating System: Use Type V system which is 2-package polyisocyanate, polyol-cured urethane coating, mixed in 1:1 ratio at time of application. Components shall be balanced viscosities in their liquid state and not require agitation during use.
- D. Exterior Coating Material: Per AWWA C222 The Valspar Corporation or approved equal.
- E. Internal Lining Material: Joint Coating Material CORROPIPE II-PW, manufactured by Carboline, Futura or Lifelast or approved equal.
- F. Cured Properties:
1. Conversion to Solids by Volume: 97 percent plus or minus 3 percent.
  2. Temperature Resistance: Minus 40°F and plus 130°F.
  3. Cure Time: For handling in 1 minute at 120°F, and full cure as follows:

Ambient Temperature	Minimum Full Cure Time
Over 70 degrees F	7 days
50 to 70 degrees F	9 days
0 to 50 degrees F	12 days

4. Maximum Specific Gravities: Polyisocyanate resin, 1.20. Polyol resin, 1.15.
  5. Minimum Tensile Strength: 2,000 psi.
  6. Minimum Hardness: 55 plus or minus 5 Shore D at 70°F.
  7. Flexibility Resistance: ASTM D 522 using 1-inch mandrel. Allow coating to cure for 7 days. Perform testing on test coupons held for 15 minutes at temperature extremes specified in this paragraph.
- G. Repair and Touchup Material
- CORROPIPE II PW - TOUCHUP (two-component, brush applied, or approved equal). Mix in accordance with coating manufacturer's recommendations.

## 2.03 FABRICATION

- A. Surface Preparation:
1. Remove deposits of oil, grease or other organic contaminants before blast cleaning by using solvent wash as specified in SSPC-PA Guide 10. Clean and dry surfaces, keep free of moisture, dust, grit, oil, grease, or other deleterious substances prior to application of coating.

2. Exterior and Interior Surfaces: SSPC-SP10, near-white metal blast cleaning. Blast with clean, hard, sharp cutting abrasives with no steel or cast iron shot in mix.

**B. Thickness**

1. External Coatings: Minimum DFT of 25 mils (0.025 inch).
2. Internal Coatings: Minimum DFT of 20 mils.
3. Thickness Determinations: Use Type 1 magnetic thickness gauge as described in SSPC-PA2 specification. Individual readings below 90 percent of specified minimum are not acceptable. Average individual spot readings (consisting of three point measurements within 3 inches of each other) less than 95 percent of minimum are not acceptable. Average of all spot readings less than minimum thickness specified are not acceptable.

**C. Factory Application of Polyurethane Coating**

1. Equipment: As required by manufacturer.
2. Temperature: Minimum 5°F above dew point temperature. Temperature of surface shall not be less than 60°F during application.
3. Humidity: Heating of pipe surfaces may be required to meet requirements of paragraph 2.01E, Cured Coating Properties, when relative humidity exceeds 80 percent.
4. Do not thin or mix resins; use as received. Store resins at temperature above 55°F at all times or as manufacturer's recommendation.
5. Application: Conform to coating manufacturer's recommendations. Apply directly to substrate to achieve specified thickness. Multiple-pass, one-coat application process is permitted provided maximum allowable recoat time specified by coating manufacturer is not exceeded.
6. Recoat only when coating has cured less than maximum time specified by coating manufacturer. When coating has cured for more than recoat time, follow coating manufacturers recommendations for recoating.
7. Cure at ambient temperature above 0°F. Do not handle pipe until coating has been allowed to cure as follows:

<b>Ambient Temperature</b>	<b>Minimum Full Cure Time</b>
Over 70 degrees F	7 days
50 to 70 degrees F	9 days
0 to 50 degrees F	12 days

D. Factory Inspection

1. Project Manager may inspect coatings at coating applicator's facilities.
2. Secure approval of surface preparation by coating manufacturer's representative prior to coating application.
3. Inspection procedures to be in accordance with AWWA C222. Conduct inspection any time after coating has reached initial cure. Repair in accordance with manufacturer's requirements and these specifications.
4. Remove rejected coating from the full length of pipe to bare metal and reapply using proper application methods.

E. Factory Repair of Linings and Coatings

1. The procedures listed below are for repairs made to internal and external coatings in the factory. For field repairs, see Part 3 – Execution.
2. Defect size is defined as follows: Minor – less than 6 inches by greatest dimension. Major – exceeds 6 inches by greatest dimension.
3. General
  - a. Repair areas where holidays are detected or coating is visually damaged, such as blisters, bubbles, cuts, or other defects.
  - b. Provide coating repair materials that are compatible with the shop-applied coating system and approved by coating manufacturer.
  - c. Provide repair materials as required for the coating system and repair classification.
4. Repair Materials:
  - a. Provide polyurethane, single use kits that are supplied by parent coating manufacturer.
  - b. For major repairs in the shop, reapply using plural component spray equipment by a manufacturer certified coating applicator.
5. For internal coatings, five repairs maximum allowed per 100 square feet of pipe for internal linings. If this number is exceeded, pipe must be stripped of lining, re-blasted, and recoated in factory.

2.04 SOURCE QUALITY CONTROL (NOT USED)



PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Joints

1. Apply coating to unlined pipe surfaces including inside of bell socket and outside of spigot.
2. Coating thickness on sealing areas of spigot end of pipe exterior: Minimum 8 mils (0.008 inch), maximum of 10 mils (0.010 inch). Maximum 10 mils may be exceeded in spigot end provided maximum spigot diameter as specified by pipe manufacturer is not exceeded.
3. Provide holding primer for corrosion protection of cutbacks or holdbacks compatible with specified joint coating system and weld after backfill requirements, where applicable.
4. Holdback coating to prevent corrosion of prepared pipe ends for duration of storage and construction, and recommended for buried exposures.
5. Primer should not result in running or melting of coating and causing toxic fumes when heated during welding on weld after backfill joints.
6. Apply holding primer in accordance with primer manufacturer's recommendations, but maintain clearances required for proper joint installation as recommended by pipe manufacturer.
7. Welded joints:
  - a. Field welded on the inside: Provide four-inch coating holdback on spigot end and six-inch coating holdback on bell end.
  - b. Field welded on the outside: Provide six-inch coating holdback on the spigot end, and four-inch coating holdback on the bell end.

B. Pipe Installation

1. When required by Project Manager, provide services of manufacturer's representative for period of not less than 2 weeks at beginning of actual pipe laying operations to advise Contractor regarding installation including but not limited to handling and storing, cleaning and inspecting, coatings repairs, and general construction methods as to how they may affect pipe coatings.
2. Use nylon straps, padded lifts and padded storage skids. Field cuts should be kept to minimum. Repair damage to coating due to handling or construction

practices. See Section 02501 – “Ductile Iron Pipe and Fittings” and Section 02502 – “Steel Pipe and Fittings” for additional requirements.

3. Just before each section of pipe is to be placed into trench, conduct visual and holiday inspection in accordance with AWWA C222. Repair defects in coating system before pipe is installed.
4. For field-welded joints, drape minimum 18-inch wide strip of heat-resistant material over top half of pipe on each side of the coating holdback to protect from weld splatter.

### 3.04 REPAIR/RESTORATION

#### A. Repair and Field Touchup

1. Apply repair and touchup materials in conformance with manufacturer’s recommendations.
2. Repair Procedure - Holidays:
  - a. Remove traces of oil, grease, dust, dirt, and other deleterious materials
  - b. Roughen area to be patched by sanding with rough grade sandpaper (40 grit).
  - c. Apply one coat of repair material described above. Work repair material into scratched surface by brushing.
3. Repair Procedure - Field Cuts or Large Damage:
  - a. Remove burrs from field cut ends or handling damage and smooth out edge of polyurethane coating.
  - b. Remove traces of oil, grease, dust, dirt, and other deleterious materials
  - c. Roughen area to be patched with rough grade sandpaper (40 grit). Feather edges and include overlap of 1 inch to 2 inches of roughened polyurethane in area to be patched.
  - d. Apply thick coat of repair material described above. Work repair material into scratched surface by brushing. Feather edges of repair material into prepared surface. Cover at least 1 inch of roughened area surrounding damage, or adjacent to field cut.
4. Repair Procedure – Joints:
  - a. External Joints. Provide heat shrink sleeve in accordance with Section 02518 – “Steel Pipe for Large Diameter Water Lines”. Metal surface

must be free of all dirt, dust, and surface corrosion prior to sleeve application.

- b. Internal Joints. Prepare surface and provide environmental controls in accordance with manufacturer's recommendations.
  - 1) Remove oil or grease by solvent wiping pipe and adjacent coating in accordance with SSPC-SP1, Solvent Cleaning.
  - 2) Abrasively blast in the field in accordance with SSPC-SP10, Near-White Metal Blast Cleaning. Clean the full circumference of the pipe and feather the edges of the existing polyurethane coating a minimum of two inches.
  - 3) Remove loose or damaged pipe lining at joint and repair as specified herein, or extend joint lining.
  - 4) Apply lining material by hand or spray equipment. Provide material that is compatible with shop lining and approved by manufacturer.
  - 5) Provide a NACE Level II or III inspector experienced with the applied coating system to inspect surface preparation of the joint lining and document application conditions. Submit documentation to Project Manager.

5. Repair Procedure - Thermite Brazed Connection Bonds:

- a. Remove polyurethane coating with power wire brush from area on metal surface which is to receive thermite brazed connection.
- b. Grind metal surface to shiny metal with power grinder and coarse grit grinding wheel.
- c. Apply thermite-brazed connection using equipment, charge, and procedure recommended by manufacturer of thermite equipment.
- d. Drape minimum 18-inch wide strip of heat-resistant material over top half of pipe on all sides during welding to protect from weld spatter.
- e. After welded surface has cooled to temperature below 130°F, apply protective coating repair material to weld, exposed pipe surface and damaged areas of polyurethane coating.

- f. Do not cover or backfill freshly repaired areas of coating at thermite-brazed connection until repair material has completely cured. Allow material to cure in conformance with manufacturer's recommendations.

3.05 – 3.10 NOT USED

END OF SECTION

Section 02528

**POLYETHYLENE WRAP**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes specifications for materials and installation of polyethylene encasement for pipe, valves, fittings, and other appurtenances in ductile or cast iron systems.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices**

No separate payment will be made for polyethylene wrap. Include cost of polyethylene wrap in unit price for pipes and fittings to be wrapped.

**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 149 – Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
- B.** ASTM D 882– Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
- C.** ASTM D 1709 REV A – Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
- D.** ASTM D 1922– Standard Test Method for Propagation Tear Resistance of Plastic Film and Thin Sheeting by Pendulum Method.
- E.** ASTM D 4976 REV A– Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.
- F.** AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
- G.** ANSI A 21.5 (AWWA C 105) - Polyethylene Encasement for Ductile-Iron Pipe Systems

**1.04 SUBMITTALS**

- A.** Submit product data in accordance with Section 01330 – “Submittal Procedures”.
- B.** Submit product data for proposed film and tape for approval.

- C. Submit quality assurance plan for field application.
- D. Submit polyethylene film manufacturer's certification of compliance with this Section.

1.05 RELATED REQUIREMENTS

- A. Section 01110 – "Summary of Work"
- B. Section 01270 – "Measurement and Payment"
- C. Section 01330 – "Submittal Procedures"

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming to the requirements of AWWA C 105, for linear, low density polyethylene film.
  - 1. Linear Low Density, Polyethylene: Low-density, Linear polyethylene material conforming to the following:
    - a. Raw Material. Raw materials to meet the requirements of ASTM D 4976:
      - 1) Group: 2 (Linear)
      - 2) Low-density: 0.910 to 0.935 g/cm<sup>3</sup>
      - 3) Dielectric Strength: Volume resistivity, 10<sup>15</sup> ohm-cm, minimum
    - b. Physical Properties: Physical properties to be as follows:
      - 1) Tensile Strength: 3,600 psi for an 8 mil minimum thickness, minimum in machine and transverse direction (ASTM D 882)
      - 2) Elongation: 700 percent, minimum in machine and transverse direction (ASTM D 882)
      - 3) Dielectric Strength: 800 volts/mil thickness, minimum (ASTM D 149)
      - 4) Impact Resistance: 600 g, minimum (ASTM D 1709 Method B)

- 5) Propagation Tear Resistance: 2550 gf, minimum in machine and transverse direction (ASTM D1922)
  - c. Thickness: Linear, low density polyethylene film shall have a minimum thickness of 0.008 in. (8 mils)
  - d. Color: Supply white polyethylene film with a minimum 2 percent hindered-amine ultraviolet inhibitor.
2. Polyethylene Tube and Sheet Size: For push-on joint pipe, polyethylene tube and sheet sizes to conform to the following:

<b>Nominal Pipe Diameter</b>	<b>Minimum Polyethylene Width (inches)</b>	
	<u>Flat Tube</u>	<u>Sheet</u>
<u>Inches</u>		
3	14	28
4	14	28
6	16	32
8	20	40
10	24	48
12	27	54
14	30	60
16	34	68
18	37	74
20	41	82
24	54	108
30	67	134
36	81	162
42	81	162
48	95	190
54	108	216
60	108	216
64	121	242

3. Large Bell Circumferences: Where bell ends of the pipe are larger than the sheet sizes listed above, use sufficiently large tubes or sheets to cover the joints. Submit sheet dimensions to Engineer for approval prior to application.
4. Marking: The polyethylene film shall be clearly marked every 2 feet with the following information:
  - a. Manufacturer's name or trademark
  - b. Year of manufacture
  - c. ANSI/AWWA C105/A21.5

- d. Minimum film thickness and material type (LLDPE)
  - e. Applicable range of nominal pipe diameter size(s)
  - f. Warning – Corrosion Protection – Repair Any Damage
5. Letters and numerals used for marking items “a” through “e” shall not be less than 1 inch in height and item “f” shall not be less than 1½ inches in height.
- B. Polyethylene Tape: Provide 3-inch wide, plastic-backed, adhesive tape; Paleocene No. 900, Scotchwrap No. 50, or approved equal.

2.03 – 2.04 NOT USED

**PART 3 EXECUTION**

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.
- B. Fit polyethylene film to contour of pipe to effect a snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.
- C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap. Circumferentially wrap with tape, every 2 feet along the barrel. Seals shall be confirmed by Project Manager or Inspector before backfill.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Tubular Type (Method A):
  - 1. Cut polyethylene tube to a length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section. Bunch accordion-fashion lengthwise until it clears pipe ends.
  - 2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.



3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points.
4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner. Any tears, punctures, or other damage shall be repaired at no cost to Owner.

**B. Tubular Type (Method B):**

1. Cut polyethylene tube to a length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.
2. Before making up joint, slip 3-foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3-foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.
3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner. Any tears, punctures, or other damage shall be repaired at no cost to Owner.

**C. Sheet Type (Method C):**

1. Cut polyethylene sheet to a length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.
2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.
3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner. Any tears, punctures, or other damage shall be repaired at no cost to Owner.

**D. Installation in Directional Drilled Bore:**

1. Install as described in 3.03.A. Tubular Type (Method A).

2. Attach pulling head to spigot end.
  3. Securely anchor the polyethylene tube at the leading pipe length with circumferential wraps of tape every 1 foot.
  4. Overlap the polyethylene wrap on the following pipe section and secure with tape on each side of joint.
  5. Continue process while taping on each side of successive joints and every 2 feet along barrel.
- E. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.
- F. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.
- G. Openings in Encasement: Create openings for branches, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with any resulting damaged areas being repaired as specified.
- H. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.
- I. Backfill
- Use the same backfill material as that specified for pipe without polyethylene wrap. Prevent damage to the polyethylene wrap when placing backfill. Assure backfill material is free from cinders, refuse, boulders, rocks, stones, or other material that could damage the polyethylene. Follow AWWA C600 for backfilling.

### 3.04 REPAIR/RESTORATION

Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place. Any tears, punctures, or other damage shall be repaired at no cost to Owner.

3.05 FIELD QUALITY CONTROL

- A. Freedom from Defects: All polyethylene film shall be clean, sound and free from defects. Defects shall be corrected by the Contractor at no expense to the Owner.
- B. Inspection: All parts of this Section are subject to inspection by the Owner or its designated representative.
- C. Non-Compliance: The CONTRACTOR shall correct any deficiencies in materials or installation at his expense, including excavating the pipe subsequent to backfilling and reinstalling the polyethylene wrap.

3.06 – 3.10 NOT USED

END OF SECTION

Section 02613

**BAR WRAPPED STEEL CYLINDER PIPE**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes furnishing and installing new bar wrapped steel cylinder pipe and fittings for buried water lines for sizes 20 inches to 60 inches.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices.**

1. No separate payment will be made for bar wrapped steel cylinder pipe under this Section. Include cost in price for water lines.
2. Maintain, on site, minimum of two 3-degree and two 5-degree grade angle adapters. Adapters are considered "extra unit price." When used during construction, adapter shall be paid at unit price.
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.

**1.03 REFERENCES**

- A. AASHTO - Standard Specifications for Highway Bridges.
- B. AREMA - Manual of Railway Engineering, Volume II, Chapter 15.
- C. ASTM A615/A615M REV A - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- D. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- E. ASTM C 35 - Standard Specification for Inorganic Aggregates for Use in Gypsum Plaster.
- F. ASTM C150/C150M - Standard Specification for Portland Cement.
- G. ASTM C 497 - Standard Test Method for Concrete Pipe, Manhole Sections, or Tile.
- H. ASTM D 512 - Standard Test Methods for Chloride Ion in Water.

- I. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- J. ASTM D 1293 - Standard Test Methods for pH of Water.
- K. ASTM E165/I165M - Standard Practice for Liquid Penetrant Examination for General Industry.
- L. ASTM E 340 - Standard Test Method for Macroetching Metals and Alloys.
- M. ASTM E 709 - Standard Test Methods for Magnetic Particle Testing.
- N. ASTM E 1032 - Standard Test Methods for Radiographic Examination of Weldments.
- O. ANSI/AWS A3.0M/A3.0 - Standard Welding Terms and Definitions Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying.
- P. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.
- Q. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.
- R. AWWA C 301 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
- S. AWWA C 303 - Standard for Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
- T. AWWA C 304 - Standard for Design of Prestressed Concrete Cylinder Pipe.
- U. AWWA M 9 - Concrete Pressure Pipe.
- V. NSF/ANSI 61 - Drinking Water System Components - Health Effects.
- W. SSPC SP 7 - Brush Off Blast Cleaning.
- X. ASTM E 536 – Standard Test Methods for Chemical Analysis of Zinc and Zinc Alloys.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit Shop Drawings and certification signed and sealed by Professional Engineer registered in State of Texas showing following:
  - 1. Manufacturer's pipe design calculations.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Plans. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (\*PDF).
  3. Include hot tapping procedure.
  4. Submit certification from manufacturer that design was performed for project in accordance with requirements of this section.
- C. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding. Submit standard repair procedures that describe in detail shop and field Work to be performed. Repair defects such as substandard welds, excessive radial offsets (misalignment), pitting, gouges, cracks, etc.
- D. Submit following within 45 days after manufacturing of pipe and fittings:
1. Steel:
    - a. Steel reports as required in AWWA C 303, Section 5.2.5.
    - b. Results of other tests of steel reinforcement required in AWWA C 303, Section 5.2.
  2. Test Results.
    - a. Hydrostatic testing, acid etching, magnetic particle and x-ray weld test reports as required.
    - b. Compressive strength (7 and 28 day) test results for each type of coating and lining mix design.
  3. Submit pipe manufacturer's certification that Bar Wrapped Steel Cylinder Pipe:
    - a. Cylinder assembly has been hydrostatically tested at factory.
    - b. Mortar coatings and linings were applied or allowed to cure at temperature above 32 degrees Fahrenheit.
- E. Submit following for nonshrink grout for special applications:
1. Manufacturer's technical literature including specifications for mixing, placing, and curing grout.

2. Results of tests performed by certified independent testing laboratory showing conformance to ASTM C1107/C1107M, Nonshrink Grout and requirements of this specification.
  3. Certification product is suitable for use in contact with potable water.
- F. Submit certification for welder and welding operator demonstrating their certification within past 6 months in accordance with AWWA C 206. Indicate certified procedures and position each welder is qualified to perform.
- G. Calibrate within last 12 months for equipment such as scales, measuring devices, and calibration tools used in manufacture of pipe. Each device used in manufacture of pipe is required to have tag recording date of last calibration. Devices are subject to inspection by Project Manager.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01110 – “Summary of Work”
- B. Section 01270 – “Measurement and Payment”
- C. Section 01330 – “Submittal Procedures”
- D. Section 02317 – “Excavation and Backfill for Utilities”
- E. Section 02425 – “Tunnel Excavation and Primary Liner”
- F. Section 02502 – “Steel Pipe and Fittings”
- G. Section 02511 – “Water Lines”
- H. Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”
- I. Section 16061 – “Joint Bonding and Electrical Isolation”

#### 1.06 QUALITY ASSURANCE

- A. Manufacturer to have permanent quality control department and laboratory facility capable of performing inspection and testing required. Inspection procedures and manufacturing process are subject to inspection by Project Manager. Perform manufacturer tests and inspections required by AWWA C 303 as modified by these Specifications. Correct nonconforming conditions.
1. Cylinder and Joint Ring Assembly:
    - a. Review mill certifications for conformance to requirements of Specifications.

- b. Perform physical testing of each heat of steel for conformance to applicable ASTM standards.
  - c. Inspect physical dimensions and overall condition of joint rings and cylinder/joint ring assembly to verify compliance with requirements of AWWA C 303. Maximum allowable thickness variation of cylinder shall not be less than determined thickness.
  - d. Test cylinder/joint ring weld for tensile strength. Test one specimen for each 500 cylinder/joint ring assemblies in addition to those tests required by AWWA C 301.
  - e. Reject pipe with dented steel cylinders.
2. Bar Rod
- a. Review mill certifications for conformance to requirements of Specifications.
  - b. Inspect rod spacing during placement on cylinder.
  - c. Test rod splices for each production run or minimum of once a week, whichever is less, for conformance with minimum strength criteria.
3. Pipe Lining Coating:
- a. Review mill certificates for each load of cement for conformance to ASTM C150/C150M.
  - b. Perform sieve analyses weekly for each source of coarse and fine aggregate for conformance to ASTM C33/C33M.
  - c. Inspect kiln recorder charts daily to confirm proper curing environment.
  - d. Verify mortar thickness on each size of pipe to a tolerance of 1/16th of an inch of required thickness.
  - e. Perform absorption tests in accordance with ASTM C 497, Method A, on cured mortar samples taken from pipes.
  - f. Check mortar batch proportions, moisture content and slurry application rate. Check coating thickness over wire on each pipe.
  - g. Check physical integrity of cured mortar coating. Check cured mortar coating for soundness on every pipe in field in addition to manufacturing plant.



- h. Reject pipe with cracks in mortar coating exceeding 0.01 inches wide.
- 4. Protective Coatings: Check daily application rate and resulting dry film thickness.
- B. Gaskets:
  - 1. Randomly test rubber cord for diameter, tensile strength, elongation, compression set, hardness, and specific gravity after oven aging on one out of 100 gaskets.
  - 2. Stretch test each gasket splice to twice its unstretched length and inspect for defects.
- C. Weld Testing
  - 1. Perform macroetching tests for complete penetration production welds on normal production weld tests. Complete joint penetration welds are defined in ANSI/AWS A3.0. Verify complete joint penetration by means of macroetch of joint weld cross section. Macroetch technique in accordance with ASTM E 340.
  - 2. Perform ultrasonic or x-ray testing of manual welds for fittings and special pipes. Perform dye penetration testing of manual lap welds for fittings and special pipes and for joint ring weld onto cylinder.
  - 3. Perform minimum of one set of weld test specimens in accordance with ANSI/AWS A3.0 on each size, grade and wall thickness at minimum of every 3,000 feet of pipe manufactured; but perform no less than one test per project by each welding machine and each operator.
- D. Cast four standard test cylinders each day for each 50 cubic yards of concrete mortar coating or portion thereof for each coating and lining mix design placed in day. Perform compressive strength test at 28 days. No cylinder test result shall be less than 80 percent of specified strength. Reject pipe that does not meet minimum strength requirements.
- E. Make available copy of Physical and Chemical testing reports for steel cylinders and provide reports at request of Project Manager.
- F. Check physical dimensions of pipe and fittings: Physical dimensions to include at least pipe lengths, pipe I.D., pipe O.D. and bend angles.

1.07 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Furnish pipe by same manufacturer. Do not ship over salt water.
- B. Provide bar wrapped steel cylinder pipe in conformance with AWWA C 303 and AWWA M 9, except as modified herein. Produce pipe cylinder to conform to AWWA C 303 except modify Section 4.5 to require that total cross-sectional area of bell ring plus cross-sectional area of bar reinforcement over bell ring exceed circumferential steel area in like length of barrel area by one-third.
- C. Use of pipe from inventory is permitted only if specifications and certifications are met. Provide testing records for such pipe.
- D. Do not use bar wrapped steel cylinder pipe in aerial crossings, exposed or other unburied areas.
- E. Pipe Manufacturer:
  - 1. Must have minimum of 5 years of manufacturer's pipe installations that have been in successful and continuous service.
  - 2. Must maintain on site or in plant minimum of four 22.5 degree bends per 10,000 linear feet of water line. These fittings are in addition to fittings called out on Plans and must be available at all times.
- F. Pipe Design Conditions:
  - 1. Working pressure: 150 psi.
  - 2. Hydrostatic field test pressure: 150 psi.
  - 3. Maximum pressure due to surge: 150 psi.
  - 4. Minimum pressure due to surge: -10 psi.
  - 5. Unit weight of soil: 120 pcf minimum, unless otherwise specified.
  - 6. Minimum trench width: O.D. of pipe + 4 feet.
  - 7. Pipe and Fittings: Designed to withstand most critical simultaneous application of external loads including construction loads and internal pressures.
  - 8. Design: Design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Plans. Design pipes with Marston's earth loads for transition width trench for all heights of cover.

Calculate moments and thrusts in wall based on earth load.

9. Increase longitudinal steel area (cylinder thickness) to prevent cylinder stress from exceeding 40 percent of minimum yield point at rated working pressure and 67 percent of minimum yield point at rated maximum surge pressure where pipe and fittings are subjected to longitudinal stresses induced by restrained joints or thrust blocks.
10. Groundwater Level: Design for most critical ground water level condition.
11. Modulus of elasticity (E) = 30,000,000 psi.
12. Design stress due to working pressure to be no greater than 50 percent of minimum yield, and stress not to exceed 16,500 psi for mortar coated pipe.
13. Design stress due to maximum hydraulic surge pressure to be no greater than 75 percent of minimum yield, and stress not to exceed 24,750 psi for mortar coated pipe.
14. Modulus of soil reaction (E ) < 1500 psi. If E > 1000 psi, do not use silty sand (SM) for embedment.
15. Deflection lag factor (DI) = 1.2.
16. Bedding constant (K) = 0.1.
17. Fully saturated soil conditions: hw = h = depth of cover above top of pipe.
18. Provide minimum inside clear diameter for tunnel liners or casing in accordance with Section 02425 – “Tunnel Excavation and Primary Liner”.
19. Exclude structural benefits associated with primary liner in design of pipe in tunnel installations.
  - a. Design pipe and joints to carry loads including overburden and lateral earth pressures, subsurface soil and water loads, grouting, other conditions of service, thrust of jacks, and stresses anticipated during handling and construction loads during installation of pipe.
  - b. Do not use internal removable stiffeners for pipe in tunnel, unless approved by Project Manager.
  - c. External welded stiffeners shall be permitted in design calculations for pipe, provided wall thickness is a minimum of 1/2 inch. Minimum clearances specified between exterior pipe wall and tunnel liner applies to distance between outside diameter of external welded stiffener and tunnel liner.

20. Design pipe for transmitting potable water, unless otherwise shown on Plans.
21. Tunnel and Augered Sections: Provide constant outside diameter from bell to spigot end for pipe. Exclude structural benefits associated with primary liner. Design pipe and pipe joints to carry loads including but not limited to: overburden and lateral earth pressures, subsurface soil, grouting, other conditions of service, thrust of jacks, and any stress anticipated during handling and installation.

G. Coatings and Linings:

1. Provide Portland cement; ASTM C150/C150M, Type I or II. Provide one type of cement for entire project.
2. Water Absorption Test: ASTM C 497, Method A; perform on samples of cured mortar coating taken from each working shift. Cure mortar coating samples in same manner as pipe.
  - a. Test Value: Average minimum of 3 samples taken from same working shift, no greater than 9 percent for average value, 11 percent for individual value.
  - b. Test Frequency: Perform tests each working shift until conformance to absorption requirements has been established by 10 consecutive passing test results, at which time testing may be performed weekly. Resume testing for each working shift if absorption test results fail until conformance to absorption requirements is reestablished by 10 consecutive passing test results.
3. Apply one coat of primer to exposed steel parts of steel bell and spigot rings. Prior to coating, blast clean in accordance with SSPCSP 7 (Brush Off Blast Cleaning). Apply primer in accordance with manufacturer's recommendations.
4. Coat and line access inlets, service outlets, test inlets and air release/vacuum relief riser pipe with same coating and lining of water line pipe in accordance with AWWA C 303, Section 4, unless otherwise indicated on Plans.
5. Do not defer placing of coating of any portion of pipe length. Verify cement mortar coating thickness on each size of pipe by nondestructive method before removing pipe from coating machine.
6. Remove and replace disbonded lining or coating. Reject pipe requiring patches larger than 100 square inches or 12 inches in greatest dimension. Allow no more than one patch on either lining or coating of pipe. Provide WELD-CRETE Probond Epoxy Bonding Agent ET-150, parts A and B; Sikadur 32 Hi-Mod, or approved equal bonding agent for pipe patching.

H. Fittings and Specials:

1. Design fittings to same internal and external loads as straight pipe.
2. Manufacture in accordance with Section 02518 – “Steel Pipe and Fittings for Large Diameter Water Lines”.
3. Provide fabricated bends or fittings with minimum radius of 2½ times pipe diameter.
4. Design test plugs to withstand forces generated by hydrostatic test and test pressure from either side. Do not exceed 50% of minimum yield for design stresses due to hydrostatic pressure. Assume opposite side of plug does not contain water.
5. Provide no specials less than 4 feet in length unless indicated on Plans or approved by Project Manager.
6. Butt Straps for Closure Piece: Provide at locations indicated on Plans or authorized by Project Manager. Minimum 12-inch-wide split butt strap; minimum plate thickness equal to thinnest member being joined; fabricated from material equal in chemical and physical properties to thinnest member being joined. Permit no angular deflection at butt-strap joints.
7. Provide minimum 6-inch welded outlet for inspecting each closure section, unless access manway is within 40 feet of closure section.
8. Provide Denso petrolatum based tape or approved equal for exposed portions of nuts and bolts.

I. Joints:

1. AWWA C 303 rubber-gasketed or welded bell-and-spigot type except where flanged joints are required for valves and fittings as shown on Plans. Refer to Section 02511 – “Water Lines” for details on joints and jointing.
2. Rubber-Gasketed Joints: Attach joint ring to steel cylinder with full-thickness fillet welds, welded inside and out (double welded). Bond as shown on Plans to provide electrical continuity along pipeline.
3. Restrained Joints: Restrain joints by welding or harnessing joints.
  - a. Design Pressure: 1.5 times working pressure.
  - b. Harnesses Joints: AWWA M 9, clamp or snap ring type, except where prohibited.
  - c. Groundwater Level: Assumed to be equal to natural ground surface.

- d. Provide restrained joint pipe with adequate cylinder thickness to transmit full thrust generated by internal pressure across joints.
  - 1) Calculate distance of restrained joints based on resistance along each leg of bend with thrust based on bend angle.
  - 2) Cylinder thickness not to be less than that defined in AWWA C 303, Table 2, minimum nominal cylinder thickness.
  - 3) Allow cylinder thickness to reduce linearly from maximum calculated thickness to minimum thickness required by design over required length of restrained joints.
  - 4) Provide full circumferential welds at joints required to be welded.
- J. Use only fully circumferentially welded joints in areas considered potentially petroleum contaminated, within tunnels and under foreign pipelines. Perform welding in accordance with Section 02502 – “Steel Pipe and Fittings” and Section 2518 – “Steel Pipe and Fittings for Large Diameter Water Lines”.
- K. Pipe Flanges: AWWA C 207 for standard steel flanges of pressure class corresponding to pipe class.
- L. Pipe lengths: Provide pipe sections in standard lengths with minimum length of 16 feet and maximum length of 25 feet, and as indicated on approved Shop Drawings or approved by Project Manager. Gasketed joints are allowed on standard lengths of pipe. Non-standard pipe lengths must be approved by Project Manager and joints must be welded as specified herein to achieve equal to or greater than standard pipe length before gasketed joints can be used. Internally and externally mark pipe section with durable marking to show location and pipe pressure.
- M. Hydrostatic Test of Cylinder: In accordance with AWWA C 303, at point of manufacture. Hold test for minimum 2 minutes for thorough inspection of cylinder. Repair or reject cylinders revealing leaks or cracks.
- N. Transport fittings with end caps. Remove end caps just prior to installation.
- O. Transport fittings 36 inches in diameter and larger with stulls. Remove stulls after completion of backfill.
- P. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe. Locate unique identifying mark minimum of 5 feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

- Q. Provide radius of curve as indicated on Plans unless approved by Project Manager. Make curves and bends by deflecting joints, by use of beveled joints, or by combination of two methods, unless otherwise indicated on Plans. Do not exceed deflection angle recommended by pipe manufacturer. Provide beveled pipe sections of standard length used in curved alignment, except when shorter sections are required to limit radius of curvature. In such case, provide sections throughout curve of substantially equal length.
- R. When manufacturing straight pipe sections, manual welding is allowed for following:
1. Tack welding of coils and plates during continuous pipe making process.
  2. Rewelding and repairing structural defects in plate and automatic machine welds.
  3. Attaching new coil of steel to previous coil.
- S. Bar Rod
1. Conform to requirements of ASTM A615/A615M, AWWA C 303 and this specification.
  2. Test foreign manufactured rod by local independent laboratory.
  3. Rod manufacturer is responsible for performing mechanical tests required in ASTM A615/A615M.
  4. Pipe manufacturer is responsible for requiring rod manufacturer to submit certified results of chemical and mechanical tests, performed by rod manufacturer. Pipe manufacturer is responsible for performing mechanical tests, and is required to attest to such in affidavit of compliance.
  5. Do not use rod with visible pitting.
- T. Grout for Joints and Special Application
1. Joint Grout:
    - a. Cement Grout Mixture: One part cement to two parts of fine, sharp clean sand. Mix interior joint mortar with as little water as possible until very stiff but workable. Mix exterior joint mortar with water until it has consistency of thick cream.
    - b. Water: Potable water with total dissolved solids less than 1000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5. Use potable water with 250 ppm limit on chlorides and sulfates.

- c. Portland Cement: ASTM C150/C150M, Type I or II. Provide one type of cement for entire project.
  - d. Sand:
    - 1) Interior joints: ASTM C 35 fine graded plaster sand.
    - 2) Exterior joints: ASTM C 33 natural sand with 100 percent passing No. 16 sieve.
  - e. Mix cement grout to specific gravity of 19 lb/gallon or greater as measured by grout/slurry balance. Use grout/slurry balance manufactured by Baroid or approved equal. Perform test in presence of and as requested by Project Manager. Add additional cement grout or water to mixed cement grout to bring mix to proper moisture content or specific gravity. Discard cement grout mixed more than 20 minutes that is not at proper moisture content or specific gravity.
2. Nonshrink Grout for Special Applications, Patches and Repairs.
- a. Conform to requirements of ASTM C 1107, Nonshrink Grout.
  - b. Pre-blended factory-packaged material manufactured under rigid quality control.
  - c. Contain non-metallic natural aggregate, be nonstaining and noncorrosive.
  - d. Meeting NSF 61 Standard suitable for use in contact with potable water supply.
  - e. Exterior: Highly flowable to fill joint wrapper without leaving voids or trapped air. Interior capable of being placed with plastic consistency.
  - f. Non-bleeding and non-segregating at fluid consistency.
  - g. Contain no chlorides or additives which may contribute to corrosion of bar wrapped steel cylinder pipe.
  - h. Free of gas-producing, gas-releasing agents.
  - i. Resist attack by oil or water.
  - j. Mix, place, and cure in accordance with manufacturer's recommendations. Upon 72 hours' notice, provide services of qualified representative of nonshrink grout manufacturer to aid in use of product under job conditions.



- k. Mix nonshrink grout to specific gravity of 17.7 lb/gallon or greater as measured by grout/slurry balance. Use grout/slurry balance manufactured by Baroid or approved equal. Perform test in presence of and as requested by Project Manager. Add additional non-shrink grout to mixed non-shrink grout to bring to proper moisture content or specific gravity. Discard grout mixed more than 20 minutes that is not at proper moisture content or specific gravity.
      - l. Compressive strength: ASTM C 1107 2500 psi minimum 7-day unconfined; 5000 psi minimum 28-day unconfined.
    - 3. Finished surface of lining and interior joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat and uniform-appearing finish.
    - 4. Joint Wrapper: Minimum width of 9 inches for 33-inch diameter and smaller; minimum width of 12 inches for diameters greater than 33-inch hemmed at edge to allow threading with minimum 5/8-inch wide steel strap. Provide minimum 6-inch wide Ethafoam strip sized, positioned, and sewn such that two circumferential edges of Ethafoam are 1½-inches from outer edge of wrapper.
  - U. Cathodic Protection
    - 1. Connect each joint of pipe with bonding straps or approved devices to maintain continuity of current. Provide bonding straps free of foreign material.
    - 2. Electrically isolate water line from other connections. Use insulating type joints or nonmetallic pipe unless otherwise indicated on Plans.
    - 3. Provide flange adapter with insulating kit as required when connecting new piping to existing piping.
    - 4. Refer to Section 16640 – “Cathodic Protection for Pipelines” for additional requirements.
- 2.03 FABRICATION (NOT USED)
- 2.04 SOURCE QUALITY CONTROL
- A. Inspection and Shipping
- 1. Permit Project Manager to inspect pipes or witness pipe manufacturing. Inspection shall not relieve manufacturer of responsibilities to provide products that comply with applicable standards and these Specifications. Should Project

Manager elect not to inspect manufacturing, testing, or finished pipes, it in no way implies approval of products or tests.

2. Manufacturer's Notification to Customer: Should Project Manager wish to see specific pipes during manufacturing process, manufacturer shall provide Project Manager with minimum of three (3) weeks advance notice of when and where production of those pipes shall take place.
3. Repair damage to pipe or protective lining per manufacture specifications before final acceptance.
4. Shipping: Where required, provide pipe and fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

### PART 3 EXECUTION

#### 3.01 – 3.02 NOT USED

#### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Conform to requirements of Section 02511 – “Water Lines”. Do not install pipe without approved lay schedule.
- B. Install pipe within six months of pipe being manufactured.
- C. Manufacturer shall make available services of representative, throughout project duration when deemed necessary by Project Manager, to advise aspects of installation including but not limited to handling, storing, cleaning and inspecting, coatings and linings repairs, and general construction methods affecting pipe.
- D. Bedding and Backfilling
  1. Conform to requirements of Section 02317 – “Excavation and Backfill for Utilities”.
  2. Take necessary precautions during bedding and backfilling operations to prevent deformation or deflection of cylindrical shape of pipe by more than allowable pipe deflection.
  3. Do not move trench support system (trench safety system) once bedding material is compacted.
  4. Align pipe at proper grade prior to joint connection and do not shift after jointing operation has been completed.
  5. Excavate outside specified trench section for bell holes, and for spaces sufficient to permit removal of slings. Provide bell holes at proper locations for unrestricted access to joint. Form bell holes large enough to facilitate joint

wrapping and to permit visual examination of process. Enlarge bell holes as required or directed by Project Manager. Subsequent backfilling thereof shall not be considered as authorized additional excavation and backfill. Backfill bell holes and spaces to satisfaction of Project Manager.

6. Remove blocking after placing sufficient backfill to hold pipe in position.
- E. Follow nonshrink grout manufacturer's specifications for nonshrink grouting.
- F. Store pipe at job-site with securely-fastened plastic end caps to maintain moist pipe interior. Promptly replace damaged end caps to avoid shrinkage or cracking of cement-mortar lining. Immediately replace damaged plastic end caps. Do not leave uncapped for more than 4 hours.
- G. No deviation from line and grade at contact interfaces are allowed.
- H. Use adequate surveying methods, procedures and employ competent surveying personnel to ensure pipe sections are laid to line and grade and within stipulated tolerances. Measure and record, in form approved by Project Manager, in-place survey data for pipe laid each day and submit copy of data to Project Manager at end of that day. Survey data to include unique pipe number, deflection angle at pipe joint and whether beveled ends were used, invert elevation at pipe joint, deviation of joint from project line, deviation of joint from project grade, inside pipe joint lap measured at top, bottom, and at springline (each side).
- I. Static Electricity:
  1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.
  2. Electrically test where required after installation of pipeline is complete.
- J. Deflection
  1. Allowable deflection from specified diameter determined as follows:

Allowable deflection in inches=  $(D)^2/4000$ , (D= Nominal inside pipe diameter in inches).
  2. Deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection are not acceptable.
  3. If deflection exceeds that specified, remove entire portion of deflected pipe section and install new pipe as directed by Project Manager at no additional cost.

K. Closures and Approved Pipe Modifications

1. No modifications of standard pipe for closures shall be permitted in field. No field cutting of pipe or exposure of bar wire is permitted without written approval from Project Manager.
2. Pipe manufacturer's representative and Project Manager to entirely witness closures and approved pipe modification efforts.
3. Provide minimum lap of 4 inches between member being joined and edge of butt strap. Weld on both interior and exterior, unless otherwise approved by Project Manager.
4. Provide full circumferential welds on joints required to be welded. Employ independent certified testing laboratory, approved by Project Manager, to perform weld tests on field welds. Include cost of such testing in contract unit price for water line. Use magnetic particle test method for lap welds or X-ray methods for butt welds, for 100 percent of joint welds. Maintain records of tests. If defective weld is revealed, repair defective weld, and retest. Use wire and flux from same manufacturer throughout entire project.
5. Fill wrapper in field and allowing excess grout water to seep out. Refill wrapper as necessary. When joint mortar level has stabilized and begun to mechanically stiffen, lap Ethafoam wrapper over top of joint, and secure in place.
6. Stretch test each gasket splice to twice its unstretched length and inspect for defects.

L. Visible Cracks

1. No visible cracks longer than 6 inches, measured to be within 15 degrees of line parallel to pipe longitudinal axis, are permitted except:
  - a. In surface laitance of centrifugally cast concrete,
  - b. In sections of pipe with steel reinforcing collars or wrappers, or
  - c. Within 12 inches of pipe ends.
2. Repair interior lining cracks that exceed 1/16-inch (0.0625 inches) wide.
3. Reject pipe with exterior coating cracks that exceed 0.01 inches wide.
4. Immediately remove pipe from site if pipe has cracks exceeding limitations and cracks are not repairable.

3.04 REPAIR/RESTORATION

A. Field Repair Procedures for Coating/Lining

1. Areas less than or equal to 6 inches in diameter: Patch honeycomb and minor defects in concrete surfaces with nonshrink grout conforming to Section 2.03.T.2. Use only manual or small (low pressure) air chisels to chip away mortar coating or lining. Cut out unsatisfactory material and replace with nonshrink grout, securely bonded to existing coating or lining. Finish junctures between patches and existing concrete as inconspicuous as possible. Strike off nonshrink grout flush with surrounding surface after patch has stiffened sufficiently to allow for greatest portion of shrinkage. Finish surface in accordance with lining requirements.
2. Pipe with defective coating areas greater than 6 inches in diameter cannot be used. Immediately remove pipe from project.
3. Reject pipe if steel cylinder is dented while making field repair. Immediately remove pipe from project.

3.05 – 3.10 NOT USED

END OF SECTION

Section 02621

GEOTEXTILE

PART 1 GENERAL

1.01 SUMMARY

This Section includes Geotextile, also called filter fabric, in applications including pipe embedment wrap, around exterior of tunnel liner, around foundations of pipeline structures, and slope stabilization.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for Work performed under this Section. Include cost of Work in unit prices for Work requiring geotextile.
2. Refer to Section 01270 – “Measurement and Payment” for unit price procedures.

1.03 REFERENCES

- A. AASHTO M 288 - Standard Specification for Geotextile Specification for Highway Applications.
- B. ASTM D 3786 - Standard Test Method for Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method.
- C. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
- D. ASTM D 4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- E. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- F. ASTM D 4751 - Standard Test Method for Determining Apparent Opening Size of Geotextile.
- G. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.

- B. Submit standard manufacturer's catalog sheets and other pertinent information, for approval, prior to installation.
- C. Submit installation methods, as part of Work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Project Manager for filter fabric material and proposed installation method prior to use of filter fabric.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02317 – “Excavation and Backfill for Utilities”
- D. Section 02517 – “Water Line in Tunnels”
- E. Section 02425 – “Tunnel Excavation and Primary Liner”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Provide geotextile (filter fabric) designed for use in geotechnical applications. Filter fabric shall provide permeable layer or media while retaining soil matrix.
- B. Use fabric which meets physical requirements for Class A subsurface drainage installation conditions as defined in AASHTO M 288 and as specified in Paragraph 2.02.C, Properties
- C. PROPERTIES
  - 1. Material: Nonwoven, nonbiodegradable, fabric consisting of continuous chain polymer filaments or yarns, at least 85 percent by weight polyolefins, polyesters or polyamide, formed into dimensionally stable network.
  - 2. Chemical Resistance: Inert to commonly encountered chemicals and hydrocarbons over pH range of 3 to 12.
  - 3. Physical Resistance: Resistant to mildew and rot, ultraviolet light exposure, insects and rodents.

4. Minimum Test Values:

Property	Value (Min.)	Test Method
Grab Strength	180 lbs.	ASTM D 4632
Trapezoidal Tear Strength	50 lbs.	ASTM D 4533
Puncture Strength	80 lbs.	ASTM D 4833
Mullen Burst Strength	290 psi.	ASTM D 3786
Apparent Opening Size <sup>(1)</sup>	0.25 mm	ASTM D 4751
Permittivity (sec <sup>-1</sup> )	0.2	ASTM D 4491

<sup>(1)</sup> Maximum average roll value.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. LINE WORK

Conform use of geotextile with backfill for utilities to Section 02317 – “Excavation and Backfill for Utilities”.

B. TUNNEL WORK

1. Use geotextile outside of tunnel primary liner to prevent migration of soil fines into excavated tunnel resulting in voids or settlement. Select geotextile, subject to minimum requirements of Paragraph 2.02, meeting tunnel liner design requirements and installation conditions.
2. Install filter fabric around exterior of primary liner when using steel ribs and lagging. Install backer rods at ribs as required to control migration of fines. Close windows in lagging.
3. Waterlines: Conform to Section 02517 – “Water Line in Tunnels”.

3.04 – 3.10 NOT USED

END OF SECTION



Section 02632

**CAST-IN-PLACE INLETS, HEADWALLS, AND WINGWALLS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Cast-in-place inlets for storm or sanitary sewers, including cast iron frame and plate or grate.
- B. Cast-in-place headwalls including wingwalls for storm sewers.
- C. Cast-in-place junction box with lid or grate top.

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices
  - 1. Payment for inlets is on unit price basis for each inlet installed.
  - 2. Payment for headwalls including wingwalls is on unit price basis for each headwall including wingwall installed.
  - 3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.
  - 4. Payment for inlets and for culvert headwalls including wingwalls and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.
  - 5. 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 REFERENCES (NOT USED)**

**1.04 SUBMITTALS**

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit shop drawings for approval of design and construction details for cast-in-place units which differ from units shown on Plans.
- C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02084 – “Frames, Grates, Rings and Covers”
- D. Section 02317 – “Excavation and Backfill for Utilities”
- E. Section 03315 – “Concrete for Utility Construction”
- F. Section 04061 – “Mortar”
- G. Section 04210 – “Brick Masonry for Utility Construction”

1.05 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Concrete: Class A concrete with minimum compressive strength of 4000 psi conforming to requirements of Section 03315 – “Concrete for Utility Construction”, unless otherwise indicated on Drawings.
- B. Reinforcing Steel: Conform to requirements of Section 03315 – “Concrete for Utility Construction”.
- C. Concrete Bricks - Conform to requirements of Section 04210 – “Brick Masonry for Utility Construction”. Use manhole bricks.
- D. Mortar and Hydraulic Cement - Conform to requirements of Section 04061 – “Mortar”.
- E. Miscellaneous metals: Cast-iron frames, grates, rings, and covers conforming to requirements of Section 02084 – “Frames, Grates, Rings and Covers”.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Verify lines and grades are correct.

- B. Verify compacted subgrade will support loads imposed by inlets.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Construct units complete in place to dimensions, lines and grades as shown on Drawings.
- B. Excavate in accordance with requirements of Section 02317 – “Excavation and Backfill for Utilities”.
- C. Construct box section of inlet of Class A concrete or brick.
- D. Plaster brick inlets with ½ inch mortar on inside. Use walls for brick inlets minimum of 8 inches thick. Conform to the requirements of Section 04210 – “Brick Masonry for Utility Construction”.
- E. Forms required for both outside and inside faces of concrete inlet walls, however, when nature of material excavated for inlet can be hand trimmed to smooth vertical face, outside forms may be omitted with approval of Project Manager.
- F. Place reinforcing steel to conform to details shown on Drawings. Provide positive means for holding steel cages in place during concrete placement. Welding of reinforcing steel is not permitted unless noted on Drawings. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus ½ inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.
- G. Chamfer exposed edges unless otherwise indicated on Drawings.
- H. Finishes
  - 1. Cut off inlet leads neatly at inside face of inlet wall. Point up with mortar.
  - 2. When box section of inlet complete, shape floor of inlet with mortar to conform to detailed Plans.
  - 3. Finish concrete surfaces in accordance with requirements of Section 03315 – “Concrete for Utility Construction”.
- I. Connections
  - 1. Connect inlet leads to inlets.
  - 2. Seal leads inside and outside with hydraulic cement.

J. Backfill

1. Backfill area of excavation surrounding each completed inlet according to requirements of Section 02317 – “Excavation and Backfill for Utilities”.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

Verify that inlets are free of leaks. Repair leaks in manner approved by Project Manager.

3.06 – 3.10 NOT USED

END OF SECTION

## Section 02633

## PRECAST CONCRETE INLETS, HEADWALLS, AND WINGWALLS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.
- B. Precast concrete headwalls and wingwalls for storm sewers.
- C. Precast junction box with lid or grate top.

## 1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
1. Payment for inlets is on unit price basis for each inlet installed.
  2. Payment for headwalls and wingwalls is on unit price basis for each headwall and wingwall installed.
  3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.
  4. Payment for inlets, headwalls, wingwalls, and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.
  5. 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 REFERENCES

ASTM C 76 Rev A- Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

## 1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.

- B. Submit Shop Drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Plans will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.
- C. Submit manufacturers' data and details for frames, grates, rings, and covers

## 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02084 – “Frames, Grates, Rings and Covers”
- D. Section 02317 – “Excavation and Backfill for Utilities”
- E. Section 04061 – “Mortar”

1.06 – 1.07 NOT USED

## 1.08 DELIVERY, STORAGE, AND HANDLING

Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

1.09 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

## 2.02 MATERIALS AND/OR EQUIPMENT

- A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4,000 psi.
- B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Plans and as follows:
  1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus ½ inch, whichever is less.

Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Plans.

2. Welding of reinforcing steel is not permitted unless noted on Plans.
- C. Mortar and Hydraulic Cement: Conform to requirements of Section 04061 – “Mortar”.
- D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Section 02084 – “Frames, Grates, Rings, and Covers”.

## 2.03 FABRICATION (NOT USED)

## 2.04 SOURCE QUALITY CONTROL

- A. Tolerances: Allowable casting tolerances for concrete units are plus or minus ¼ inch from dimensions shown on Plans. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.
- B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.
- C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:
  - 1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.
  - 2. Surface defects indicating honeycombed or open texture.
  - 3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.
- D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.
- E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Project Manager, repaired units conform with requirements of these specifications.

## PART 3 EXECUTION

## 3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02      PREPARATION

- A.      Verify lines and grades are correct.
- B.      Verify compacted subgrade will support loads imposed by inlets

3.03      ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A.      Install units complete in place to dimensions, lines, and grades as shown on Plans.
- B.      Excavate in accordance with requirements of Section 02317 – “Excavation and Backfill for Utilities”.
- C.      Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.
- D.      Provide adequate means to lift and place concrete units.

E.      FINISHES

- 1.      Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.
- 2.      When box section of inlet has been completed, shape floor of inlet with mortar to conform to the Plans .
- 3.      Adjust cast iron inlet plate frames to line, grade, and slope shown on Plans.  
         Grout frame in place with mortar

F.      Inlet Watertightness

Verify that inlets are free of leaks. Repair leaks in manner approved by Project Manager .

G.      CONNECTIONS

Connect storm sewer leads to inlets as shown on Plans. Seal connections inside and outside with hydraulic cement. Make connections watertight.

H.      BACKFILL

Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Section 02317 – “Excavation and Backfill for Utilities”.

3.04 – 3.10 NOT USED

END OF SECTION



## Section 02753

## CONCRETE PAVEMENT CURING

## PART 1 GENERAL

## 1.01 SUMMARY

This Section includes curing of Portland cement concrete paving.

## 1.02 MEASUREMENT AND PAYMENT

## A. Unit Prices.

1. No separate payment will be made for concrete curing under this Section. Include payment in unit price for Concrete Paving, Concrete Sidewalks, Concrete Driveways, Curbs, and Curb and Gutters.
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 the total Stipulated Price

## 1.03 REFERENCES

- A. ASTM C 156 – Standard Test Method for Water Loss [from a Mortar Specimen] Through Liquid membrane-Forming Curing Compounds for Concrete.
- B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.
- C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete

## 1.04 SUBMITTALS

- A. Submittals shall conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit manufacturer’s product data for cover materials and liquid membrane-forming compounds.

## 1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”

## 1.06 – 1.13 NOT USED

**PART 2 PRODUCTS****2.01 MANUFACTURER(S) (NOT USED)****2.02 MATERIALS AND/OR EQUIPMENT****A. Cover Materials for Curing**

1. Conform curing materials to one of the following:
  - a. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.
  - b. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.
  - c. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than three-fourths of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitched mats so that mat shall contact surface of pavement at all points when saturated with water.

**B. Liquid Membrane-Forming Compounds**

Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m<sup>2</sup> in 72 hours using test methods ASTM C 156.

**2.03 – 2.04 NOT USED****PART 3 EXECUTION****3.01 – 3.02 NOT USED****3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION****A. Curing Equipment**

1. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.
2. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations

**B. Polyethylene Film Curing**

1. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of a fine spray. Cover surface with polyethylene film so film shall remain in direct contact with surface during specified curing period.
2. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or by replacing.

**C. Waterproofed Paper Curing**

1. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper shall remain in direct contact with surface during specified curing period.
2. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Overlap joints in blankets caused by joining paper sheets not less than 5 inches and securely sealed with asphalt cement having melting point of approximately 180°F. Place blankets to secure overlap of at least 12 inches. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects

**D. Cotton Mat Curing**

1. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.
2. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water shall drip freely from them. Keep banked earth or cotton mat covering edges saturated

**E. Liquid Membrane-Forming Compounds**

1. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.
2. Moisten concrete by water fogging prior to application of membrane when surface has become dry.
3. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Project Manager, but not less than 1 gallon per 200 square feet of surface area

3.04 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

- A. Treated areas shall be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.
- B. Reapply membrane compound immediately at no cost to Owner when membrane fails above test.

3.09 – 3.10 NOT USED

END OF SECTION

Section 02754

**CONCRETE DRIVEWAYS**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes Portland cement concrete driveways.

**1.02 MEASUREMENT AND PAYMENT**

**A. Unit Prices.**

1. Payment for concrete driveways is on square yard basis, including excavation.
2. No payment will be made for Work in areas where driveway has been removed or replaced for Contractor's convenience.
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 – 1.04 NOT USED**

**1.05 RELATED REQUIREMENTS**

- A.** Section 01270 – "Measurement and Payment"
- B.** Section 02336 – "Lime-Stabilized Subgrade"
- C.** Section 02337 – "Lime/Fly-Ash Stabilized Subgrade"
- D.** Section 02338 – "Portland Cement Stabilized Subgrade"
- E.** Section 02752 – "Concrete Pavement Joints"
- F.** Section 02753 – "Concrete Pavement Curing"
- G.** Section 03002 – "Concrete Pavement"

**1.06 – 1.13 NOT USED**

**PART 2 PRODUCTS**

**2.01 MANUFACTURER(S) (NOT USED)**

2.02 MATERIALS AND/OR EQUIPMENT

- A. Concrete: Conform to material and proportion requirements for concrete of Section 03002 – “Concrete Pavement” – Harris County.
- B. Reinforcing Steel: Conform to material requirements for reinforcing steel of Section 03002 – “Concrete Pavement” – Harris County.
- 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 02336 – “Lime Stabilized Subgrade”, Section 02337 – “Lime/Fly-Ash Stabilized Subgrade”, or Section 02338 – “Portland Cement Stabilized Subgrade”.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 PREPARATION

Prepare subgrade in accordance with applicable portions of Section 02336 – “Lime Stabilized Subgrade”, Section 02337 – “Lime/Fly-Ash Stabilized Subgrade”, and Section 02338 – “Portland Cement Stabilized Subgrade”.

3.02 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Placement

Place and finish concrete in accordance with applicable portions of Section 03002 – “Concrete Pavement” – Harris County.

B. Joints

Install joints in concrete driveway in accordance with Section 02752 – “Concrete Pavement Joints”.

C. Concrete Curing

Cure concrete driveway in accordance with Section 02753 – “Concrete Pavement Curing”.

3.04 – 3.08 NOT USED

3.09 PROTECTION

Conform to applicable requirements of Section 02753 – “Concrete Pavement Curing”.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02771

CURB, CURB AND GUTTER, AND HEADERS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
  - 1. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.
  - 2. Paving headers and railroad headers poured monolithically with concrete base or pavement

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Payment for curbs, curbs and gutter, and esplanade curbs is on linear foot basis measured along face of curb.
  - 2. Payment for 3-foot, concrete-valley gutter is on a linear foot basis.
  - 3. Payment for mountable concrete curbs is on a square foot basis.
  - 4. Payment for concrete paving headers and concrete railroad headers is on a linear foot basis.
  - 5. 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 concrete pavement.
  - 6. 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 (NOT USED)

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit details of proposed form work for approval.



1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 02752 – “Concrete Pavement Joints”
- D. Section 02753 – “Concrete Pavement Curing”
- E. Section 03002 – “Concrete Pavement”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Concrete: Conform to material and proportion requirements for concrete of Section 03002 – “Concrete Pavement” – Harris County.
- B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Section 03210 – “Reinforcing Steel”.
- C. Grout: Nonmetallic, nonshrink grout containing no chloride-producing agents conforming to the following requirements:
  - 1. Compressive strength
    - a. at 7 days: 3,500 psi
    - b. at 28 days: 8,000 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 1½ parts of fine aggregate. Use only when approved by Project Manager.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Placement

1. 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 Plans.
2. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Plans.
3. Reinforcement: Secure in position so that steel shall remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Plans.
4. Joints: Place in accordance with Section 02752 – “Concrete Pavement Joints”. Place dummy groove joints as to match concrete pavement joints at right angles to curb lines. Cut dummy grooves ¼ inch deep using an approved edging tool.
5. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

B. Manual Finishing

1. 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 Plans.
2. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.
3. 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.
4. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

5. Edge outer edge of gutter with 1/4-inch edger. Finish edges with tool having 1/4-inch radius.
6. 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.

C. Mechanical Finishing

Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, if approved by Project Manager. Use of mechanical methods shall provide specified curb design and finish.

D. Curing

Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Section 02753 – “Concrete Pavement Curing”.

E. Tolerances

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, except at grade changes.

3.04 – 3.08 NOT USED

3.09 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.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02775

CONCRETE SIDEWALKS

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
  - 1. Reinforced concrete sidewalks.
  - 2. Wheelchair Ramps.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
  - 1. Payment for concrete sidewalks is on square foot basis.
  - 2. No payment will be made for work outside these limits or in areas where driveway has been removed or replaced for Contractor's convenience.
  - 3. Payment for wheelchair ramps of each type specified is on square foot basis. Staining of wheelchair ramps is included in cost of ramp.
  - 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 C 31 Rev A- Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- B. ASTM C 39 Rev B- Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- D. ASTM C 138 Rev A- Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- E. ASTM C 172 Rev A- Standard Practice for Sampling Freshly Mixed Concrete.

- F. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
- G. Texas Accessibility Standards of the Architectural Barriers Act, Article 9102, Texas Civil Statutes

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit certified testing results and certificates of compliance.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01454 – “Testing Laboratory Services”
- D. Section 01576 – “Waste Material Disposal”
- E. Section 02233 – “Clearing and Grubbing”
- F. Section 02320 – “Utility Backfill Materials”
- G. Section 02336 – “Lime-Stabilized Subgrade”
- H. Section 02752 – “Concrete Pavement Joints”
- I. Section 02753 – “Concrete Pavement Curing”
- J. Section 02761 – “Colored Concrete for Medians and Sidewalks”
- K. Section 02922 – “Sodding”
- L. Section 02951 – “Pavement Repair and Resurfacing”
- M. Section 03002 – “Concrete Pavement”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Concrete: Conform to material and proportion requirements for concrete of Section 03002 – “Concrete Pavement”.
- B. Reinforcing Steel: Conform to material requirements of Section 03002 – “Concrete Pavement” for reinforcing steel. Use No. 3 reinforcing bars.
- 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. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than the proposed sidewalk thickness. The use of 2" by 4" lumber as forms will not be allowed.
- F. Sand Bed: Conform to material requirements for bank run sand of Section 02320 – “Utility Backfill Materials”.
- G. Sodding: Conform to material requirements for sodding of Section 02922 – “Sodding”.
- H. Coloring for wheelchair ramps: Conform to material requirements for colored concrete of Section 02761 – “Colored Concrete for Medians and Sidewalks”. Color shall be Brick Red or as shown on Plans.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

- A. Identify and protect utilities which are to remain.
- B. Protect living trees, other plant growth, and features designated to remain.
- C. Conduct clearing and grubbing operations in accordance with Section 02233 – “Clearing and Grubbing”.
- D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to line, grade, and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with Section 02336 – “Lime-Stabilized Subgrade”. Compact subgrade to minimum of 90 percent maximum dry density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.

- E. Immediately after subgrade is prepared, cover with compacted sand bed to depth as shown on Plans. Lay concrete when sand is moist but not saturated

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. Placement

1. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4s as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.
2. Reinforcement:
  - a. Install reinforcing bars.
  - b. Install reinforcing steel as shown on the Plans. Lay longitudinal bars in walk continuously, except through expansion joints.
  - c. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.
  - d. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.
  - e. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Plans. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In place of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.
3. Expansion Joints: Install expansion joints with load transfer units in accordance with Section 02752 – “Concrete Pavement Joints”.
4. Colored Concrete: Apply coloring agent in accordance with Section 02761 – “Colored Concrete for Medians and Sidewalks”.
5. Place concrete in forms to specified depth and tamp thoroughly with “jitterbug” tamp, or other acceptable method. Bring mortar to surface.
6. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.
7. Apply coating to wheelchair ramp with contrasting color in accordance with Section 02761 – “Colored Concrete for Medians and Sidewalks”.

8. Unless otherwise indicated on Plans, mark off joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.
9. Finish edges with tool having 1/4-inch radius.
10. After concrete has set sufficiently, refill space along sides of sidewalk to top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Section 01576 – “Waste Material Disposal”. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Section 02951 – “Pavement Repair and Resurfacing”.

B. Curing

Conform to requirements of Section 02753 – “Concrete Pavement Curing”.

3.04 REPAIR/RESTORATION

- A. Replace sidewalks and slope paving, which are removed or damaged during construction, with thickness and width equivalent to one removed or damaged, unless otherwise shown on Plans. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.
- B. Provide replaced and new sidewalks with wheelchair ramps if sidewalk intersects curb at street or driveway.

3.05 NONCONFORMING CONCRETE

- A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Plans.
- B. Replace nonconforming sections at no additional cost.

3.06 FIELD QUALITY CONTROL

- A. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.
- B. Compressive Strength Test Specimens: Four test specimens for compressive strength test shall be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in 1 day. Two specimens shall be tested at 7 days. The remaining two specimens shall be tested at 28 days. Specimens shall be tested in accordance with ASTM C 39. Minimum compressive strength: 3,000 psi at 7 days and 3,500 psi at 28 days.
- C. Yield test for cement content per cubic yard of concrete shall be made in accordance with ASTM C 138. If such cement content is found to be less than that specified per



cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

- D. If the Contractor places concrete without notifying the laboratory, the Project Manager will have the concrete tested by means of a core test as specified in ASTM C 42. When concrete does not meet specification, the cost of the test will be deducted from payment.
- E. Sampling of fresh concrete shall be in accordance with ASTM C 172.
- F. Take slump tests when cylinders are made and when concrete slump appears excessive.
- G. Concrete shall be acceptable if the average of the two, 28-day compression tests is equal to or greater than minimum 28-day strength specified.
- H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.
- I. If 28-day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Project Manager. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due

3.06 – 3.08 NOT USED

3.09 PROTECTION

- A. Maintain sidewalks in good condition until completion of the Work.
- B. Replace damaged areas.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 02821

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes the following:
  - 1. Fence framework, fabric, and accessories.
  - 2. Excavation for post bases, concrete foundation for posts and center drop for gates.
  - 3. Manual gates and related hardware.

1.02 MEASUREMENT AND PAYMENT

- A. Payment for fencing shall be on a linear foot basis for height noted. Payment for gates shall be per unit.
- B. Refer to Section 01270 – “Measurement and Payment” for Unit Price Procedures.

1.03 REFERENCES

- A. ANSI/ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- B. ANSI/ASTM F 567 – Standard Practice for Installation of Chain-Link Fence.
- C. ASTM A 116 – Standard Specification for Metallic-Coated, Steel-Woven Wire Fence Fabric.
- D. ASTM A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
- E. ASTM A 153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- F. ASTM A 392 Rev A – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
- G. ASTM A 428 – Standard Test Method for Weight [Mass] of Coating on Aluminum-Coated Iron or Steel Articles.
- H. ASTM C 94 – Standard Specification for Ready-Mixed Concrete.

- I. ASTM F 668 – Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.
- J. ASTM A 307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
- K. ASTM A 1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- L. AASHTO M 232 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- M. Chain Link Fence Manufacturers Institute (CLFMI) - Product Manual.
- N. Federal Specification RR-F-191 - Fencing, Wire and Post, Metal

1.04 SUBMITTALS

- A. Submit under provisions of Section 01330 – “Submittal Procedures”.
- B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.
- C. Product Data: Provide data on fabric, posts, accessories, fittings, and hardware that indicates that items match or exceed the quality of existing items.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”

1.06 QUALITY ASSURANCE

Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years’ experience.

1.07 SYSTEM DESCRIPTION

- A. Fence height shall be as indicated on Plans or as noted to match height of existing.
- B. Extension arms for barbed wire shall match existing.
- C. Line post spacing shall not exceed 10 feet, or as shown on Plans.

1.08 DELIVER, STORAGE, AND HANDLING (NOT USED)

1.09 PROJECT SITE CONDITIONS

Field Measurements: Verify that field measurements are as indicated on Shop Drawings.

1.10 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Galvanized Fencing

1. Fence fabric shall be No. 9 steel wire, hot galvanized after weaving, to match or exceed existing fence fabric.
2. Framework shall be hot-dipped galvanized with a minimum coating of 2 ounces/sf, or one ounce/sf plus 30 micrograms/square-inch chromate conversion coating.
3. Line posts shall conform to ASTM A 1011.
4. End corner, angle, and pull posts shall conform to ASTM A 1011.
5. Top rails shall be 1.65 x 1.25-inch formed C-section; or 1.6-inch round ASTM A 1011, 1.35 lbs/ft; or 1-5/8-inch outside diameter steel pipe, 2.27 lbs/ft. Top rails shall pass through openings provided for that purpose in post tops.
6. Fabric ties shall be hog rings, galvanized steel wire not less than 9-ga with a zinc coating of not less than 1.2 ounces/sf.
7. Bolts and nuts shall be in conformance with ASTM A 307 and shall be galvanized in accordance with AASHTO M 232.
8. Install horizontal braces fabricated of 1-5/8-inch, 2.27-lb copper bearing steel pipe at all corner, gate, and end posts.
9. Gates shall be either swing or slide as shown on the plans. Swing gates shall be hinged to swing 90 degrees from closed to open or hinged to swing 180 degrees from close to open. Slide gates shall be roller type with no vertical obstructions. All gate leaves shall have intermediate members and diagonal stress rods as required for rigid construction and shall be free from sag or twist. All gates shall be fitted with vertical extension arms or shall have frame end number extended to carry barbed wire. Gate posts for gates shall be 4-inch, 9.1 lb pipe. Gate frames shall be made of 2-inch outside diameter, castings.

Fabric shall be the same as for the fence. Gates shall have malleable iron ball and socket hinges, catches, stops and padlocks with 3 keys each. Posts for single gates shall be the same as end posts.

### PART 3 EXECUTION

#### 3.01 – 3.02 NOT USED

#### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

- A. Install chain link fence in accordance with the directions of the manufacturer and these Specifications.
- B. Install fence posts at not more than 10-foot centers and at least 36 inches into the ground in a Class B concrete base. Allow concrete to cure for at least 7 days before erecting remainder of fence. Fasten fabric to line posts with wire ties spaced about 14 inches apart and to top rail spaced about 24 inches apart.
- C. Use standard chain link fence stretching equipment to stretch the fabric before tying it to the rails and posts. Repeat the stretching and tying operations about every 100 feet.
- D. Erect gates so they swing or slide in the appropriate direction as shown on Plans. Provide gate stops as required. Secure hardware, adjust, and leave in perfect working order. Adjust hinges and diagonal bracing so that gates shall hang level. Adjust rollers and guides of sliding gates so that gates are level.
- E. At small natural or drainage ditches where it is not practical for the fence to conform to the contour of the ground, span the opening below the fence with wire fastened to stakes of required length. The finished fence shall be plumb, taut, true to line and ground contour. When directed by the Project Manager, stake down the chain link fence at several points between posts.
- F. Where new fence joins an existing fence, set a corner post and brace post at the junction and brace as directed. If the connection is made at other than the corner of the new fence the last span of the old fence shall contain a brace.

#### 3.04 – 3.10 NOT USED

END OF SECTION

Section 02911

TOPSOIL

PART 1 GENERAL

1.01 SUMMARY

This Section includes 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 Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 – 1.04 NOT USED

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01576 – “Waste Material Disposal”
- C. Section 02315 – “Roadway Excavation”
- D. Section 02320 – “Utility Backfill Materials”
- E. Section 02921 – “Hydromulch Seeding”
- F. Section 02922 – “Sodding”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Topsoil

1. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having following characteristics:
  - a. pH value of between 5.5 and 6.5
  - b. Liquid limit: 50 or less
  - c. Plasticity index: 20 or less
  - d. Gradation: maximum of 10 percent passing No. 200 sieve
2. 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.
3. Obtain topsoil from naturally well-drained areas where topsoil occurs at minimum depth of 4 inches and has similar characteristics to that found at placement site. Do not obtain topsoil from areas infected with growth of, or reproductive parts of nut grass or other noxious weeds.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

A. Examination

1. Excavate topsoil for esplanades and areas to receive grass or landscaping from areas to be further excavated. Stockpile in area approved by Project Manager.
2. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Topsoil Excavation

Conform to excavation and stockpiling requirements of Section 02315 – “Roadway Excavation”.

B. Placement

1. Place no topsoil until subgrade has been approved. For areas to be seeded or sodded, scarify or plow existing material to minimum depth of 4 inches, or as indicated on Plans. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with appropriate lawn roller to consolidate topsoil.
2. Increase depth of topsoil to 6 inches when placed over sand bedding and backfill materials specified in Section 02320 – “Utility Backfill Material”.
3. For areas to receive shrubs or trees, excavate existing material and place topsoil to depth and dimensions shown on Plans.
4. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Section 01576 – “Waste Material Disposal”.
5. Place topsoil to promote good drainage and compact with light roller. Water topsoil after placement until saturated for minimum depth 6 inches, fill in, and recompact areas of settlement.

3.04 – 3.08 NOT USED

3.09 PROTECTION

Protect topsoil from wind and water erosion until planting is completed.

3.10 SCHEDULES (NOT USED)

END OF SECTION



Section 02915

TREE PLANTING

PART 1 GENERAL

1.01 SUMMARY

This Section includes street right-of-way tree planting and maintenance.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for tree planting is on unit price basis for each tree planted.
2. When shown on Plans or directed by Project Manager to remove and relocate tree affected by trench zone, Work shall be paid for under one of the following bid items.
  - a. Bid item “Remove and Relocate Tree” includes moving tree with truck mounted tree spade and replanting same tree in new location. Payment is for each tree removed and relocated.
  - b. Bid item “Remove, Temporary Store and Replant Tree” includes moving tree with truck mounted tree spade and replanting tree at temporary location, (determined by Contractor) maintaining tree until construction is complete and replanting same tree back to its original location. Payment is for each tree removed, stored, and replanted.
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.

1.03 REFERENCES

- A. ANSI Z 60.1 – American Standard for Nursery Stock.
- B. Association of Official Agriculture Chemists (AOAC) – Official Methods of Analysis of AOAC International.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.

- B. Submit certification from supplier that each type of tree conforms to these specification requirements.
- C. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by Association of Official Agriculture Chemists, when applicable.
- D. Submit name and experience of qualified Arborist to Project Manager.
- E. Submit temporary tree storage location. Location must be outside public right-of-way and within 5 miles of project site, unless otherwise approved by Project Manager.

1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01576 – “Waste Material Disposal”
- D. Section 02911 – “Topsoil”
- E. Section 02921 – “Hydromulch Seeding”

1.06 QUALITY ASSURANCE

- A. Landscaper shall be a firm specializing in landscape and planting work.
- B. Do not make substitutions of approved trees unless approved in writing by Project Manager. When specified planting material is not obtainable, submit proof of non-availability together with proposal for use of equivalent material. Substitutions of larger size or better grade than specified will be allowed, but with no increase in unit price.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Ship trees with Certificates of Inspection as required by governing authorities. Label each tree and shrub with securely attached waterproof tag bearing legible designation of botanical and common name. Do not remove container grown stock from containers before time of planting.
- B. Deliver packaged materials in fully labeled original containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at Site.

- C. Materials shall not be pruned prior to installation unless approved by Project Manager in writing. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches, or destroy natural shape. Use protective covering during delivery.

1.09 – 1.12 NOT USED

1.13 WARRANTY

- A. Warrant trees against defects including death, unsatisfactory growth, or loss of shape due to improper pruning, maintenance, or weather conditions, for 1 year after completion of planting. Plumb leaning trees during warranty period.
- B. Remove and replace trees found to be dead during warranty period. Remove and replace trees which are in doubtful condition at end of warranty period, or when approved by Project Manager, extend warranty period for trees for full growing season.

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Trees
  - 1. Provide container grown trees which are straight and symmetrical and have persistently preferred main leader. Crown shall be in good overall proportion to entire height of tree with branching configuration as recommended by ANSI Z60.1 for type and species specified. Where clump is specified, furnish plant having minimum of three stems originating from common base at ground line. Measure trees by average caliper of trunk as follows:
    - a. For trunks up to 4 inches or less in diameter, measure caliper 6 inches above top of root ball.
    - b. For trunks more than 4 inches, measure caliper 12 inches above top of root ball.
    - c. Caliper measurements shall be by diameter tape measure. Indicated calipers on plans are minimum. Averaging of plant calibers will not be allowed.
  - 2. Trees shall conform to following requirements:
    - a. Healthy, vigorous stock, grown in recognized nursery.

- b. Free of disease, insects, eggs, larvae; and free of defects such as knots, sun-scald, injuries, abrasions, disfigurement, or borers and infestations.

**B. Soil Products**

- 1. Topsoil: Conform to requirements of Section 02911 – “Topsoil”.
- 2. Peat moss, bark, and fertilizer: Use material recommended by nursery for establishment of healthy stock after replanting.

**C. Stakes and Guys**

- 1. Provide minimum 8-foot long steel T-stakes and 1 inch wide plastic tree chains.
- 2. Where applicable for anchoring trees, use wood deadmen of at least 2 by 4 stock, 36 inches long and buried 3 feet. Provide white surveyor’s plastic tape for flagging tree guys

**D. Tree Wrap, Twine, and Seal**

- 1. Wrap: First quality, bituminous impregnated tape, corrugated or crepe paper, specifically manufactured for tree wrapping and having qualities to resist insect infestation.
- 2. Twine: Lightly tarred, medium-coarse sisal (lath) yarn. Do not use nails or staples to fasten wrapping.
- 3. Seal: Commercially available asphaltic-base black emulsion specifically produced for use in sealing tree cuts and wounds.

**E. Water**

Water shall be potable from municipal water supplies.

**2.03 FABRICATION (NOT USED)**

**2.04 SOURCE QUALITY CONTROL**

Notify Project Manager, prior to installation, of location where trees that have been selected for planting may be inspected. Plant material shall be inspected for compliance with following requirements.

- 1. Genus, species, variety, size and quality.
- 2. Size and condition of balls and root systems, insects, injuries and latent defects.

**PART 3 EXECUTION**

**3.01 GENERAL / MANUFACTURER(S) (NOT USED)**

**3.02 PREPARATION**

- A. Schedule Work so that planting can proceed rapidly as portions of site become available. Plant trees after final grades are established and prior to planting of lawns, unless otherwise approved by Project Manager in writing. When planting of trees occurs after seeding work, protect lawn areas and promptly repair damage to lawns resulting from tree planting operations.
- B. Layout individual trees at locations shown on Plans. In case of conflicts, notify Project Manager before proceeding with Work. Trees shall be staked and approved by Project Manager prior to planting.
- C. Preparation of Planting Soil
  - 1. Before mixing, clean topsoil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.
  - 2. Strip and utilize 4 inch layer of top soil, placed on esplanades under Section 02921 – “Hydromulch Seeding”, for planting soil mixture.
  - 3. Mix recommended soil amendments with topsoil at following rates:
    - a. Top soil: 50 percent.
    - b. Peat moss: 25 percent.
    - c. Well rotted Bark: 25 percent.
    - d. Fertilizer: Rate recommended by nursery.
  - 4. Delay mixing of fertilizer when planting will not follow placing of planting soil within 48 hours, unless otherwise directed.
  - 5. Incorporate amendments into soil as part of soil preparation process prior to fine grading, fertilizing, and planting. Broadcast or spread amendments evenly at specified rate over planting area. Thoroughly incorporate amendments into top 3 or 4 inches of soil until amendments are pulverized and have become homogeneous layer of topsoil ready for planting.

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Planting

1. Excavate pits, beds, or trenches with vertical sides and with bottom of excavation raised minimum of 6 inches at center for proper drainage. Provide following minimum widths:
  - a. 15-gallon containers or larger, 2 feet wider than diameter of root ball.
  - b. 1-and 5-gallon containers, 6 inches wider than diameter of root ball.
2. When conditions detrimental to plant growth are encountered, such as unsatisfactory soil, obstructions, or adverse drainage conditions, notify Project Manager before planting.
3. Deliver trees after preparations for planting have been completed and plant immediately. When planting is delayed more than 6 hours after delivery, set trees and shrubs in shade, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap, or other acceptable means of retaining moisture, and water as needed.
4. Set root ball on undisturbed soil in center of pit or trench and plumb plant. Place plants at level that, after settlement, natural relationship of plant crown with ground surface will be established.
5. When set, place additional backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets. When excavation is approximately 2/3 full, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
6. Dish top of backfill to allow for mulching. Mulch pits, trenches and planted areas. Provide not less than 4 inch thickness of mulch, work into top of backfill, and finish level with adjacent finish grades. Cover entire root ball.
7. Prune, thin out, and shape trees in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed in writing, do not cut tree leaders, and remove only injured and dead branches from flowering trees. Remove and replace excessively pruned or malformed stock resulting from improper pruning.
8. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures.
9. Guy and stake trees immediately after planting.

10. Control dust caused by planting operations. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.

**B. Moving Existing Trees**

1. Perform tree moving and replanting by a professional Arborist during dormant growth season.
2. Provide tree spade of adequate size as directed by professional Arborist.

**C. Maintenance**

1. Maintain trees during planting operations and for period of 12 months after completion of planting.
2. Water trees to full depth minimum of once each week, or as required to maintain healthy vigorous growth.
3. Prune, cultivate, and weed as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports, and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.

**3.04 REPAIR/RESTORATION (NOT USED)**

**3.05 FIELD QUALITY CONTROL**

- A. Project Manager may reject unsatisfactory or defective material at any time during progress of Work. Remove rejected trees immediately from site and replace with specified materials. Plant material not installed in accordance with these Specifications will be rejected.
- B. An inspection to determine final acceptance will be conducted by Project Manager at end of 12 month maintenance period. Additional inspections will be conducted for extended warranty periods provided for in paragraph 1.07B.

**3.06 – 3.08 NOT USED**

**3.09 PROTECTION**

- A. During planting work, keep pavements clean and work area in orderly condition.
- B. Protect planting work and materials from damage due to planting operations. Maintain protection during installation and maintenance period. Treat, repair, or replace damaged planting work as directed by Project Manager.

- C. Dispose of excess soil and waste in accordance with requirements of Section 01576 – “Waste Material Disposal”. On-site burning of combustible cleared materials will not be permitted.

3.10 SCHEDULES (NOT USED)

END OF SECTION



Section 02921

HYDRO MULCH SEEDING

PART 1 GENERAL

1.01 SUMMARY

This Section includes seeding, fertilizing, mulching, and maintenance of areas indicated on Plans.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hydro mulch seeding is on an acre basis.
2. When limits of construction are shown on Plans, payment for hydro mulch will be limited to within limits of construction shown on Plans.
3. If no limits of construction are shown, payment to be per Section 01740 – “Restoration of Site”.
4. 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 REFERENCES

- A. Texas Department of Agriculture – “Texas Seed Law”
- B. Office of the Texas State Chemist – “Commercial Fertilizer Laws and Rules”
- C. United States Department of Agriculture (USDA) – “Federal Seed Act”

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
- B. Submit certification from supplier that each type of seed conforms to these specifications and requirements of “Texas Seed Law”. Certification shall accompany seed delivery.
- C. Submit certificate stating that fertilizer complies with these specifications and requirements of “Commercial Fertilizer Laws and Rules”.

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
STANDARD SPECIFICATION

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1.05 RELATED REQUIREMENTS

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”
- C. Section 01576 – “Waste Material Disposal”
- D. Section 01740 – “Restoration of Site”
- E. Section 02911 – “Topsoil”
- F. Section 02922 – “Sodding”

1.06 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

- A. Topsoil: Conform to material requirements of Section 02911 – “Topsoil”.
- B. Seed: Conform to U.S. Department of Agriculture rules and regulations of “Federal Seed Act” and “Texas Seed Law”. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:
  - 1. Rye: Fresh, clean, Italian rye grass seed (loium 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	40	Jan 1 to Mar 31
Unhulled Common Bermuda Grass 98/88	40	
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
STANDARD SPECIFICATION

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Hulled Common Bermuda Grass 98/88	40	Oct 1 to Dec 31
Unhulled Common Bermuda Grass 98/88	40	
Annual Rye Grass (Gulf)	30	

C. Fertilizer: Dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers which bear manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of 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 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 same fiber content and size as for cellulose fibers from wood chips.
3. Dye mulch 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.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

3.01 GENERAL / MANUFACTURER(S) (NOT USED)

3.02 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".

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

NORTH HARRIS COUNTY REGIONAL WATER AUTHORITY  
STANDARD SPECIFICATION

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- A. Seed: Apply uniformly at rates given in Paragraph 2.02.B for type of seed and planting date.
- B. Fertilizer: Apply uniformly at rate of 500 pounds per acre.
- C. Mulch: Apply uniformly at rate of 50 pounds per 1,000 square feet.
- D. Soil Stabilizer: Apply uniformly at rate of 40 pounds per acre.
- E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydro mulching.
- F. Sod: Lay single row of sod along perimeter where top soil and pavement intersect. Apply in conformance to Section 02922 – “Sodding”.
- G. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Project Manager approval before resuming operations.
- H. Maintenance
  - 1. Maintain grassed areas minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in fall, continue maintenance following spring until acceptable lawn is established.
  - 2. Maintain grassed areas by watering, fertilizing, weeding, and trimming.
  - 3. Repair areas damaged by erosion by regrading, rolling, and replanting.
  - 4. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydro mulch.
  - 5. Mow grass when height reaches 3½ inches or greater on average before final acceptance. Mow to height of 2½ inches.

3.04 – 3.10 NOT USED

END OF SECTION

Section 02922

**SODDING**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes the following:

- A. Restoration of existing lawn areas disturbed by construction shall be by installation of new sod.
- B. Planting of sod within areas designated on Plans for purpose of surface stabilization, channel stabilization or vegetation buffer strips.
- C. Sod is defined as blocks, squares, strips of turf grass, and adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.
- D. Lawn is defined as ground covered with fine textured grass kept neatly mowed.

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices.
  - 1. Payment for sodding is on square yard basis.
  - 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 REFERENCES**

Texas Department of Agriculture – Structural Pest Control Service of the State of Texas.

**1.04 SUBMITTALS**

Conform to requirements of Section 01330 – “Submittal Procedures”.

**1.05 RELATED REQUIREMENTS**

- A. Section 01270 – “Measurement and Payment”
- B. Section 01330 – “Submittal Procedures”

C. Section 01576 – “Waste Material Disposal”

1.06 QUALITY ASSURANCE

- A. Sod only when weather and soil conditions are deemed by Project Manager to be suitable for proper placement.
- B. Water and fertilize new sod.
- C. Guarantee sod to be growing 30 days after substantial completion.
- D. Maintenance Period:
  - 1. Begin maintenance immediately after each section of grass sod is installed and continue for 30 day period from date of substantial completion.
  - 2. Resod unacceptable areas.
  - 3. Water, fertilize, control disease and insect pests, mow, edge, replace unacceptable materials, and perform other procedures consistent with good horticultural practice to ensure normal, vigorous, and healthy growth. Install disease control within guidelines set forth by the Structural Pest Control Service of the State of Texas.
- E. Notify Project Manager 10 days before end of maintenance period for inspection.

1.07 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIAL AND/OR EQUIPMENT

- A. Sod
  - 1. Species: Bermuda (*Cynodon Dactylon*), Buffalo (*Buchloe Dactyloides*), or St. Augustine (*Stenotaphrum Secundatum*) Gulf Coast variety to match existing sod.
  - 2. Contents: 95 percent permanent grass suitable to climate in which it is to be placed; not more than 5 percent weeds and undesirable grasses; good texture, free from obnoxious grasses, roots, stones, and foreign materials.
  - 3. Size: 12 inch wide strips, uniformly 2 inches thick with clean-cut edges.

- 4. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.
- B. Fertilizer  
  
Available nutrient percentage by weight: 12 percent nitrogen, 4 percent phosphoric acid, and 8 percent potash; or 15 percent nitrogen, 5 percent phosphoric acid, and 10 percent potash.
- C. Weed and Insect Treatment  
  
Provide acceptable treatment to protect sod from weed and insect infestation. Submit treatment method to Project Manager for approval. Install insect and disease control within guidelines set forth by Structural Pest Control Service of the State of Texas.
- D. Water  
  
Potable, available on-site through Contractor's water trucks. Do not use private resident's water.
- E. Bank Sand  
  
Free of clay lumps, roots, grass, salt, or other foreign material.

2.03 – 2.04 NOT USED

### PART 3 EXECUTION

#### 3.01 GENERAL / MANUFACTURER(S) (NOT USED)

#### 3.02 PREPARATION

- A. Verify that soil placement and compaction have been satisfactorily completed. Verify that soil is within allowable range of moisture content.
- B. Top soil shall be free of weeds and foreign material immediately before sodding.
- C. Do not start Work until conditions are satisfactory. Do not start Work during inclement or impending inclement weather.
- D. Rake areas to be sodded smooth, free from unsightly variations, bumps, ridges, or depressions.
- E. Spread 2 inch layer of bank sand over areas to be sodded prior to planting of sod.

- F. Apply fertilizer at rate of 25 pounds per 1000 square feet. Apply after raking soil surface and not more than 48 hours prior to laying sod. Mix thoroughly into upper 2 inches of soil. Lightly water to aid in dissipation of fertilizer

3.03 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

- A. Full Sodding: Lay sod with closely fitted joints leaving no voids and with ends of sod strips staggered. Lay sod within 24 hours of harvesting.
- B. On slopes 2:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
- C. Prior to placing sod, on slopes 3:1 or where indicated, place Hold/Gro or Roll Lite or equal over topsoil. Securely anchor in place with posts sunk firmly into ground at maximum 16 feet on center along pitch of slope and equal to width of wire mesh horizontally across slopes.
- D. After sod is laid, irrigate thoroughly to secure 6-inch minimum penetration into soil below sod.
- E. Tamp and roll sod with approved equipment to eliminate minor irregularities and to form close contact with soil bed immediately after planting and watering. Submit type of tamping and rolling equipment to be used to Project Manager for approval, prior to construction.
- F. Maintenance

1. Watering:

- a. Water lawn areas once a day with minimum ½ inch water for first 3 weeks after area is sodded.
- b. After 3 week period, water twice a week with ¾ inch of water each time unless comparable amount has been provided by rain.
- c. Make weekly inspections to determine moisture content of soil unless soil is in frozen condition.
- d. Water in afternoon or at night to enable soil to absorb maximum amount of water with minimum evaporation.

2. Mowing:

- a. Mow sod at intervals which shall keep grass height from exceeding 3½ inches.
- b. Set mower blades at 2½ inches.



- c. Do not remove more than one-half of grass leaf surface.
  - d. Mow sodded areas requiring mowing within 1 month after installation with light-weight rotary type mower. Mow sod only when dry and not in saturated or soft condition. Remove grass clippings during or immediately after mowing.
- 3. Fertilizer and Pest Control:
  - a. Evenly spread fertilizer composite at rate of 40 pounds per 5,000 square feet or as recommended by manufacturer. Do not place fertilizer until 2 weeks after placement of sod.
  - b. Restore bare or thin areas by topdressing with mix of 50 percent sharp sand and 50 percent sphagnum peat moss.
  - c. Apply mixture  $\frac{1}{4}$  to  $\frac{1}{2}$  inch thick.
  - d. Treat areas of heavy weed and insect infestation as recommended by treatment manufacturer.
- 4. Restrict all traffic from sodded areas until sod is established or for minimum 10 days during growing season. Use wood lath and plastic tape to cordon sodded areas. Maintain tape and lath throughout for minimum 30 days during growing season.

3.04 – 3.06 NOT USED

3.07 CLEANING

- A. During course of planting, remove excess and waste materials; keep lawn areas clean and take precautions to avoid damage to existing structures, plants, grass, and streets.
- B. Remove barriers, signs, and other Contractor material and equipment from project site at termination of establishment period.
- C. Dispose of unused materials and rubbish in accordance with Section 01576 – “Waste Material Disposal”.

3.08 – 3.10 NOT USED

END OF SECTION

Section 03002

CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SUMMARY

This section includes construction of concrete pavement for roadways, driveways, turnouts, concrete medians, directional islands, sidewalks and curbing when Harris County rules, regulations and requirements relating to the approval and acceptance of improvements are a requirement.

1.02 MEASUREMENT AND PAYMENT

A. Measurement

Concrete Pavement to be measured by the square yard of surface area of completed and accepted pavement of thickness designated. Measurement to be made from back to back of curb.

B. Payment

1. Adjustment of payment for acceptable pavement and replacement of faulty pavement to be in accordance with the following:
  - a. Thickness of pavement to be determined by measurement of cores taken prior to final acceptance at such points as Project Manager or Engineer may select. Four-inch diameter cores to be taken at rate of at least one core per each 1,000 square yards of pavement. These initial cores to be paid for by Owner.
  - b. The thickness of individual cores shall be determined in accordance with ASTM C174 by averaging no less than three (3) such measurements. Any core, the thickness of which is equal to or greater than one-quarter-inch ( $\frac{1}{4}$ " ) less than the thickness shown on the approved Plans, shall be considered one of deficient thickness.

If a core is determined to be deficient in thickness, additional cores shall be taken at ten-foot (10') intervals on either side of the deficient core to establish the length of the deficient section. The length of the deficient section shall be the distance between the nearest cores of satisfactory thickness, and the width shall be the entire width of the pavement. Additional 4-inch diameter cores required to determine areas of deficient thickness to be paid for by Contractor.

- c. Deficient pavement shall be removed and replaced with concrete that meets or exceeds requirements. Contractor to bear expense of removal of deficient pavement.
- 2. No additional payment over Contract unit price to be made for pavement of thickness exceeding that required by Plans.
- 3. No separate payment to be made for “Concrete Paving Headers.” Include cost of same in Contract price for items of which this Work is a component.

#### 1.03 REFERENCES

- A. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete
- B. ASTM C174/C174M - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
- C. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- D. ASTM D994/D994M – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
- E. ASTM D6690 – Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
- F. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
- G. TXDOT SP433-003 – Joint Sealants and Fillers
- H. Portland Cement Association (PCA) - Design and Control of Concrete Mixtures Thirteenth Edition (Revised) 1992

#### 1.04 SUBMITTALS

- A. Samples, mix designs, tests, and reports, as specified within Section 03001 – “Concrete (Pavement and Structures)”
- B. Standard Beam Test in accordance with Section 03001 – “Concrete (Pavement and Structures)”
- C. Core Samples to consist of one core taken for each 1,000 square yards of finished pavement (minimum one core per street). Each core to be tested for thickness and compressive strength.

1.05 RELATED REQUIREMENTS

- A. Section 02315 – “Roadway Excavation”
- B. Section 02330 – “Embankment”
- C. Section 2754 – “Concrete Driveways”
- D. Section 2761 – “Colored Concrete for Medians and Sidewalks”
- E. Section 2771 – “Curb, Curb and Gutter, and Headers”
- F. Section 2772 – “Concrete Medians and Directional Islands”
- G. Section 2775 – “Concrete Sidewalks”
- H. Section 2951 – “Pavement Repair and Resurfacing”
- I. Section 03001 – “Concrete (Pavement and Structures)”
- J. Section 03210 – “Reinforcing Steel”

1.06 QUALITY ASSURANCE (NOT USED)

1.07 – 1.08 NOT USED

1.09 PROJECT/SITE CONDITIONS

Concrete placement weather limitations are as specified under Paragraph 3.03.

1.10 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Concrete

In accordance with Section 03001 – “Concrete (Pavement and Structures)”. Thickness as shown on Plans.

B. Reinforcing Steel

In accordance with Section 03210 – “Reinforcing Steel”. Bar size and type as shown on Plans.

- C. Expansion Joint Material shall be in accordance with section and location shown on Plans.

1. Fillers

a. Premolded

- 1) Asphalt filler board per ASTM D994.
- 2) Premolded joint material per ASTM D1751

b. Wood

Clear heart Redwood; maximum weight per cubic foot when oven dried to constant weight to be 30 pounds. Other materials may be used with prior approval of the Project Manager.

c. Hot Poured

Per ASTM D6690.

2. Load Transmission Devices

To be of type and size as shown on Plans.

D. Forms

1. Pavement

a. Wood Forms (Used only in residential construction)

To be 2X material, free from warps, bends and kinks, and sufficiently true to provide a straight edge on concrete. Use precautionary methods to prevent leakage of mortar through or under side forms. Top of each form section, when tested with a straight edge, to conform to the requirements specified for the surface of completed pavement.

b. Metal Forms

Use metal forms of approved shape and section. Preferred depth of form to be equal to required edge thickness of pavement. Forms with depths greater or less than 1 inch of pavement thickness may be used. Forms with less depth than pavement thickness to be brought to required depth by securely attaching wooden planks of approved section and size to bottom of form. Use form section at least 10 feet in length, and provide for staking in position with not less than 3 pins. Use forms of adequate strength to withstand machine loads without

visible springing or settlement. Use forms free from warps, bends and kinks, and sufficiently true to provide a straight edge on concrete. Top of each form section, when tested with a straight edge, to conform to the requirements specified for the surface of the completed pavement. Use flexible or curved forms of wood or metal of proper radius for curves of 200-foot radius or less.

c. Slip Forms

Slip form equipment to be equipped with a longitudinal transangular finishing float adjustable to crown and grade. Float to extend across pavement to the side forms and/or edge of slab.

2. Curbs

a. Wood or Metal

Wood or metal curb forms to be of approved section, straight and free of warp. Outside curb forms to have a depth at least ½-inch greater than height of curb. Rigidly attach inside curb forms (if required) to outside forms.

b. Machine Laid

Equipment to conform to the requirements as specified under Paragraph 3.03. Use flexible or curved forms of wood or metal of proper radius for curves but not to exceed radius recommended by curb machine manufacturer.

E. Positioning and Support Devices for Reinforcement and Joint Assemblies

The devices to be of sufficient structural quality to prevent movement of the dowels or steel reinforcement during concrete placement and finishing. Devices to be of a type approved by the Engineer.

Positioning and supporting devices (chairs) for steel reinforcement bars to be either plastic or metal and of sufficient number to maintain the position of the bars within the allowable tolerances.

F. Materials for Curing

1. Burlap

Mats to be in good condition, clean, and free of any substance which would have deleterious effect on concrete.

2. Cotton Mats

Mats to be in good condition, clean, and free of any substance which would have deleterious effect on concrete.

3. Waterproof Paper

Per ASTM C171.

4. Membrane Curing Compounds

Conform to ASTM C309

5. White Polyethylene Sheeting

Sheet having thickness not less than 4 mils (.004 inch).

G. Grouting

1. Material and mixtures for grouting curb dowels.

- a. Proportion by weight.
- b. One part Portland cement, Type I or Type II.
- c. One part clean, sharp sand.
- d. Seven-tenths part nonshrinking grout aggregate.
- e. No more than 5-1/2 gals. water per sack cement.

2. Other

Use mixture by weight of one part portland cement and two parts sand for general purposes. If space to be grouted is less than 1 inch and is impossible to tamp grout, use one-to-one mix. Where space to be filled with grout is large, use original concrete mixture. Use stiff mixture for grout to be tamped, produced by prolonged mixing. To obtain stiff grout, mix mortar using amount of water required to thoroughly mix ingredients, then continue mixing without additional water until grout is stiff enough to be compacted by tamping when placed. For grouting blockouts for embedded pipes and similar items, use grout to which 5 pounds of nonshrinking grout aggregate per sack of cement has been added.

H. Joint Sealing Compound

Polyurethane joint seal conforming to Texas Department of Highways Specification SP433-003.

2.03 – 2.04 NOT USED

PART 3 EXECUTION

3.01 GENERAL/MANUFACTURER(S) (NOT USED)

3.02 PREPARATION

Excavate, shape, and compact subgrade to grades, sections, and densities shown on Plans. Maintain drainage of subgrade at all times. Test subgrade section with an approved template, operated and maintained by Contractor. Wet down subgrade sufficiently in advance of placing of pavement. No pavers, batch trucks, or other equipment to be permitted between forms during paving operations.

3.03 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION

A. Wood and Steel Forms

1. Setting

Set forms on compacted subgrade, cut true to grade so that entire form section is supported by subgrade. Stake metal form sections with at least 3 pins per section, with a pin on each side of every joint. Adequately stake wood form sections to prevent bows in form and to keep form sections to grade. Join form sections to prevent displacement. Clean and oil forms with form oil each time they are used. Set forms to line and grade for at least 200 feet ahead of mixer. Check conformity of alignment and grade immediately prior to placing concrete.

2. Removal

Leave forms in place for at least 12 hours. Remove forms without injury to concrete. Immediately repair damage resulting from form removal. Point up all exposed honeycombed areas with approved mortar. As soon as curb forms are removed, backfill behind curbs with approved material and compact to 90 percent standard Proctor density.

B. Slip Forms

Equipment to be provided with traveling side forms of sufficient dimensions, shape, and strength to support concrete laterally for sufficient length of time during placement to produce pavement of required cross-section. Concrete to be distributed uniformly into final position by slip form paver, and horizontal deviation in alignment of edges not to exceed 1-¼ inches from established alignment. When slip form paving equipment is designed by manufacturer to place the curb monolithically with the pavement, curb reinforcing steel is optional.



C. Concrete Placing and Handling

1. Wood and Steel Forms

- a. Deposit concrete on subgrade in such manner as to require as little rehandling as possible. Use shovels for hand spreading of concrete. Use of rakes will not be permitted. Place concrete in a rapid, continuous operation.
- b. Consolidate all concrete placed for pavement by an approved mechanical vibratory unit designed to vibrate the concrete internally. Use vibratory member equipped with synchronized vibratory units to extend across pavement practically to, but not to come in contact with, side forms. Space separate vibratory units at sufficiently close intervals to provide uniform vibration and consolidation to entire width of pavement. Mount mechanically operated vibrators in such manner as not to come in contact with forms or reinforcement and not to interfere with transverse or longitudinal joints.
- c. Furnish hand-manipulated mechanical vibrators in number required for proper consolidation of concrete along forms, at joints, and in areas not covered by mechanically controlled vibrators.

2. Slip Forms

- a. Concrete, for full paving width, to be effectively consolidated by internal vibration, with transverse vibrating units, or with a series of longitudinal vibrating units. Internal vibration to mean vibration by means of vibrating units loaded within the specified thickness of pavements section and at a minimum distance ahead of screed equal to pavement thickness.
- b. When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement to be equipped with protective pads on crawler tracks or rubber-tired wheels, offset to run a sufficient distance from edge of pavement to avoid breaking or cracking pavement edge.
- c. After concrete has been given a preliminary finish by finishing devices incorporated in the slip-form paving equipment, surface of the fresh concrete to be checked with a straightedge to tolerances and finish required.

3. Wood or Metal Formed Curb

Curbing may be poured monolithic with pavement or may be added to pavement surface at a later time. Place curb dowel bars while pavement is plastic. Provide expansion joint or contraction joint in curb opposite each expansion joint or contraction joint in pavement and at each curb inlet. Use same expansion joint material as used in pavement. Cut weakened plane joints with an approved grooving tool opposite each joint in pavement, as required. Apply finish coat of mortar on exposed surfaces of curb. Mortar composed of one part Portland cement and two parts sand. Apply mortar with a template or "mule" conforming to plan curb dimensions. Steel trowel finish all exposed surfaces of curb and brush to a smooth, uniform surface.

4. Machine-Laid Curb

- a. Lay curbs by an extrusion-type machine. Immediately prior to placing of the curb, thoroughly clean the previously approved foundation.
- b. Grade and alignment for top of curb to be as shown on Plans. The forming tube of the extrusion machine to be readily adjustable vertically during the forward motion of the machine, to provide required variable height of curb necessary to conform to the established grade line.
- c. Feed concrete into machine in such a manner and at such consistency that the finished curb shall present a well-compacted mass with a surface free from voids and honeycomb and true to established shape, line, and grade.
- d. Perform any additional surface finishing specified and/or required immediately after extrusion. Construct joints as specified or as shown on Plans.

5. Placing Concrete in Cold Weather

Minimum temperature of all concrete at time of placement to be not less than 50°F.

- a. Maintain temperature of concrete placed on or in the ground above 40°F for period of 72 hours from time of placement.
- b. Protect concrete against freezing during curing period in accordance with Portland Cement Association "Design and Control of Concrete Mixtures."
- c. Protect concrete from temperatures below 40°F until it has cured for a minimum of 3 days at 70°F or 5 days at 50°F. Remove and replace, at Contractor's expense, all concrete not meeting this requirement.

- d. Protection may consist of additional covering, insulated forms, artificial heatings, or other means approved by Engineer.

6. Placing Concrete in Hot Weather

When air temperature is above 90°F, use approved retarding agent in all exposed concrete.

- a. Reinforcing steel and other surfaces in contact with concrete, to be cooled to below 90°F by means of water spray or other approved methods.
- b. Concrete temperature prior to placement not to exceed 90°F, plus a maximum tolerance of 5°F. Concrete above this maximum will be rejected.
- c. Reduce concrete temperature at time of placement to satisfy maximum allowable temperature by one or more of the following:
  - 1) Addition of cold water with a subsequent addition of cement to maintain proper water-cement ratio. Tanks or trucks used for storing or transporting water to be insulated or painted white. Mechanical refrigeration may be used to reduce water temperatures.
  - 2) Addition of crushed, shaved, or chipped ice directly into the mixer with a subsequent addition of cement to maintain proper water-cement ratio. Continue mixing until ice is completely melted.
  - 3) Other approved methods.

D. Finishing

1. Nonresidential Pavements

Finish concrete pavement by power-driven transverse finishing machines and longitudinal finishing machines. Provide transverse finishing machine with two screeds accurately adjusted to crown of pavement. Ride transverse finishing machine on forms, so designed and operated as to strike off and consolidate concrete. Make at least two trips over each area, or more if necessary. Provide longitudinal finishing machine with a longitudinal float not less than 10 feet in length, adjusted to a true plane. Ride longitudinal finishing machine on forms, so designed and operated as to finish pavement to required grade. Equip finishing machines with rubber tires to roll on concrete pavement. Just before concrete becomes nonplastic, belt pavement surface

with a canvas or canvas-rubber composition belt of two- or four-ply construction, not less than 6 inches nor more than 10 inches wide, and at least 2 feet longer than width of pavement. Use short transverse strokes and rapid advance longitudinally to produce uniform surface of gritty texture. In lieu of canvas or canvas-rubber composition belt finish, Contractor may furnish a seamless burlap drag and finish the pavement by one or more passes of the burlap drag over the pavement. The burlap drag to consist of four or more piles of 10-ounce burlap fastened to a bridge to form a continuous strip of burlap the full width of the pavement and with approximately 3 feet of its width in contact with the pavement surface.

2. Residential Pavements

Concrete pavement may be finished by machine or by hand. If by machine, finish in accordance with paragraph D.1 above. If finished by hand, thoroughly vibrate concrete around reinforcement and embedded fixtures. Tamp concrete with a tamping template made of 4-inch by 10-inch lumber, or equivalent metal section, at least 2 feet longer than width of pavement, to conform to crown section of pavement. If wood tamping template is used, it is to have a steel face not less than 3/8 inch in thickness. Strike off concrete with a strike-off screed made of 4-inch by 10-inch lumber or equivalent metal section at least 2 feet longer than width of pavement and conforming to crown section of pavement. Move strike-off screed forward with combined transverse and longitudinal motion in direction Work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Use a longitudinal float not less than 10 feet in length to level surface. Prior to concrete becoming nonplastic, belt pavement surface with a canvas or canvas-rubber composition belt of two- to four-ply construction not less than 6 inches nor more than 10 inches wide, and at least 2 feet longer than width of pavement. Use short transverse strokes and rapid advance longitudinally to produce uniform surface of gritty texture. In lieu of canvas or canvas-rubber composition belt finish, Contractor may furnish a seamless burlap drag and finish the pavement by one or more passes of the burlap drag over the pavement. The burlap drag to consist of four or more piles of 10-ounce burlap fastened to a bridge to form a continuous strip of burlap the full width of the pavement and with approximately 3 feet of its width in contact with the pavement surface.

3. Slip Form

If this method of construction is used, all requirements of this Specification Section in regards to subgrade and pavement tolerances, pavement depth, alignment, consolidation, finishing, workmanship, etc. to be met. Equip "slip form paver" with longitudinal transangular finishing float adjustable to crown

and grade. Extend float across the pavement almost to the side form and/or the edge of slab.

E. Surface Tests

1. Test entire surface before initial set and correct irregularities or undulations to bring surface within requirements of following test, then finish.
2. Place approved 10-foot straight edge parallel to center of roadway so as to bridge any depressions and touch all high spots. Ordinates measured from face of straight edge to surface of pavement not to exceed 1/16 inch per foot from nearest point of contact, and in any case maximum ordinate to 10-foot straight edge to be no greater than 1/8 inch.

F. Joints

Place joints of types shown on Plans at required locations and at spacing shown.

1. Construction Joints

Place transverse construction joint when necessary to stop concrete placement for period of more than 30 minutes. Length of slab to be not less than 10 feet from nearest joint of complete slab. If closer than 10 feet, Contractor to remove concrete from between forms back to nearest normal joint and place construction joint bulkhead. Use longitudinal keyed construction joints at pavement edges where required.

2. Expansion Joints

Place expansion joint at radius points of curb returns for cross-street intersections, or as shown on Plans. Do not use boards less than 6 feet in length. When pavement is 24 feet or less in width, use not more than two lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross-section of concrete slab. Use premolded joint filler, accurately shaped, in curb section. Load transmission devices to be of type and size shown on Plans. Use joint sealing compound as required.

3. Contraction Joints

Make straight and place at spacings as shown on Plans. Place asphalt-coated smooth dowels accurately and normal to joint. Tool edges of groove and seal with joint sealing compound.

4. Longitudinal Weakened Plane Joints

Form longitudinal weakened plane joint by an approved continuous metal shield or an asphalt impregnated felt strip placed continuously behind longitudinal float by a machine of the flex plane type.

3.04 – 3.08 NOT USED

3.09 PROTECTION

If alternate methods of curing are used, cover concrete with burlap or cotton mats, when concrete has hardened sufficiently to prevent marring of surfaces, and keep wet continuously for 72 hours. Apply curing compound immediately after free water has disappeared and at rate specified. Keep polyethylene sheets or membrane curing film in place and intact for 5 days, in lieu of 72 hours wet curing. Cure concrete curbs and gutters to prevent checking while setting. After each day's run, barricade street. No wheeling will be allowed on concrete during curing period. Do not open pavement to traffic until concrete is at least 10 days old. Clean off pavement and seal joints before opening pavement to any traffic.

Polyethylene sheeting shall be kept on the jobsite at all times to cover and protect a minimum of 400 linear feet of pavement during adverse weather conditions. Concrete surface which is still in a plastic state shall be protected from adverse rainfall conditions so as not to impair the quality of the pavement surface.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 03210

**REINFORCING STEEL**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes the furnishing and subsequent placing of reinforcing steel, deformed and smooth, chairs, ties, splicing devices, and other reinforcing accessory items required to complete Work excluding concrete for utility construction or otherwise as shown on Plans and specified in other Specification Sections.

**1.02 MEASUREMENT AND PAYMENT**

- A. No separate measurement or payment for Work performed under this Section, except as indicated below. Include cost of same in Contract price bid for Work of which this is a component part.
- B. Measure “Extra Reinforcing Steel,” when approved by the ENGINEER, by pound of calculated weight of steel actually placed. Pay for “Extra Reinforcing Steel” at Contract unit price bid per pound of “Extra Reinforcing Steel” placed.

**1.03 REFERENCES**

- A. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- B. ASTM A615/A615M REV A - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
- C. AWS D1.4/D1.4M - Structural Welding Code—Reinforcing Steel

**1.04 SUBMITTALS**

Submit the following in accordance with Specification Section 01330 – Submittal Procedures

- A. Product data for all materials used.
- B. Shop drawings indicating location, placement, sizes, and bending.
- C. When welding is required, furnish report of chemical analysis, showing percentages of carbon, manganese, phosphorus, and sulphur.
- D. Certificate of Compliance

Submit certified copy of mill certificates of compliance with requirements herein specified.

E. Special Equipment

Submit information on mechanical splicing devices, couplers, and all other reinforcing accessories

1.05 RELATED REQUIREMENTS

Section 01330 – “Submittal Procedures”

1.06 QUALITY ASSURANCE

Reinforcement and placement to be in accordance with the requirements and guidelines as specified within ACI 315.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver to jobsite free from dirt, loose scale and rust, paint, oil, or other foreign material.
- B. Store above surface of ground upon platforms, skids, or other supports, and protect from mechanical injury and surface deterioration caused by exposure to conditions producing rust or other damage.
- C. Handle so as not to sustain crimping, bending, or warping before and during placement.

1.09 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. General Requirements

- 1. Nominal size, area, and theoretical weight in accordance with ASTM A615/A615M Rev A Table(s) 1a/1b.



2. Bending

Bends to be completed in shop, cold, true to shapes shown on Plans. Any irregularities in bending are cause for rejection.

3. Fabrication tolerances as necessary to satisfy clearance requirements indicated within Paragraph 3.03.A.2 of this Specification Section.

4. Splices

- a. Splices are not permitted except where shown on Plans without Project Manager's prior written approval.
- b. Splices are not permitted in main reinforcement at points of maximum stress, unless shown otherwise on Plans.
- c. Splices not indicated on Plans, but permitted with Project Manager's prior written approval, are subject to the following:
  - 1) Not larger than No. 8 bars.
  - 2) Not permitted in bars 30 feet or less in length, except vertical.
  - 3) Splices center to center not less than 30 feet, and no individual bar length less than 10 feet.
  - 4) Maintain specified concrete cover and tie bars together securely.
  - 5) Stagger main bar splices in adjacent bars a minimum of two splice lengths.
- d. Lap Splices
  - 1) Lap bars in accordance with table shown on Plans.
  - 2) Lap bars so that both bars shall be in the same plane parallel with the nearest concrete surface.
  - 3) All splices to be full contact lap splices and securely tied together.
- e. Welded Splices
  - 1) Procedures and electrodes as specified in AWS D1.4.

- 2) For bars No. 6 and smaller, use lap weld splices with fillet weld equal to one-half bar diameter on each side for 4 inches in length.
  - 3) For bars No. 7 and larger, use butt weld splices in accordance with AWS D1.4.
  - 4) Prepare ends for butt welding in the field, and deliver bars of sufficient length to permit this practice.
- f. All splices, whether lap weld, mechanical, or coupler, to develop full strength of bar.

**B. Reinforcing Steel**

1. Deformed, conforming to ASTM A615/A615M Rev A Grade 40 and Grade 60, as shown on Plans.
2. Welded wire fabric conforming to ASTM A1064/A1064M.
3. Cold drawn steel wire conforming to ASTM A1064/A1064M.
4. Spiral reinforcement to be deformed bars conforming to ASTM A615/A615M Rev A, or smooth bars or wire conforming to ASTM A1064/A1064M.
5. Smooth dowels for expansion joints, conforming to ASTM A615/A615M Rev A Grade 60.

**C. Epoxy**

Unless otherwise specified or shown, the epoxy for grouting reinforcement into existing concrete shall conform to the materials as specified within these Contract Documents.

**PART 3 EXECUTION**

**3.01 ERECTION/INSTALLATION/APPLICATION AND/OR CONSTRUCTION**

- A. Place reinforcing steel in positions indicated on Plans and approved shop drawings.**
1. Dimensions shown on Plans are to centers of bars, unless otherwise noted.
  2. Hold bars securely in place with tie wires and other approved means during placement of concrete.

- a. In plane of steel parallel to nearest surface of concrete, bars not to vary from placement shown on Plans, by more than one-twelfth of spacing between bars.
  - b. In plane of steel perpendicular to nearest surface of concrete, bars not to vary from placement shown on Plans, by more than 1/4-inch.
3. Looped wire bar ties ("pig tails") will be permitted for concrete pavement only. Do not use looped wire bar ties ("pig tails") for structural concrete.
4. Do not tack weld reinforcing.
5. Space steel required distance from forms or earth by galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers, or precast mortar or concrete blocks. Prior to installation receive approval from the ENGINEER of spacers or precast mortar concrete blocks.
  - a. For approval of plastic spacers, provide samples of plastic which show no indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.
  - b. Cast precast block, maximum 2-1/2 inches square, to thickness required for proper reinforcement clearance from forms, or seal slabs.
6. Use galvanized metal chairs to support all reinforcing steel. For pavement use plastic chairs as manufactured by Sheplers (or approved equal) or metal chairs to support all reinforcing steel. Metal chairs for pavement need not be galvanized. Spacing for plastic or metal chairs to be 24-inch, center to center each way to support reinforcing in concrete pavement. Metal chairs to be secured with wire to the reinforcing steel.
7. Use heavy bolster to support bottom layer of reinforcing in abutment caps, bent caps, and other beams.
8. In bridge deck slab, use two rows of supports for bottom layer of reinforcing parallel to beams for each bay between beams. Use high chairs to support top layer.
9. Clean all mortar, mud, dirt, etc. from reinforcement before placing concrete.
10. Protect exposed steel from corrosion or other damage.
11. Correct placement of steel to be verified by Contractor before concrete is placed.
12. Provide adequate support for reinforcement extending out of formwork to ensure proper alignment.

13. Tie reinforcing steel for all structural slabs at all intersections, except where spacing is less than one foot in each direction, alternate intersections only need to be tied. Tie reinforcing steel in concrete pavement at a minimum of alternate intersections.
  14. For reinforcing steel cages for other structural members, tie steel at enough intersections to provide a rigid cage of steel.
- B. Grout reinforcing steel into existing concrete when shown on Plans.
1. Holes to receive reinforcement may be wet or dry drilled using rotating machines only.
  2. Drill holes within 1/4-inch of the location shown on Plans.
  3. Flush wet drilled holes with clean water to remove residue and blow out using oil-free compressed air.
  4. Blow out dry drilled holes with oil-free compressed air.
  5. Clean oil-contaminated hole using appropriate solvents and bottle brush. Solvents to be flushed and hole blown out with oil-free compressed air.
  6. Backfill over-drilled holes with epoxy grout.
  7. Reinforcement grouted in place to be free of contaminants. Use the appropriate solvents and wire brushing to remove contaminants.
  8. Provide adequate support for reinforcement to ensure alignment and maintain reinforcement in the center of the drilled hole.

3.04 – 3.10 NOT USED

END OF SECTION

Section 03315

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

This Section includes 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. 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 REFERENCES

- A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials (ACI 117-10) and Commentary (ACI 117R-10).
- 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 308R - Guide to Curing Concrete.
- F. ACI 309R - Guide for Consolidation of Concrete.
- G. ACI 311.5 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mixed Concrete.
- H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.

- I. ACI 544.3R - Guide for Specifying, Proportioning, and Production of Fiber-Reinforced Concrete.
- J. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
- K. ASTM A615/A615M REV A - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
- L. ASTM A767/A767M REV B - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- M. ASTM A775/A775M REV B - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
- N. ASTM A820/A820M - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.
- O. ASTM A884/A884M - Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
- P. ASTM C31/C31M REV A - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- Q. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
- R. ASTM C39/C39M REV A - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- S. ASTM C42/C42M - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- T. ASTM C94/C94M REV B - Standard Specification for Ready-Mixed Concrete.
- U. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
- V. ASTM C143/C143M REV A - Standard Test Method for Slump of Hydraulic Cement Concrete.
- W. ASTM C150/C150M - Standard Specification for Portland Cement.
- X. ASTM C172/C172M REV A - Standard Practice for Sampling Freshly Mixed Concrete.
- Y. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

- Z. ASTM C231/C231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
  - AA. ASTM C260/C260M REV A - Standard Specification for Air-Entraining Admixtures for Concrete.
  - BB. ASTM C309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
  - CC. ASTM C494/C494M REV A - Standard Specification for Chemical Admixtures for Concrete.
  - DD. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements.
  - EE. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
  - FF. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
  - GG. ASTM C1077 REV A- Standard Practice for Agencies Testing Concrete and Concrete Aggregate for Use in Construction and Criteria for Testing Agency Evaluation.
  - HH. CRSI MSP-1 - Manual of Standard Practice.
  - II. CRSI - Placing Reinforcing Bars.
  - JJ. CPMB 100-07 – Part 2 – Plant Control Systems
  - KK. Corps of Engineers CRD-C572 – Specifications for Polyvinylchloride Waterstop.
- 1.04 SUBMITTALS
- A. Conform to requirements of Section 01330 – “Submittal Procedures”.
  - B. Submit proposed mix design and test data for each type and strength of concrete in Work.
  - C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.
  - D. Submit manufacturer’s mill certificates for reinforcing steel. Provide specimens for testing when required by Project Manager.
  - E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

- F. When required on Plans, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.
- G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications

1.05 RELATED REQUIREMENTS

- A. Section 01270 – "Measurement and Payment"
- B. Section 01330 – "Submittal Procedures"
- C. Section 01454 – "Testing Laboratory Services"

1.06 – 1.07 NOT USED

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Cement: Store cement off of ground in 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 coating.

1.09 – 1.13 NOT USED

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

- A. PVC Waterstops: Flat Strip and Center-Bulb Waterstops:
  - 1. Kirkhill Rubber Co., Brea, California
  - 2. Water Seals, Inc., Chicago, Illinois
  - 3. Progress Unlimited, Inc., New York, New York
  - 4. Greenstreak Plastic Products Co., St. Louis, Missouri
  - 5. Approved equal.
- B. Resilient Waterstops, Adhesive:
  - 1. Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.



2. Approved equal.

## 2.02 MATERIALS AND/OR EQUIPMENT

### A. Concrete Materials

#### 1. Cementitious Material:

- a. Portland Cement: ASTM C150/C150M, Type II, unless use of Type III is authorized by Project Manager; or ASTM C595/C595M, Type IP. For concrete in contact with sewage use Type II cement.
- b. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of  $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$ .

2. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C94/C94M REV B.

#### 3. Aggregate:

- a. Coarse Aggregate: ASTM C33/C33M. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
- b. Fine Aggregate: ASTM C33/C33M.
- c. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C33/C33M.

4. Air Entraining Admixtures: ASTM C260/C260M REV A.

#### 5. Chemical Admixtures:

- a. Water Reducers: ASTM C494/C494M REV A, Type A.
- b. Water Reducing Retarders: ASTM494/C494M REV A, Type D.
- c. High Range Water Reducers (Superplasticizers): ASTM C 494/C494M REV A, Types F and G.

6. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

7. Reinforcing Steel:

- a. Use new billet steel bars conforming to ASTM A615/A615M REV A, ASTM A767/A767M REV B, or ASTM A775/A775M REV B, grade 40 or grade 60, as shown on Plans. 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.
- b. Where shown, use welded wire fabric with wire conforming to ASTM A1064/A1064M or ASTM A884/A884M. Supply 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.
- c. Wire: ASTM A1064/A1064M. Use 16½ gauge minimum for tie wire, unless otherwise indicated.

8. Fiber:

- a. Fibrillated Polypropylene Fiber:
  - 1) Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
  - 2) Physical Properties:
    - a) Material: Polypropylene
    - b) Length: ½-inch or graded
    - c) Specific Gravity: 0.91
  - 3) Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.
- b. Steel Fiber: Comply with applicable provisions of ACI 544.3R and ASTM A820/A820M.
  - 1) Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
  - 2) Physical Properties
    - a) Material: Steel
    - b) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1

- c) Specific Gravity: 7.8
  - d) Tensile Strength: 40-400 ksi.
  - e) Young's Modulus: 29,000 ksi
  - f) Minimum Average Tensile Strength: 50,000 psi
  - g) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking
9. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C309.

B. Form Work Materials

- 1. 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 finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber, or  $\frac{3}{4}$  inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.
- 2. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of  $\frac{1}{4}$  inch minimum thickness, preferably oiled at mill.
- 3. 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.
- 4. Form Ties: Metal or fiberglass of approved type with tie holes not larger than  $\frac{7}{8}$  inch in diameter. Do not use wire ties or snap ties.
- 5. 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 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 smooth surface and which line up properly.

C. Measurement of Materials

- 1. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C685/C685M.

2. Measure water and liquid admixtures by volume.

D. Design Mix

1. Use design mixes prepared by certified testing laboratory in accordance with ASTM C1077 REV A and conforming to requirements of this section.
2. 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 Project Manager for review.
3. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Project Manager.
4. Classification:

CLASS	TYPE	MINIMUM COMPRESSIVE STRENGTH (LBS/SQ. IN.)		MAXIMUM W/C RATIO	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP (INCHES)
		7-DAY	28-DAY			
A	Structural	3,200	4,000	0.45	4 $\pm$ 1	2 to 4*
B	Pipe Block Fill, Thrust Block	----	1,500	----	4 $\pm$ 1	5 to 7
*When ASTM C494/C494M REV A, Type F or Type G admixture is used to increase workability, this range may be 6 to 9.						

5. Add steel or polypropylene fibers only when called for on Plans or in another section of these Specifications.
6. Determine air content in accordance with ASTM C138/C138M, ASTM C173/C173M or ASTM C231/C231M.
7. Use of Concrete Classes: Use classes of concrete as indicated on Plans and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

E. Waterstops

1. 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 material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.
  - b. Flat Strip and Center-Bulb Waterstops:

Thickness: not less than 3/8 inch
2. Resilient Waterstop: where shown on Plans; either bentonite- or adhesive-type material.
  - a. 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.
  - b. Adhesive Waterstop:
    - 1) Preformed plastic adhesive waterstop at least 2 inches in diameter.
    - 2) Supplied wrapped completely by 2 part protective paper.
    - 3) Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.
    - 4) Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.

## 2.03 FABRICATION

### A. Production Methods

Use either ready-mixed concrete conforming to requirements of ASTM C94/C94M REV B, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C685/C685M.

2.04 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 – 3.02 NOT USED

3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

A. Forms and Shoring

1. 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 tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.
2. 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.
3. 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.
4. Back form work with sufficient number of studs and wales to prevent deflection.
5. Re-oil or lacquer liner on job before using. Facing may be constructed of  $\frac{3}{4}$  inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.
6. Unless otherwise indicated, form outside corners and edges with triangular  $\frac{3}{4}$  inch chamfer strips (measured on sides).
7. Remove metal form ties to depth of at least  $\frac{3}{4}$  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.
8. Treat facing of forms with approved form coating before concrete is placed. When directed by Project Manager, treat both sides of face forms with coating.

Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

B. Placing Reinforcement

1. Place reinforcing steel accurately in accordance with approved Plans. 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 Project Manager and obtain acceptance before concrete is placed.
2. Minimum spacing center-to-center of parallel bars:  $2\frac{1}{2}$  times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Plans: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.
3. Detail bars in accordance with ACI 318. 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.
4. Do not splice bars without written approval of Project Manager. 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 Plans. Stagger splices or locate at points of low tensile stress.

C. Embedded Items

1. Install conduit and piping as shown on Plans. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.
2. Install waterstops according to manufacturer's instructions. Securely position waterstops at joints as indicated on Plans. Protect waterstops from damage or displacement during concrete placing operations.

D. Batching, Mixing and Delivery of Concrete

1. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in CPMB 100-07, Part 2 - Plant Control Systems.
2. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C685/C685M, Sections 6 through 8.

3. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Project Manager before adjustment and change of mix proportions.
4. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C685/C685M, Section 14.
5. 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 shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.
6. Clean, maintain and operate equipment so that it thoroughly mixes material as required.
7. Hand-mix only when approved by Project Manager.

E. Placing Concrete

1. Give sufficient advance notice to Project Manager (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 Project Manager's approval.
2. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect Work.
3. 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.
4. 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 initial set; do not place strain on projecting reinforcement or anchor bolts.
5. 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.



6. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.
7. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through 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.
8. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

F. Waterstops

1. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.
2. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.
3. Splicing PVC Waterstops:
  - a. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer's printed instructions.
  - b. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.
  - c. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24 inch long strips of waterstop material beyond joint. Upon inspection and approval by Project Manager, install prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24-inch strips to straight-run portions of waterstop in forms.
4. Setting PVC Waterstops:

- a. Correctly position waterstops during installation. Support and anchor waterstops during progress of Work to ensure proper embedment in concrete and to prevent folding over of 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.
  - b. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6 inches below top of wall.
5. 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 with Specifications.
6. Resilient Waterstop:
- a. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
  - b. When requested by Project Manager, provide technical assistance by manufacturer's representative in field at no additional cost.
  - c. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
  - d. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6 inches and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.
  - e. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6 inches from top in vertical wall joints.
  - f. Bentonite Waterstop:
    - 1) Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.
    - 2) Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least  $\frac{3}{4}$  inch deep and  $1\frac{1}{4}$  inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.

- 3) 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 material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.
- 4) Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.
- 5) In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12 inch maximum spacing.

g. Adhesive Waterstop:

- 1) With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.
- 2) If surface is too rough to allow waterstop to form complete contact, grind to form adequately smooth surface.
- 3) Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1 inch and cover back over with protective paper.
- 4) Do not remove protective paper until just before final form work completion. Place concrete immediately. Time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

G. Construction Joints

1. Definitions:

- a. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.
- b. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Plans will not be permitted without written approval of Project Manager. Where so

approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

- c. 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.

#### H. Curing

1. Comply with ACI 308R. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for 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 concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when 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 end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Project Manager.
2. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during 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.
3. Rubbed Finish:
  - a. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.
  - b. 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.
4. Unformed Surfaces: Cure by membrane curing compound method.
  - a. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Project Manager. 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 compound.

- b. Thoroughly agitate 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.
- c. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

I. Removal of Forms and Shoring

- 1. 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 required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.
- 2. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Project Manager.

J. Finishing

- 1. 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 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 surface.
- 2. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Plans. After pointing has set sufficiently, wet surface with 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 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 surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

3. Apply wood float finish to concrete slabs.

### 3.04 REPAIR/RESTORATION

#### A. Defective Work

Immediately repair defective Work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

### 3.05 FIELD QUALITY CONTROL

#### A. Testing shall be performed under provisions of Section 01454 – “Testing Laboratory Services”.

#### B. Unless otherwise directed by Project Manager, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C1077 REV A.

1. Take concrete samples in accordance with ASTM C172/C172M REV A.
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 specimens in accordance with ASTM C31/C31M REV A and ASTM C39/C39M REV A.
3. When taking compression test specimens, test each sample for slump according to ASTM C143/C143M REV A, for temperature according to ASTM C1064/C1064M, for air content according to ASTM C231/C231M, and for unit weight according to ASTM C138/C138M.
4. Inspect, sample and test concrete in accordance with ASTM C94, Section 13, 14, and 15, and ACI 311.5-5R.

#### C. Test Cores: Conform to ASTM C42/C42M.

#### D. Testing High Early Strength Concrete: When Type III cement is used in concrete, 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 resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of

structure which fail to develop required strength may be required by Project Manager, at no additional cost.

3.06 – 3.08 NOT USED

3.09 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 protection while concrete is still plastic, and whenever precipitation is imminent or occurring.
- C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Project Manager.

3.10 SCHEDULES (NOT USED)

END OF SECTION

Section 16640

CATHODIC PROTECTION FOR PIPELINES

PART 1 GENERAL

1.01 SUMMARY

This Section includes:

- A. Requirements for impressed current cathodic protection systems on steel, ductile iron and concrete cylinder pipe in water pipeline projects using rectifiers and deep anode groundbeds.
- B. Requirements for sacrificial anode cathodic protection on steel, ductile iron, concrete cylinder and metallic fittings in plastic pipe systems using zinc and/or magnesium anodes.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

- 1. This item will be measured and paid for as a lump sum item for the job.
- 2. Payment will be full compensation for all labor, equipment, materials and supervision for the installation of the cathodic protection system, complete in place including rectifier systems with deep anode groundbed and junction boxes, sacrificial anodes, power feed hookups, and all excavation, backfill, field welding, connections, adjustments, testing, cleanup, and other related work necessary for construction as shown on the Plans and specified herein.

1.03 REFERENCES

- A. ASTM C94 - Ready Mixed Concrete.
- B. ASTM A518 – Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.
- C. ASTM B418 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- D. ASTM D1248 – Polyethylene Plastics Molding and Extrusion Material for Wire and Cable.
- E. ASTM D4239 – Standard Test Methods for Sulfur in the Analysis Sample of Coal and Coke using High Temperature Tube Furnace Combustion Methods.
- F. ASTM D5192 – Standard Practice for Collection of Coal Samples from Core.



- G. AWWA M9 Manual - Concrete Pressure Pipe.
- H. CSA C22.2 No. 107 – General Use Power Supplies
- I. CSA C22.2 No. 66 – Low Voltage Transformers
- J. City of Houston Electrical Code.
- K. NACE SP0169-2013 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems.
- L. NACE SP0572-2007 - Design, Installation, Operation and Maintenance of Impressed Current Deep Groundbeds.
- M. NFPA 70 – National Electrical Code.
- N. NEMA TC6 - PVC and ABS Plastic Utilities Duct for Underground Installation.
- O. NEMA TC9 - Fittings for ABS and PVC Plastic Utilities Duct for Underground Installation.
- P. NEMA 4 – Type 3R Enclosures.
- Q. UL 83 - Thermoplastic-Insulated Wires.
- R. UL 467 - Bonding and Grounding Equipment.
- S. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- T. UL 506 – Specialty Transformers.

1.04 SUBMITTALS

- A. Submittals to conform to the requirements of Section 01330 – “Submittal Procedures”.
- B. All required computations and drawings shall be prepared by or under the direct supervision of a Professional Engineer, registered in the State of Texas with a minimum of ten years of corrosion control experience.
- C. Submit manufacturer's catalog cuts for each item. Include the manufacturer’s name on the catalog cuts. Provide sufficient information to show that the materials meet the requirements of the Plans and specifications. Where more than one item or catalog number appears on a catalog cut, clearly identify the item proposed.
- D. Provide the Project Manager a minimum of 48 hours notice prior to drilling the anode bore. Type and submit to the Owner or Owner’s Representative, copies of detailed geological and resistance logs of each deep anode bore.

- E. The rectifier manufacturer to include a complete operation and maintenance manual with each rectifier shipped to the job site. In addition to operating instructions, include a circuit diagram and spare parts list in the manual. The rectifier manufacturer to reference each operating manual by rectifier model number and individual serial number.
- F. Submit an electronic copy of monitoring and maintenance reports for the cathodic protection systems to the Project Manager. Include all test data as required by Paragraph Section 3.08.A.8 of this specification. Include operating instructions, maintenance data, product data and test procedures in the manuals.
- G. Maintain as-built drawings of the cathodic protection installation during installation and construction. Revise drawings to show exact locations of all rectifiers, anodes, wiring, connections and terminal boxes. Properly identify all items of equipment and material. Submit the as-built drawings to the Project Manager.

#### 1.05 RELATED REQUIREMENTS

- A. Section 01330 – “Submittal Procedures”.
- B. Section 01785 – “Project Record Documents”.
- C. Section 16061– “Joint Bonding and Electrical Isolation”.
- D. Section 16062 – “Corrosion Control Test Stations”.
- E. Section 16645 – “AC Interference Mitigation Systems for Pipelines Gradient Control Systems”.

#### 1.06 QUALITY ASSURANCE

- A. Provide manufacturer's certification that all components of the cathodic protection system meet the requirements of the Plans and specifications. Reference the applicable section of the specifications and the applicable standard detail on the certification.
- B. The specification reference drawings for the cathodic protection system are diagrammatic and not scaled for exact locations unless scales are explicitly stated on the specific drawing. Determine exact locations by field conditions and non-interference with other utilities or mechanical and structural features. Specific site drawings shall be approved by the Engineer.
- C. Note other existing utilities in the area and during excavation, do not damage these utilities. Repair any damaged utilities to the satisfaction of the Owner at the Contractor's expense.

- D. Operate the rectifier under full load conditions at the factory and thoroughly inspect and test by the manufacturer prior to delivery to the job site. Report results of this testing on a manufacturer's quality control form and include in the operation manual.
- E. All materials, fabrication, and installations are subject to inspection and testing by the Owner or its designated representative. Testing and inspection by the Owner does not relieve the Contractor of any obligation for full compliance with this Specification.

1.07 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

A. Sacrificial Anodes - Magnesium

- 1. Magnesium Anodes: Use high potential magnesium anodes. Follow the metallurgical composition of the magnesium anodes as listed below:

<u>Element</u>	<u>Percent Composition</u>
Aluminum	0.01 Maximum
Manganese	0.50 to 1.3
Copper	0.02 Maximum
Nickel	0.001 Maximum
Iron	0.03 Maximum
Other - (each)	0.05 Maximum
Other - (total)	0.30 Maximum
Magnesium	Balance

- 2. Magnesium Anode Current Capacity: Magnesium anodes require a current capacity of no less than 500 amp-hours per pound of magnesium.
- 3. Anode Backfill Material: Use chemical backfill material around all galvanic anodes. Backfill provides a reduced contact resistance to earth, provides a uniform environment surrounding the anode, retains moisture around the anode, and prevents passivation of the anode.
  - a. All galvanic anodes come prepacked in a backfill material conforming to the following composition:
    - 1) Ground hydrated gypsum: 75 percent
    - 2) Powdered bentonite: 20 percent
    - 3) Anhydrous sodium sulfate: 5 percent.

- b. Have a grain size backfill such that 100 percent is capable of passing through a 20 mesh screen and 50 percent is retained by a 100 mesh screen.
- c. Completely surround the anode with the backfill mixture within a cotton bag.
- d. For standard cast magnesium ingots, the required weight of backfill follows:

<u>Anode Weight (Pounds)</u>	<u>Backfill Weight (Pounds)</u>	<u>Total Weight (Pounds)</u>
9	15	24
17	25	42
20	50	70
32	38	70
48	48	96
60	70	130

- 4. Anode Lead Wires:
  - a. Use a 20-foot length of No. 12 AWG solid copper wire equipped with TW or THW insulation for standard lead wires for a galvanic anode, unless otherwise stated on the Plans.
  - b. Color code all anode lead wires green when terminated in test stations.
- 5. Lead Wire Connection to Magnesium Anode:
  - a. Cast magnesium anodes with a galvanized steel core with the weight of the core not to exceed 0.10 pounds per linear foot.
  - b. Recess one end of the anode to expose the core for the lead wire connection.
  - c. Silver-solder the lead wire to the core and fully insulate the connection by filling the recess with an electrical potting compound.

**B. Sacrificial Anodes - Zinc**

- 1. Zinc Anodes: Use high purity zinc anodes. The metallurgical composition of the zinc anodes conform to ASTM B418, Type II and the following:

<u>Element</u>	<u>Percent Composition</u>
Aluminum	0.005 Maximum
Cadmium	0.003 Maximum
Iron	0.0014 Maximum

Lead                      0.003 Maximum  
Zinc                      Balance

2. Zinc Anode Current Capacity: Zinc anodes require a current capacity of no less than 335 amp-hours per pound of zinc.
3. Anode Backfill Material: Use chemical backfill material around all galvanic anodes. Backfill provides a reduced contact resistance to earth, provides a uniform environment surrounding the anode, retains moisture around the anode, and prevents passivation of the anode.
  - a. All galvanic anodes come prepackaged in a backfill material conforming to the following composition:
    - 1) Ground hydrated gypsum: 75 percent
    - 2) Powdered bentonite: 20 percent
    - 3) Anhydrous sodium sulfate: 5 percent.
  - b. Have a grain size backfill such that 100 percent is capable of passing through a 20 mesh screen and 50 percent is retained by a 100 mesh screen.
  - c. Completely surround the anode with the backfill mixture within a cotton bag.
  - d. For standard cast zinc ingots, the required weight of backfill follows:

Anode Weight (Pounds)	Backfill Weight (Pounds)	Total Weight (Pounds)
30	40	70
45	55	100
60	70	130

4. Anode Lead Wires:
  - a. Use a 20-foot length of No. 12 AWG solid copper wire equipped with TW or THW insulation for standard lead wires for a galvanic anode, unless otherwise stated on the Plans.
  - b. Color code all anode lead wires green when terminated in test stations.
5. Lead Wire Connection to Zinc Anode:
  - a. Cast zinc anodes with a 1/4-inch diameter galvanized steel core.

- b. Extend one end of the core beyond the anode for the lead wire connection.
- c. Silver-solder the lead wire to the core and fully insulate the connection.

C. Impressed Current Anodes

- 1. Description: Use high silicon-chromium-iron anode centrifugally cast in tubular form in accordance with the following specifications.
  - a. Anode Alloy: The anode consists of Durichlor 51, high silicon, chromium iron. This alloy to be made in accordance with ASTM A518, Grade 3 with nominal percentages as follows:

Chemical Composition

<u>Element</u>	<u>Composition, Weight %</u>
Carbon	0.70 - 1.10
Manganese	1.50, max
Silicon	14.20 - 14.75
Chromium	3.25 - 5.00
Molybdenum	0.20, max
Copper	0.50, max

- b. Casting Method: Centrifugally cast anodes in tubular form with a hollow, straight walled design. Do not exceed ¼" bowing and malformation tolerances over the seven-foot anode length. Do not allow anode designs which include enlargement of the outside diameter, at the center or elsewhere, or constrictions of a venturi type of the inside wall.

The anode body to have solid walls of a uniform thickness with an open cylindrical interior. Do not allow static casting methods, such as sand, die or metal mold techniques, in order to avoid the risk of shrink cavities and internal stresses caused by non-uniform wall thickness.

Use of extraneous materials such as chaplets, spacers or chills to center the anode mold are not to be permitted. Restrict any slag deficiencies to one end of the casting only allowing for simple inspection techniques to ascertain metal density and absence of slag inclusions.

- c. Mechanical and Physical Properties: The mechanical and physical properties of the anode are as follows:

Tensile Strength (1/2" dia. bar) psi.....	15,000
Compressive Strength, psi.....	100,000
Hardness, Brinell .....	520
Density, gr/ml .....	7.0
Melting Point, °F .....	2300
Specific Resistance, micro-ohms-cm (20°C) .....	72
Coefficient of expansion, 32° to 212° F .....	7.33 X 10 <sup>6</sup>

- d. Size: Conform to the following sizes for anode castings:

<u>Type</u>	<u>Weight (pounds)</u>	<u>O.D. (inches)</u>	<u>Length (feet)</u>
TA-2	46	2.19	7
TA-3	63	2.66	7
TA-4	85	3.75	7
TA-5	110	4.75	7

The anode type for each location shall be per the specific site Plans.

2. Anode Lead Wire Connection:
  - a. Use a No. 8 AWG seven strand, copper conductor equipped with HMWPE/HALAR insulation for the lead wire for an impressed current anode. Require the length of the lead wire sufficient to reach the anode terminal box without splicing additional wire.
  - b. Attach the anode lead wire at the center of the anode. Have a minimum pull-out strength of one and one-half times the breaking strength of the No. 8 AWG lead wire or 788 pounds for the center connection.
  - c. Do not exceed 0.004 ohms for the electrical contact resistance as measured across the lead wire-to-connector junction.
3. Impressed Current Anode Backfill: Use SC3 calcined fluid petroleum coke as manufactured by Loresco, Inc. to backfill impressed current anodes. Anode backfill properties to be as follows:
  - a. Typical Chemical Analysis:

<u>Component</u>	<u>Percent Composition</u>
Carbon (fixed)	99.35 minimum
Ash	0.6 maximum
Volatiles	0 (950 ° C)

Moisture 0.05

- b. Physical Properties: Bulk density of 74 pounds/cubic foot.
- c. Particle Analysis: Dust free with a maximum particle size of 1 mm.

D. Miscellaneous Deep Anode Groundbed Hardware

Include the following miscellaneous components of a deep anode groundbed:

- 1. Venting Facilities:
  - a. Use plastic vent pipe from the bottom anode to the surface for dissipating gases to the atmosphere.
  - b. Require 1-inch diameter with 1/8-inch holes drilled on 6-inch centers in the area of the anodes for the plastic vent pipe. Do not drill holes in the vent pipe above the anodes.
  - c. Extend the plastic vent pipe above grade, screen the vent outlet, and install in an inverted manner.

E. Rectifiers

Cathodic protection rectifiers to be air-cooled, tap adjust Super Custom model as manufactured by Universal Rectifiers, CorrPower or approved equal, conforming to NEMA MR-20-1958 and listed in CSA File No. 45382.

- 1. DC Output Ratings: Rate rectifiers as shown on the Plans. Supply units that are capable of operating at continuous, full rated output at an ambient temperature of 45° C, in full sunlight with an expected life in excess of 10 years.
- 2. AC Input Ratings: Full rated DC output shall be obtainable with an AC input voltage at 5% below the nominal value. Continuous AC input voltage at 10% above the nominal value shall not damage the transformer, the diode bridge assembly, or exceed any component rates. (Note: This shall apply provided that the rectifier has not been previously adjusted to exceed the maximum DC voltage or amperage rating of the unit.)
- 3. Cooling: Cool by natural air convection. Vent cabinets for natural air convection and screen against insects.
- 4. Voltage Adjustments: Provide adjustment of the output voltage by means of not less than 25 approximately equal steps of secondary taps from 5 percent of rated voltage to full-rated voltage.



5. Rectifying Elements: Rectifying elements to be silicon diodes sized as follows:
  - a. The Peak Inverse Voltage (PIV) of the diode shall be 300% of the maximum impressed voltage on the diode or 400 volts, whichever is greater.
  - b. Configure diodes into a full-wave bridge assembly. Size diodes to carry a minimum average current of one half of rated rectifier output.
  - c. Size heat sinks to keep diode junction temperatures less than 100° C at rated output and maximum ambient temperature.
  - d. Protect diodes against overload by means of semiconductor fuses, located in the transformer secondary leg to the diode bridge assembly.
  - e. Equip diodes with supplemental Metal Oxide Varistor (M.O.V.) surge arrestors at the diode bridge assembly sized to provide protection against secondary over-voltage surges.
6. AC Circuit Breakers: Provide input overload and short circuit protection by magnetic trip circuit breakers. Size the circuit breaker to hold 100 percent of rated load. It may trip between 101 percent and 125 percent of rated load, and must trip at 125 percent and above.
7. Surge Protection: Provide separate AC and DC surge protection by means of high energy Metal Oxide Varistors rated at 500 joules on the DC output and 750 joules on the AC input.
8. Electrical Panels: Construct electrical panels from a minimum thickness of 1/4" NEMA "XX" laminated phenolic, rated for Class "B" operation (105° C maximum). Equip rectifiers rated at 100 amperes DC or higher with panels constructed from a minimum sheet thickness of 1/4" "UTR" fiberglass reinforced laminate rated for Class "F" operation (155° C). Permanently silk-screen rectifier front panel identifications onto the panel.
9. Connection Hardware: Use only copper or high conductivity brass electrical hardware, suitably sized, and finished in electroless nickel plating for superior corrosion resistance. Tightly secure all connections with lock washers and nuts torqued to manufacturer's recommended specifications.
10. Enclosures:
  - a. For outdoor units mount rectifier, disconnect switch and anode junction panel in a single enclosure. For indoor units wall-mount rectifier, disconnect switch and anode junction panel.
  - b. Outdoor enclosure to be free standing, NEMA 4X, 36" wide x 48" high x 24" deep, 12 gauge, type 304 stainless steel with lifting eyes.

- c. Equip with single, louvered door with provisions for padlocking. Provide drip shield and inside insect screen.
  - d. Include ground lug, sized for No. 6 AWG wire.
  - e. Place stickers on all four sides that read "Danger, High Voltage, Keep Out."
  - f. Provide permanent engraved nameplate with black letters on white background that reads "Cathodic Protection Cabinet, Property of North Harris County Regional Water Authority."
11. Rectifier Instrumentation.
- a. Equip rectifier with separate digital ammeter and voltmeter.
  - b. Meters to be a minimum of 3-1/2" size, with a minimum scale length of 2-7/8".
  - c. Meters to be 0 - 50 millivolts full scale deflection, taut-band movement with four-to-one swamping (i.e. internal meter resistance comprised of 25% winding resistance and 75% fully temperature compensated dropping resistor for wide temperature range performance).
  - d. Provide meters with accuracy  $\pm 2\%$  full scale deflection at 25° C., temperature compensated to 0.085% per degree C.
  - e. Scale rectifier meters to have rated output no less than 70%, or greater than 85% of full scale deflection.
  - f. Meter shunts to be panel-mounted Holloway type "SW" style, with an accuracy of  $\pm 0.25\%$ .
12. Transformers: Construct transformers to meet UL 506, Specialty Transformers and the following:
- a. Transformer designed as full isolation with separate isolated primary and secondary windings and a minimum efficiency of 95%.
  - b. Equip transformer secondary with a minimum of 25 steps of secondary voltage adjustment (5-COARSE, 5-FINE). Provide tap adjustment by means of tap bars.
  - c. Rate transformer materials and construction for Class "H" operation (180° C). Further enhance insulation materials by dipping in thermosetting varnish and baking.

- d. Rate transformer for a minimum dielectric strength of 2250 volts applied for one minute between the windings and the core.
- 13. Potential Monitoring Connections: Provide two, five-way binding posts on the front of the rectifier instrument panel. One to be labeled “Reference” and one to be labeled “Structure”.
- 14. Miscellaneous:
  - a. Supply rectifiers capable of operating on either 115 or 230 volt, single phase, 60 hertz AC input.
  - b. All cathodic protection rectifiers to be 100% quality control tested as outlined in this specification.
  - c. During manufacture, subject the rectifier to frequent visual and performance testing to assure a high degree of quality.
  - d. Subject rectifiers to 100% testing of the following rectifier electrical parameters:
    - 1) AC input voltage, current, apparent power and true power.
    - 2) DC output current, voltage and power.
    - 3) AC power factor.
    - 4) AC to DC conversion efficiency.
    - 5) Output ripple.
    - 6) Correct operation of optional features such as interrupters, filters, etc.
  - e. Give each rectifier a final overall visual inspection prior to packaging.

F. Anode Junction Panel

- 1. Enclosure: For outdoor units, mount the anode junction panel in the stainless steel rectifier enclosure as shown on the Plans. For indoor units, wall-mount the anode junction panel under the rectifier. Provide positive terminal, 0.01 ohm type SRS Holloway shunts, and a minimum 3/16” thick, NEMA Grade “XX” phenolic panel. For size and terminal configurations, see specification drawing No 28.
- 2. Positive Cable: Use cable size #4 #6 AWG, red insulation, single conductor, seven strand, copper with THHN insulation for the positive cable from the junction box to the transformer-rectifier.

G. Negative Cables

1. Cables: Use cable size #4 #6 AWG, black insulation, single conductor, seven-strand, copper with medium density, HMW/PE insulation for the rectifier negative cables. The polyethylene to conform to ASTM D1248, Type I, Class C, Grade 5.
2. Test Lead: The test lead to be No. 12 AWG, solid copper wire with white, THHN insulation and of sufficient length to extend from the protected structure to the rectifier without splicing.

H. Permanent Reference Electrodes

1. Type: Provide a copper/copper sulfate, double membrane, ceramic cell in a geomembrane package such as a Permacell Plus or approved equal.
2. Wire: Equip the electrode with No. 14 AWG stranded copper wire with blue HMWPE insulation of suitable length to attach to the terminal board of the test station without splicing.

I. Exothermic Weld Equipment

1. Charges and Molds: Select weld charges and mold size for the specific surface configuration in accordance with manufacturer recommendations. Use Erico Cadweld, or Continental Industries Thermoweld weld charges and molds.
2. Repair coating to be 2-part epoxy repair kit SPC SP-2888 or approved equal. Specific coating system used shall be completely compatible with pipe and factory-applied pipe coating materials.

J. AC Power Service

1. Products: All AC power components must meet local power company requirements.
2. Meter Base: Meter base to be 120/240-volt, single phase, 30-ampere.
3. Disconnect Switch: Provide fused disconnect switch in NEMA 1 enclosure. Mount in cathodic protection cabinet with rectifier.
4. Ground Rod: Ground rod must conform to the requirements of the utility company having jurisdiction.
5. Ground Wire and Clamp: Ground wire to be bare, No. 6 AWG solid copper wire. Use a bronze, bolt-on ground rod clamp.

## PART 3 EXECUTION

### 3.01 – 3.02 NOT USED

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. Cathodic Protection System Installation

##### 1. Installation of Sacrificial Anodes

- a. Install sacrificial anodes at locations specified on the Plans.
- b. Install anodes in native soil, in a vertically augured hole as shown on the Plans. If a vertical installation of the anodes is not feasible, the anodes may be installed horizontally, such changes to the design shall be submitted to the Project Manager for approval by the Engineer prior to the installation.
- c. After the hole is augured, lower the packaged anode into the hole and firmly tamp the soil around the package so that it is in intimate contact with the package.
- d. Run lead wires from the anodes underground at a minimum depth of 36 inches. Connect the wires through a test station as indicated on the Plans.
- e. Handle galvanic anodes carefully to avoid damaging anode materials and wire connections.

##### 2. Installation of Deep Anode Groundbeds

- a. A qualified well driller who is recognized as a fully experienced specialist in the installation of deep anode cathodic protection systems is required to perform the drilling and installation of the deep anode systems. The deep anode system installer is required to have a minimum of 5 years experience installing deep anode systems with a minimum of 10 successful deep anode groundbed installations. The Contractor is required to obtain and submit all applications for well drilling permits required by any City, County or State agency.
- b. Locate the anode groundbed as shown on Plans. Contractor is responsible for verifying actual field conditions, location of underground structures, and assuring adequate physical separation from other structures and utilities. Any concerns regarding obtaining AC power from the utility at specified rectifier locations or any other construction related questions shall be addressed to the Project Manager and Engineer prior to the installation. Contractor is responsible for any repairs associated with inadequate installation.

- c. Perform drilling with rotary bit equipment designed specifically for this purpose. Use standard techniques (i.e. trough and vacuum truck) to capture and contain the drilling fluids, mud and cuttings at the top of the hole. Select the type and consistency of drilling fluids to be consistent with soil characteristics. Level the drilling rig to provide a round, straight and plumb anode hole.
- d. Drilling of the holes may require the installation of temporary well casings. Remove all temporary casings by the end of the job.
- e. As the hole is drilled, maintain a record describing the depth and type of the geological formations encountered. Submit typed copies of the log as required by Paragraphs 1.04.D and 3.08.A.8 of this specification.
- f. Record an electric log of the hole using one of the anodes. Previously mark the anode lead wire in five-foot increments. Mark the anode lead wire for a distance equaling or exceeding the maximum anticipated depth of the hole. As the anode is lowered into the hole, perform a resistance log by impressing a minimum 12 volt DC current between the anode and a very well grounded structure such as the local AC power neutral network. Do not use Nilsson type soil resistance meters to perform this test. A recommended 12-volt DC power source is a heavy duty lead acid automobile battery. Lower the anode into the hole at ten foot increments, hold in place, and measure the voltage and current output of the DC current source. Record the data, time and location and submit as required under Paragraphs 1.04.D. and 3.08.A.8 of this specification.
- g. Install the vent pipe in the hole with the first anode. Cap the bottom of the vent pipe. Cap the top of the vent pipe throughout the anode and coke breeze backfill installation procedure to prevent intrusion of foreign material. Do not allow drilling mud to enter in the vent pipe.
- h. The number of anodes and interval is per the Plans. Center the anodes in the hole using anode centralizers. Install the anodes by lowering them individually into the hole. Mark the lead wires for the nominal anode depth. Record the final depth with the first anode in the hole (i.e. the bottom anode) identified as anode number one (1). Do not damage the anode lead during handling or lowering into the hole. Under no circumstances, clamp or pinch the anode lead wires around another object while lowering the anodes into the hole. If the insulation for any anode lead wires are cut, broken, or nicked during this operation or at any other time, reject the complete anode and remove from the job site immediately. Replace all damaged anodes at no additional expense to the Owner.

- i. Slurry the coke backfill above-grade and then pump into the hole after the anodes are installed. Pump the coke from the bottom of the hole up using a pipe that is the length of the anode hole. Do not use the vent pipe to pump the coke. Raise the pipe as the anode column is filled with coke. Remove the pipe from the hole after the coke installation operation is completed. Use a sufficient amount of backfill such that the coke breeze column extends above the top of the uppermost anode per the Plans. Install the coke backfill uniformly with no voids around the anodes.
  - j. Terminate the 1-inch diameter internal vent pipe with a gooseneck fitting. Leave the top end of the vent pipe open to allow gases from the anode hole to exit. The inactive column shall be filled with soil or bentonite per the Plans and environmental requirements. If bentonite is required, use Aquaplug or approved equal.
  - k. Take all necessary precautions to avoid entrance of foreign matter into the hole, movement of soil strata, or collapsing of the hole during the progress of the work. Should movement of soil strata or collapse of the drilled hole interfere with proper completion of the anode groundbed, recover the wires, anodes and vent pipe and ream or redrill the hole at no cost to the Owner.
  - l. Dispose of drilling mud, cuttings and other waste in accordance with the methods and procedures of the best recognized practices and comply with the rules and regulations of the State, City and County.
  - m. Cap PVC casing aboveground. Pour a 4' x 3' steel reinforced concrete pad as shown on the Plans.
3. Installation of Cathodic Protection Rectifiers
- a. Comply with the latest edition of the NFPA National Electrical Code and with all City of Houston, and local power company codes and standards.
  - b. Mount rectifiers on reinforced concrete pad as shown on the Plans. Place at elevation above the 100-year flood plain.
  - c. Equip rectifiers with permanent engraved nameplates to identify the units as "Cathodic Protection Cabinet, Property of North Harris County Regional Water Authority."
  - d. Place all wiring to the rectifier in rigid galvanized steel conduit when run above grade.
    - 1) Use insulating bushings at the ends of all conduits.

- 2) Extend steel conduit 12 inches below grade.
  - e. Provide AC electrical service for each rectifier unit. Furnish and install the necessary wiring, conduits, wires, meter sockets, splice boxes and equipment to the service connection as required by the local power company.
  - f. Notify Project Manager for Engineer to inspect the rectifier installation prior to energization. The installation is not considered complete until the AC and DC wiring is installed and the rectifier is capable of operating at full rated load. Install AC power such that the rectifier can be activated for test purposes.
4. Installation of Wire and Cable
- a. Install all underground wires and cables at a minimum of 36 inches below final grade with a minimum separation of 6 inches from other underground structures.
  - b. Enclose all positive and negative cables, and anode lead wires in rigid galvanized steel conduit when above-grade.
    - 1) Use insulating bushings at the ends of all conduits.
    - 2) Extend conduit 12 inches below grade.
5. Installation of Anode Junction Panel
- a. For outdoor units, install anode lead panel inside the cathodic protection cabinet, immediately adjacent to the rectifier with the bottom of the panel at a minimum height of one foot above grade. For indoor units, wall-mount the anode junction panel in a fiberglass box, at a distance of one foot under the rectifier.
  - b. Contractor is responsible for replacing all malfunctioning anodes at no cost to the Owner.
6. Negative Cable and Test Lead Attachment
- a. Attach negative cables and test leads to the pipe (for the dielectrically coated steel and ductile iron pipe options) or to the “L” bracket (for the concrete cylinder pipe option) by thermite welding.
  - b. Clean and dry the pipe to which the negative cables and test lead are to be attached.



- c. Remove all coating, mill scale, oxide, grease and dirt from the pipe over an area approximately 3 inches square. Clean the surface to bright metal.
  - d. Remove approximately one inch of insulation from each end of the wires to be exothermically welded to the pipe, exposing clean, oxide-free copper for welding.
  - e. Using the proper size exothermic weld mold as recommended by the manufacturer, place the wire between the graphite mold and the prepared metal surface. Use a copper sleeve crimped over the wire for all wires No. 12 AWG size.
  - f. Place the metal disk in the bottom of the mold.
  - g. Pour the exothermic charge to the mold. Squeeze the bottom of the weld charge container and spread ignition powder over the charge, in case that it is consistent with the manufacturer specification.
  - h. Close the mold cover and ignite the starting powder with a flint gun. Hold the mold firmly in place until all of the charge has burned and the weld has cooled slightly.
  - i. Remove the exothermic weld mold and gently strike the weld with a hammer to remove the weld slag. Pull on the wire to assure a secure connection. If the weld is not secure or the wire breaks, repeat the procedure.
  - j. If the weld is secure, coat all bare metal and weld metal with 2-part epoxy.
7. Permanent Reference Cell
- a. Install the permanent reference cell at all test station locations.
  - b. Remove the permanent reference cell from the shipping package. Totally submerge the reference electrodes in a 5-gallon bucket of potable water for a minimum period 15 minutes. Brackish water or saltwater will not be allowed. Measure the accuracy of each copper/copper sulfate reference electrode before installation by measuring the DC voltage difference between it and another reference electrode of known accuracy. The measurements shall be within the written DC voltage calibration as specified by the reference electrode manufacturer. Reference electrodes that do not comply with the manufacturer's stated calibration shall not be used. The reference electrode data shall be recorded and included in the as-built documentation submitted to the Owner.

- c. Place below the springline and 6-inches from the pipeline.
- d. Run continuous lengths of the blue reference cell wiring, and the white test lead to the rectifier unit in the same trench as the negative cable. Do not nick or otherwise damage the wire insulation.
- e. Backfill the reference electrode with six inches of select, native soil and compact by hand. Moisten the soil, if necessary, for good compaction.

3.04 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTION

A. Post Installation Testing of the Cathodic Protection Systems

- 1. General: Inspect, energize, and adjust the cathodic protection as soon as possible after the equipment has been installed.
- 2. Continuity testing: Continuity testing of joint bonds shall be performed by the Contractor's qualified corrosion technician as defined in this section after backfill. The electrical continuity test may additionally be performed before backfill at the Contractor's option.
  - a. The pipe shall be tested for electrical continuity. Continuity shall be verified using the linear resistance method. The pipe shall be tested in spans that are no less than 250 feet unless the pipe is shorter than 250 feet and no more than 1,000 feet. Each test span shall have two test leads connected to the pipe at each end. Existing test stations can be used. A direct current shall be applied through the pipe using two of four test leads. The potential across the test span shall be measured using the other two test leads. The current applied and voltage drop shall be recorded for a minimum of three different current levels.
  - b. The theoretical resistance of the pipe shall be calculated. It shall take into account the pipe wall thickness, material, and joint bonds.
  - c. Acceptance of the test span; The average measured resistance shall be compared to the theoretical resistance of the pipe and bond wires. If the measured resistance is greater than 125% of the theoretical resistance, then the joint bonds shall be considered deficient and shall be repaired and retested at the Contractor's expense. If the measured resistance is less than 100% of the theoretical resistance then the test and/or calculated theoretical resistance shall be considered deficient and the test span shall be retested and/or recalculated at the Contractor's expense. If the piping forms a loop which allows current to flow both in and out of the test span, then consideration shall be made for current circulating through both the loop and the test span.

3. Energization: Perform the energizing of the cathodic protection system by a Corrosion Engineer to achieve compliance with the referenced corrosion control standards set forth by NACE and/or AWWA.
4. Notice: Prior to native state and polarized potential testing, give a minimum of 48 hours notice to the Project Manager and Engineer to facilitate observation of the tests by the Owner's Representative.
5. Method: The Corrosion Engineer to:
  - a. Measure native state pipe-to-soil potentials at all test stations, permanent reference cells, electrical isolation devices, and locations of exposed pipe prior to energizing the cathodic protection system. Contractor to provide corrosion engineer proof of isolation devices including flange isolators and casing spacers are installed and operating properly.
  - b. Measure casing-to-soil potentials and foreign line potentials, prior to energizing the cathodic protection system.
  - c. Energize the cathodic protection system and adjust the DC current output such that the pipe-to-soil potentials near the cathodic protection current source (either transformer-rectifier or sacrificial anodes) is approximately -1000 millivolts to a permanent copper sulfate reference cell (CSE). Record the DC voltage and current of the power supply.
  - d. Allow a minimum time for the pipeline to polarize, typically 2 weeks.
  - e. Using a current interrupter, cycle the power supply "On" and "Off". If multiple rectifiers are installed and the pipeline is continuous, interrupt all the rectifiers simultaneously.
  - f. Record "On" and "Instant Off" potentials at all water pipeline test stations, permanent reference cells, electrical isolation devices, locations of exposed pipe, casings and foreign pipelines.
  - g. For steel and ductile iron pipe, adjust the cathodic protection power supplies to satisfy the criteria of a minimum 100 millivolts of polarization or an "Instant Off" potential at least as negative as -850 millivolts CSE.
  - h. For concrete cylinder pipe, adjust the cathodic protection power supplies to achieve a minimum 100 millivolt of polarization without any "Instant Off" potentials more negative than -1000 millivolts CSE.
  - i. Record all final adjustments of the DC power supplies.

- j. Verify that interference does not exist with foreign pipelines. Perform joint tests and provide recommendations for mitigation any interference.
- 6. After initial energization and after rectifiers have been adjusted as necessary for compliance with NACE SP-0169-2013, perform a walk-through inspection with Project Manager to verify that all corrosion control components have been installed in accordance with Plans and specifications.
- 7. Make a punch list of outstanding work identified during walk-through inspection. Once Contractor has completed all work on punchlist, pipeline will be allowed to polarize for 30 days before final testing. Perform final testing and adjustment after 30-day polarization period. Repair deficiencies discovered during final testing at Contractor's expense and at no additional cost to the Owner.
- 8. Equipment: All cathodic protection testing instruments to be in proper working order and calibrated according to factory specifications.
- 9. Report: Submit a written report in accordance with Section 1.04, Submittals.

3.09 – 3.10 NOT USED

END OF SECTION

Section 16645

**AC INTERFERENCE MITIGATION SYSTEMS FOR PIPELINES  
GRADIENT CONTROL SYSTEMS**

**PART 1 GENERAL**

**1.01 SUMMARY**

This Section includes:

- A. AC mitigation materials and installation requirements for gradient control mat systems on water pipeline projects.
- B. Locations requiring AC mitigation are - test stations or other above grade pipeline apparatus such as valves, risers or any other exposed metal pipeline parts, associated with coated carbon steel or polyethylene encased ductile iron piping paralleling or crossing high voltage power transmission lines, that are required to have gradient control mats per the AC interference mitigation design.

**1.02 MEASUREMENT AND PAYMENT**

- A. Unit Prices

No payment will be made for AC mitigation for pipelines under this section. Include cost in unit price for water mains or sewers.

**1.03 REFERENCES**

- A. Institute of Electrical and Electronics Engineers (IEEE) Standard 80, Guide for Safety in AC Substation Grounding. IEEE, New York, New York, August 2000.
- B. ASTM B418 – Standard Specification for Cast and Wrought Galvanic Zinc Anodes
- C. NFPA 70, National Electrical Code
- D. NACE P0177-2014, Mitigation of Alternating Current and Lightning Effects on Metallic Structures and Corrosion Control Systems
- E. CSA Standard CAN/CSA-C22.3 No. 6-M91, Principles and Practices of Electrical Coordination Between Pipelines and Electrical Supply Lines
- F. European Standard CEN/TS 15280, Evaluation of A.C. Corrosion Likelihood of Buried Pipelines – Application to Cathodically Protected Pipelines.
- G. UL 83, Thermoplastic Insulated Wires

- H. UL 467, Bonding and Grounding Equipment
- I. UL 486A, Wire Connections and Soldering Lugs for Use with Copper Conductors

#### 1.04 SUBMITTALS

- A. Contractor shall employ personnel qualified by education, training and experience to fulfill requirements of this specification. To accomplish this for gradient control systems installation, as part of AC interference mitigation systems, it may be necessary for Contractor to subcontract all or part of the work required by this specification. (Contractor shall coordinate installations performed by subcontractors with pipeline construction so as to avoid delays in construction of the pipeline.) Contractor shall submit to the Project Manager approval of qualifications for all personnel and subcontractors that are to perform work required by this specification.
- B. Manufacturer's catalog cuts shall be submitted to the Project Manager in accordance with Section 01330 – "Submittal Procedures". The catalog cuts shall include the manufacturer's name and shall provide sufficient information to show that the items meet the requirements of the Contract Documents. Where more than one item or catalog number appears on a catalog cut, the proposed item shall be clearly identified.
- C. As-built drawings of the potential gradient control mats at cathodic protection test stations or other above grade apparatus shall be prepared and maintained by Contractor during construction and installation. As-built drawings shall show exact locations and dimensions of all installations covered by this specification. All items of equipment and material shall be properly identified on the As-built drawings. As-built drawings shall be submitted to the Project Manager after completion of construction.

#### 1.05 RELATED REQUIREMENTS

- A. Section 1330 – "Submittal Procedures".
- B. Section 16062 – "Corrosion Control Test Stations".
- C. Section 16640 – "Cathodic Protection for Pipelines".

#### 1.06 QUALITY ASSURANCE

- A. Contractor shall note other utilities and structures near the construction sites and repair any damaged utilities to the satisfaction of the owner at the Contractor's expense.
- B. All equipment, materials, fabrications, and installations are subject to inspection and testing by the Owner or its designated representative. Testing and inspection by

Owner does not relieve the Contractor of any obligation for full compliance with this Specification.

1.07 – 1.13 NOT USED

## PART 2 PRODUCTS

2.01 MANUFACTURER(S) (NOT USED)

2.02 MATERIALS AND/OR EQUIPMENT

### A. Zinc Ribbon

1. The alloy of the zinc ribbon will be ASTM B418 (latest revision), Type II, for use in soil applications. Composition of the zinc alloy will be as follows: aluminum - 0.005% maximum, cadmium – 0.003% maximum, iron – 0.0014% maximum, lead – 0.003% maximum, copper – 0.002% maximum, with the remainder to be zinc.
2. The zinc ribbon will be of the “standard” size with cross sectional dimensions of 1/2-inch diagonal width and 9/16-inch diagonal height.
3. The zinc ribbon will have a 1/8-inch diameter steel wire core to which the zinc will be permanently bonded.
4. The zinc ribbon will be coiled in 1000-foot long rolls from the manufacturer.

### B. Potential Gradient Control Mats at CP Test Stations

1. Potential gradient control mats shall be installed at indicated cathodic protection test stations.
2. Potential gradient control mats shall be comprised of zinc ribbon, zinc ribbon lead wires, electrical connectors, insulation putty, tape and coating for electrical connections, thermite weld materials, and pipe coating repair materials.
3. Materials for potential gradient control mats at cathodic protection test stations shall be as follows:
  - a. Zinc ribbon shall be as specified in Paragraph 2.02.A of this specification.
  - b. Zinc ribbon lead wires shall be No. 6 AWG single conductor stranded copper wire with high molecular weight polyethylene (HMWPE) insulation. The insulation shall be black in color. Each

individual lead wire shall be continuous without splices and without damage to the insulation.

- c. Electrical connectors for connecting No. 6 AWG zinc ribbon lead wires to zinc ribbon core wires shall be Burndy YC4C8 compression crimpits, or an approved equal.
- d. Materials for insulation of connections of zinc ribbon lead wires to zinc ribbon shall be electrical insulation putty, tape and coating as specified in Paragraph 2.02.D of this specification.
- e. Exothermic welding materials and pipe coating repair materials for connecting pipe lead wires to pipe shall be as specified in Paragraph 2.02.E.

C. Potential Gradient Control Mats at Valve Sites or Other Above Grade Pipeline Apparatus

- 1. Potential gradient control mats shall be installed at valve sites or other exposed pipeline apparatus, subject to AC interference, per the Plans.
- 2. Materials for the gradient control systems at valve sites or other above grade pipeline apparatus shall follow the guidance specified in Paragraph 2.02.B of this document.

D. Insulation of Buried Electrical Connections

- 1. All buried electrical connections involving zinc ribbon core wires and No.6 AWG wires cables shall be provided with electrical insulation using electrical insulation putty, rubber and vinyl electrical tapes and electrical coating.
- 2. Electrical insulation putty shall be 3M Scotchfill®, or an approved equal.
- 3. Rubber electrical tape shall be 3M Scotch™ 130C, or an approved equal.
- 4. Vinyl electrical tape shall be 3M Scotch™ Super 88, or an approved equal.
- 5. Electrical coating shall be 3M Scotchkote™, or an approved equal.

E. Exothermic Weld Equipment

- 1. Charges and Molds: Select weld charges and mold size for the specific surface configuration in accordance with manufacturer recommendations. Use Erico Cadweld, or Continental Industries Thermoweld weld charges and molds.
- 2. Repair coating to be 2-part epoxy repair kit SPC SP-2888 or approved equal.



Specific coating system used shall be completely compatible with pipe and factory-applied pipe coating materials.

2.03 – 2.04 NOT USED

## PART 3 EXECUTION

### 3.01 GENERAL / MANUFACTURER(S)

This section of the specification provides information needed by Contractor to install potential gradient control systems. Equipment and materials required for installation of the systems are as specified in Part 2 of this specification. Installation requirements and details may be also found on the specification reference drawings.

### 3.02 PREPARATION (NOT USED)

### 3.03 ERECTION/INSTALLATION APPLICATION AND/OR CONSTRUCTION

#### A. Installation of Potential Gradient Control Mats at Cathodic Protection Test Stations

1. Materials to be used for potential gradient control mats at cathodic protection test stations shall be those materials specified in Paragraph 2.02.B of this specification. Cathodic protection detail drawings show installation requirements and details for potential gradient control mats at cathodic protection test stations.
2. Potential gradient control mats shall be installed for all cathodic protection test stations within transmission line parallelism as well as at HVAC and pipeline crossing locations.
3. Potential gradient control mats shall be spiral runs of zinc ribbon installed around the cathodic protection test stations with two lead wires that connect the mats directly to the pipeline. The mats can be pre-fabricated with supplied two lead wire connections. The mats shall be installed approximately 12 inches below final grade and shall extend approximately 4 feet horizontally around the test stations. Backfill directly above the mats shall be finished to final grade with a 2-inch thick layer of backfill conforming with AWWA Standards and a 4-inch thick layer of fine-to- medium gravel.
4. Prior to backfilling the pipeline at cathodic protection test stations, two lead wires shall be installed on the pipeline as close as practicable to the test stations. The lead wires shall be connected to the pipeline as specified in Paragraph 3.03.B of this specification. The lead wires shall be sufficiently long to reach from the pipeline to the connection points on the zinc ribbon with approximately 12 inches of slack in the lead wires for backfill settlement.

5. After installing the lead wires on the pipeline, the pipeline shall be backfilled to approximately 12 inches below final grade. Backfill material shall be approved backfill in accordance with AWWA Standards. The surface of this initial backfill shall be relatively smooth and level to provide a supporting bed for the zinc ribbon. The lead wires shall be protected from damage during the backfill operation and shall be maintained in a vertical position so that the loose ends of the wires are accessible after this initial backfilling operation is complete.
  6. After the initial backfilling operation is complete, zinc ribbon shall be laid down in spirals around the test stations. The spirals shall start approximately 6 inches away from the test station posts and continue in a spiral until the outside run of ribbon is no less than 4 feet horizontally from all touchable points on the test stations. Separation between any two adjacent runs of ribbon shall be approximately 6 inches. The ribbon shall be formed in a manner that will not damage the zinc or the steel wire core and so that the spiral of ribbon will lie flat on the surface of the backfill.
  7. Following placement of the spirals of zinc ribbon, the two lead wires that were installed on the pipeline shall be attached to the two ends of the zinc ribbon. Connections of lead wires to ribbon core wires shall be accomplished using the specified compression crimpits. After the connections are completed, the connections shall be insulated using electrical insulation putty, tape and coating as specified in Paragraph 3.03.C of this specification.
  8. Final backfilling of the potential gradient control mat shall be accomplished by placing a layer of backfill on top of the mat and a layer of fine-to-medium gravel on top of the sifted native soil backfill. The soil shall be firmly compacted to a thickness of approximately 2 inches prior to placing the gravel. The layer of gravel shall be approximately 4 inches thick and shall fully cover the soil backfill immediately above the zinc ribbon.
- B. Installation of Potential Gradient Control Mats at Valve Sites or Other Above Grade Pipeline Apparatus
1. The quantity of gradient control mats for sites other than cathodic protection test stations should be determined by the specific site dimensions and should be specified on the Plans.
  2. Gradient control mats shall be arranged to accommodate specific sites and should cover the entire area of no less than 4 feet away from any above grade pipeline apparatus.
- C. Wire and Cable Connections to Pipe

Wire and cable connections to pipe shall be made using the exothermic weld process and exothermic welding materials and equipment as shown on the specification reference drawing No. 34.

1. Attach test leads to the pipe by exothermic welding following the manufacturer's written instructions.
2. Clean and dry the pipe to which the wires are to be attached.
3. Remove all coating, mill scale, oxide, grease, and dirt from an area approximately 3 inches square to effect a bright metal surface.
4. Remove approximately 1 inch of insulation from each end of the wires to be exothermically welded to the pipe, exposing clean, oxide-free copper for welding.
5. Using the proper size exothermic weld mold and charge as recommended by the manufacturer, place the wire between the graphite mold and the prepared metal surface. Use a copper sleeve crimped over the wire for all No. 12 AWG wires.
6. Place the metal disk in the bottom of the mold. Pour the exothermic weld charge into the mold. Squeeze the bottom of the cartridge to spread ignition powder over the charge, in case that it is consistent with the manufacturer specification.
7. Close the mold cover and ignite the starting powder with a flint gun.
8. After the exothermic reaction, remove the thermite weld mold and gently strike the weld with a hammer to remove the weld slag. Pull on the wire to assure a secure connection. If the weld is not secure or the wire breaks, repeat the procedure.
9. If the weld is secure, coat all bare metal and weld metal with 2-part epoxy.

**D. Insulation of Buried Electrical Connections**

1. All buried electrical connections involving zinc ribbon core wires and No. 6 AWG wires shall be provided with electrical insulation using electrical insulation putty, electrical coating, and rubber and vinyl electrical tapes as specified in Paragraph 2.02.D of this specification.
2. After the electrical connection has been completed, surfaces of wire and cable insulation shall be trimmed to remove any irregularities or slivers protruding from the insulation. All wire and cable strand ends that are unnecessarily long or that are protruding from the connection shall be cut off. Zinc ribbon, its

core wire, and wire and cable shall be bent into a configuration that will facilitate easy application of the electrical insulation putty and the rubber and vinyl tapes.

3. After the electrical connection has been properly prepared, the electrical insulation putty shall be applied to the connection in a manner that will fill and contour any voids and irregularities around the connection, up to the zinc ribbon and up to the insulation on wire and cable. Prior to application of the insulation putty, all surfaces to which the putty is to be applied shall be clean, dry and free of oil, grease and any other debris. Manufacturer instructions shall be followed during application of the insulation putty.
4. After application of the electrical insulation putty, the connection shall be wrapped with the specified rubber tape. Prior to application of the rubber tape, all surfaces to be wrapped shall be clean, dry and free of oil, grease and any other debris. A minimum of two full layers of rubber tape shall be applied over the entire connection area and extend a minimum of 1 inch onto zinc ribbon and wire and cable insulation. Each wrap of rubber tape shall overlap previous wraps by a minimum of  $\frac{1}{2}$  of the width of the rubber tape. Manufacturer instructions shall be followed during application of the rubber tape.
5. After application of the rubber tape, the connection shall be wrapped with the specified vinyl tape. Prior to application of the vinyl tape, all surfaces to be wrapped shall be clean, dry and free of oil, grease and any other debris. A minimum of two full layers of vinyl tape shall be applied over the entire area previously wrapped with rubber tape. The vinyl tape shall extend a short distance beyond the ends of the rubber tape. Each wrap of vinyl tape shall overlap previous wraps by a minimum of  $\frac{1}{2}$  of the width of the vinyl tape. Manufacturer instructions shall be followed during application of the vinyl tape.
6. After application of the vinyl tape, the entire taped connection shall be coated with the specified electrical coating. Prior to application of the electrical coating, all surfaces to be coated shall be clean, dry and free of oil, grease and any other debris. The electrical coating shall be applied evenly over the taped connection and extend onto zinc ribbon and onto wire and cable insulation for a minimum of  $\frac{1}{2}$  inch. Manufacturer instructions shall be followed during application of the electrical coating.

### 3.04 REPAIR/RESTORATION

#### A. Determination and Correction of Deficiencies

1. Determinations of deficiencies shall be made by the Owner or its

representative.

2. Contractor shall correct any and all deficiencies in equipment, materials and any and all deficiencies in installation to the satisfaction of the Owner at the Contractor's expense.

3.05 – 3.07 NOT USED

3.08 DEMONSTRATION / TESTING AND INSPECTIONS

A. Inspection of Equipment, Materials and Installation

1. All equipment and materials installed under this specification and all installation procedures and techniques employed by Contractor are subject to inspection and testing by the Owner or its representative.
2. The Owner reserves the right to reject any equipment or materials that do not comply with this specification and to halt installations of same if installation procedures or techniques compromise proper installation or jeopardize safety.

B. Testing of Systems Following Completion of Installation

1. Contractor shall provide qualified personnel to test operation and function of all equipment and materials installed under this specification. These personnel shall be those pre-approved by the Owner as required in Paragraph 1.04.A of this specification. Testing plans and schedules shall be provided to the Owner at least two weeks in advance of testing for approval and so that arrangements can be made for witnessing of the tests by the Owner or its representative.
2. Operation and function testing shall be performed in a manner that is standard for the type of equipment or material being tested. Full documentation of test procedures and test results shall be produced and provided to the Owner.
3. The Owner reserves the right to perform independent testing of equipment and materials.

3.09 – 3.10 NOT USED

END OF SECTION