NORTH TEXAS MUNICIPAL WATER DISTRICT

CONTRACT DOCUMENTS AND SPECIFICATIONS FOR

BUFFALO CREEK PARALLEL INTERCEPTOR, PHASE I

PROJECT NUMBER 507-0484-17

OCTOBER 2020

Huitt-Zollars, Inc.
1717 McKinney Avenue, Suite 1400
Dallas Texas 75202-1236
Texas Firm Registration No. F-761
HZI Project No. R308085.01

HUITT-ZOLLARS

NORTH TEXAS MUNICIPAL WATER DISTRICT

CONTRACT DOCUMENTS AND SPECIFICATIONS FOR

BUFFALO CREEK PARALLEL INTERCEPTOR, PHASE I

PROJECT NUMBER 507-0484-17

OCTOBER 2020

JOHN HO
58873
10/14/20

STATE OF TEXAS
TRISTAN ADAM NICKEL
113153
LICENSED
PROFESSIONAL ENGINEER
10/14/2020

Huitt-Zollars, Inc.
1717 McKinney Avenue, Suite 1400
Dallas Texas 75202-1236
Texas Firm Registration No. F-761
HZI Project No. R308085.01

HUITT-ZOLLARS

STATE OF TEXAS
WILLIAM A. WALLACE
59641
LICENSED
PROFESSIONAL ENGINEER
William A. Wallace
10/14/2020

Specifications sections listed on this page were prepared by Huitt-Zollars except where noted:
(1) Tristan Nickel, Texas PE 113153 (RJN Group, Inc. – TBPE Firm No. F-3260)

Specifications sections listed on this page were prepared by Huitt-Zollars except where noted:
(1) Tristan Nickel, Texas PE 113153 (RJN Group, Inc. – TBPE Firm No. F-3260)

Specifications sections listed on this page were prepared by Huitt-Zollars except where noted:
(1) Tristan Nickel, Texas PE 113153 (RJN Group, Inc. – TBPE Firm No. F-3260)

Specifications sections listed on this page were prepared by Huitt-Zollars except where noted:
(1) Tristan Nickel, Texas PE 113153 (RJN Group, Inc. – TBPE Firm No. F-3260)

Sheet No.			Title	# Sheets	Sheet Name
	1		TITLE SHEET	1	GCV01
	2		SHEET INDEX AND DRAWING LEGEND	1	GIN01
3	-	4	GENERAL NOTES	2	GNT01-02
5	-	9	PROJECT LAYOUT SHEETS	5	PL01,02,03,04,05
10	-	13	ACCESS EASEMENT SHEETS	4	AE04,03,02,01
	14		PLAN & PROFILE, 319+42.92 TO 324+00	1	USS01
	15		PLAN & PROFILE, 324+00 TO 336+00	1	USS02
	16		PLAN & PROFILE, 336+00 TO 348+00	1	USS03
	17		PLAN & PROFILE, 348+00 TO 360+00	1	USS04
	18		PLAN & PROFILE, 360+00 TO 372+00	1	USS05
	19		PLAN & PROFILE, 372+00 TO 384+00	1	USS06
	20		PLAN & PROFILE, 384+00 TO 396+00	1	USS07
	21		PLAN & PROFILE, 396+00 TO 408+00	1	USS08
	22		PLAN & PROFILE, 408+00 TO 420+00	1	USS09
	23		PLAN & PROFILE, 420+00 TO 432+00	1	USS10
	24		PLAN & PROFILE, 432+00 TO 444+00	1	USS11
	25		PLAN & PROFILE, 444+00 TO 456+00	1	USS12
	26		PLAN & PROFILE, 456+00 TO 468+00	1	USS13
	27		PLAN & PROFILE, 468+00 TO 480+00	1	USS14
	28		PLAN & PROFILE, 480+00 TO 492+00	1	USS15
	29		PLAN & PROFILE, 492+00 TO 504+00	1	USS16
	30		PLAN & PROFILE, 504+00 TO 516+00	1	USS17
	31		PLAN & PROFILE, 516+00 TO 528+00	1	USS18
	32		PLAN & PROFILE, 528+00 TO 540+00	1	USS19
	33		PLAN & PROFILE, 540+00 TO 552+00	1	USS20
	34		PLAN & PROFILE, 552+00 TO 564+00	1	USS21
	35		PLAN & PROFILE, 564+00 TO 576+00	1	USS22
	36		PLAN & PROFILE, 576+00 TO 580+00	1	USS23
	37		PLAN & PROFILE, 580+00 TO 600+00	1	USS24
	38		PLAN & PROFILE, 600+00 TO 612+00	1	USS25
	39		PLAN & PROFILE, 612+00 TO 624+00	1	USS26
	40		PLAN & PROFILE, 624+00 TO 636+00	1	USS27
	41		PLAN & PROFILE, 636+00 TO 648+00	1	USS28
	42		PLAN & PROFILE, 648+00 TO 660+00	1	USS29
	43		PLAN & PROFILE, 660+00 TO 672+00	1	USS30
	44		PLAN & PROFILE, 672+00 TO 684+00	1	USS31
	45		PLAN & PROFILE, 684+00 TO 696+00	1	USS32

Sheet No.			Title	# Sheets	Sheet Name
	46		PLAN & PROFILE, 696+00 TO 708+00	1	USS33
	47		PLAN & PROFILE, 708+00 TO 720+00	1	USS34
	48		PLAN & PROFILE, 720+00 TO 732+00	1	USS35
	49		PLAN & PROFILE, 732+00 TO 744+00	1	USS36
	50		PLAN & PROFILE, 744+00 TO 753+63.46	1	USS37
	51		GRADING PLAN	1	GRD01
52	-	53	RETAINING WALL PLAN & PROFILE	2	RWLY01,02
	54		ONCOR RELOCATION PLAN	1	ONCOR01
	55		SHEET PILING DETAIL	1	GSD01
56	-	57	RETAINING WALL CROSS SECTIONS	2	RWXS01, 02
	58		MAINTENANCE FACILITY DETAIL	1	CDM01
59	-	60	TEMPORARY GOLF PATH PLAN	2	CDM 02-03
	61		SWPPP - 1 OF 2	1	DTLSWPPP1
	62		SWPPP - 2 OF 2	1	DTLSWPPP2-1
	63		EMBEDMENT DETAILS	1	CDT08
	64		ENCASEMENT DETAILS	1	CDT09
	65		MANHOLE DETAILS	1	CDT03
	66		MANHOLE FRAME & COVER DETAIL	1	CDT03A
	67		MANHOLE INSIDE DROP CONNECTION	1	CDT03B
	68		EXISTING SANITARY SEWER CONNECTION SEQUENCE OF CONSTRUCTION	1	CDT13
	69		PAVING DETAILS	1	CDT12
	70		PAVESTONE DETAIL	1	CDT04
	71		PIPELINE MARKER DETAIL	1	CDT05
	72		MANHOLE AND CARBON CAN DETAILS	1	CDT10
73	-	74	FENCE AND GATE DETAILS	2	CDT06-07
	75		TCP(2-1)-18 (TRAFFIC CONTROL PLAN CONVENTIONAL ROAD SHOULDER WORK)	1	TCP2-1-18
	76		MULTIPLE LOCATIONS GENERAL NOTES	1	RJN
77	-	81	MANHOLE REHABILITATION MAPS	5	RJN
82	-	84	MANHOLE REHABILITATION SCHEDULE	3	RJN
	85		DS1 GENERAL DETAILS	1	RJN
	86		DS2 GENERAL DETAILS	1	RJN
	87		DS3 GENERAL DETAILS	1	RJN
	88		DS4 GENERAL DETAILS	1	RJN
89	-	142	ROCKWALL-HEATH TRANSFER SEWER SECTION 1	54	RD
143	-	178	ROCKWALL-HEATH TRANSFER SEWER SECTION 2	36	RD

INVITATION FOR BIDS

The North Texas Municipal Water District is soliciting proposals for the construction of the following project:

Buffalo Creek Parallel Interceptor, Phase I
Project No. 507-0484-17

Proposals must be delivered to Office of the Executive Director at 505 East Brown Street, Wylie, Texas 75098 no later than **2:00 PM, Wednesday, November 11, 2020** to be accepted. Proposals will be collected under the awning on the west side of the building. The proposals will be publicly opened and read aloud thru a Conference Call. Call-in information will be posted on www.CIVCASTUSA.com at a later date. Bids received after this time will be returned unopened. Address proposals to President and Board of Directors of the North Texas Municipal Water District.

Contract Documents may be downloaded or viewed free of charge from CivCast at www.civcastusa.com. It is the responsibility of the Contractor to download a complete set of documents as defined in the Instruction to Bidders. The Bidders' attention is directed to Article 6 of the Bid Form for list of required submittals for complete Bid.

A **NON-MANDATORY** pre-bid conference for the project will be held on **10:00 AM, Wednesday, October 28, 2020 thru a Virtual Conference Call, call in information will be posted on www.civcastusa.com at a later date**

All questions must be submitted in writing, posted to CivCastUSA.com by Monday, November 2, 2020.

This project is located in Rockwall County and Kaufman County Texas. The project is a linear project from FM 740 to Buffalo Creek Wastewater Treatment Plant includes construction of **Approximately 43,600 LF of 36" - 48" diameter wastewater pipe with associated appurtenances including manholes, a sheet pile retaining wall, Concrete Trail and Pavement restoration. Portions of the new pipe are to be installed by other than open cut with the required casing pipe, numerous existing manholes and existing wastewater lines to be rehabilitated / repaired**, from Wiser Road to Buffalo Creek Wastewater Treatment Plant**.**

Bidders must submit a cashier's check, certified check, or acceptable bidder's bond with their proposal as a guarantee that the Bidder will enter into a contract for the project with the Owner within fifteen (15) days of Notice of Award of the contract. The security must be payable to North Texas Municipal Water District in the amount of five (5%) percent of the bid submitted. Contractor must execute the contract, bonds and certificates of insurance on the forms provided in the Contract Documents.

Contractors for this Project must pay no less than the prevailing wage rates for the area established by the Owner and included in the contract documents.

Performance and Payment Bonds are required, each in an amount of not less than one-hundred percent (100%) of the contract price, conditioned upon the faithful performance of the contract and upon payment of all persons supplying labor or furnishing materials.

The North Texas Municipal Water District reserves the right to adopt the most advantageous interpretation of the bids submitted in the case of ambiguity or lack of clearness in stating proposal prices, to reject any or all bids, and/or waive formalities. Bids may not be withdrawn within sixty (60) days from date on which bids are opened.

NORTH TEXAS MUNICIPAL WATER DISTRICT

_____

Larry Parks
President, Board of Directors

1.00 GENERAL

1.01 DEFINED TERMS

A. Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions.

1.02 QUALIFICATIONS OF BIDDERS

A. Submit documentation required in Section 00 45 16 Statement of Qualifications with the Bid to demonstrate that the Contractor is qualified by experience and capability to successfully construct the project within the Contract Time and for the Contract Amount.

B. Owner may conduct investigations as considered necessary to establish the responsibility, qualifications and financial ability of the Bidders, proposed Subcontractors and other persons and organizations to do the work in accordance with the Contract Documents, to Owner's satisfaction, and within the prescribed time. Owner may reject the Bid of any Bidder who does not meet any such evaluation to Owner's satisfaction.

1.03 **EXAMINATION OF CONTRACT DOCUMENTS AND SITE**

A. Examine Contract Documents, make observations and investigations, correlate knowledge and observations with the requirements of the Contract Documents and consider these in preparation of a bid for the project.

1. Read the Contract Documents and related technical data and reports thoroughly. Use a complete set of Contract Documents in preparing Bids. Assume responsibility for errors or misinterpretations resulting from the use of partial or incomplete contract documents.
2. Visit the site to become familiar with general, local and site conditions that may affect cost, progress or performance of the work in any manner.
3. Become familiar with federal, state and local laws, ordinances, rules and regulations affecting cost, progress or performance of the work.

B. Surveys and investigation reports of subsurface or latent physical conditions at the site, or conditions or situations affecting the design of the Project used by the Engineer in preparing the Contract Documents are referenced in the Supplementary Conditions.

1. These reports are available for information only and neither the Owner nor Engineer guarantees their accuracy or that any opinions expressed in the report are correct.
2. Make additional surveys and investigations as necessary to determine the bid price for performance of the work in compliance with the terms of the Contract Documents before submitting a bid.
3. Cost for these investigations is to be paid by the Bidder(s).

C. Acknowledge sole responsibility for job site safety, including trench excavation and confined space entry safety, by the submission of a Bid for this project.

D. A **NON-MANDATORY** pre-bid conference for the project will be held on **10:00 AM, Wednesday, October 28, 2020 thru a Virtual Conference Call, call in information will be posted on www.civcastusa.com at a later date**

The submission of a Bid is incontrovertible representation by the Bidder that he has complied with every requirement of this Section.

1.04 INTERPRETATIONS

A. Submit all questions about the meaning or intent of the Contract Documents to the Engineer in writing via the CivCast website at www.civcastusa.com . Replies are issued by Addenda through the CivCast website to all parties recorded by the Engineer as having received the bidding documents through CivCast. Only questions answered by formal written Addenda are binding. Oral and other interpretations or clarifications will be without legal effect. Questions received less than three (3) days (72 hours) prior to the date for opening of Bids may not be answered.

1.05 BID SECURITY

A. Submit a bid security in the amount of five (5%) percent of the amount of the maximum total bid as a guarantee that the Bidder will promptly enter into a Contract and execute a Performance and Payment Bond on the forms included in the Contract Documents if awarded the contract.

B. Acceptable Bid securities are:

1. Certified or cashier's check made payable to the Owner.

2. An approved Bidder's Bond underwritten by a surety named in the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Department.

C. Bid securities will be returned to bidders when the contract award is made or bids are rejected.

1.06 CONTRACT TIME

This project is to be substantially complete and ready for operation **within 550 consecutive calendar days from the date of the notice to proceed.** Substantial completion of the project INCLUDES HAVING THE GOLF COURSE FINAL GRADING RESTORATION COMPLETED AND ACCEPTED BY GOLF COURSE STAFF PRIOR TO SUBSTANTIAL COMPLETION and Final Acceptance shall be achieved within **60 days** of the Substantial Completion date. Liquidated damages are set forth in the Agreement.

1.07 BID FORM

A. Submit bids on the Bid forms provided with the Contract Documents for each contract Bid. Include supplemental data to be furnished in the same sealed envelope with Bid.

B. Bid forms must be completed in ink. The Bid price of each item on the form must be stated in words and/or numerals. Words take precedence in case of a conflict. In the case of a conflict between the unit price indicated and the extended amount shown, the unit price indicated multiplied by the stated quantity shall govern.

C. Execute bids by corporations in the corporate name by the president or a vice-president or other corporate officer accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown below the signature.

D. Execute bids by partnerships in the partnership name. Forms are to be signed by a partner. Print the name below the signature. Write the title of the Partner and show the official address of the partnership shown below the signature.

E. Acknowledge receipt of all Addenda on the bid form by signing beside the Addenda number.

1.08 SUBMISSION OF BIDS

A. Submit bids at the time and place indicated in the Invitation for Bids. Submit bids in a sealed envelope, marked with the NTMWD Project title, NTMWD project number and name and address of the Bidder. Include the Bid security and other required documents in the envelope.

1.09 MODIFICATION AND WITHDRAWAL OF BIDS

A. Modify or withdraw bids by submitting an appropriate document executed in the manner that a Bid must be executed. Deliver the modification or withdrawal to the place where Bids are to be submitted at any time prior to the opening of Bids.

1.10 OPENING OF BIDS

A. Bids will be opened as indicated in the Invitation for Bids.

B. All Bids shall remain open for the period of time set forth in the Invitation for Bids, but Owner may, in his sole discretion, release any Bid and return the Bid Security prior to that date.

1.11 AWARD OF CONTRACT

A. Owner may reject Bids, waive formalities, or disregard nonconforming, conditional Bids or counter proposals.

B. Owner may consider the following in evaluating the bids and awarding the contract:

1. Contractor's qualifications and ability to demonstrate current capability to complete the project in conformance with the requirements of the contract documents.
2. Compliance of the Bids with requirements of the Contract Documents
3. Alternates and unit prices if requested in the Bid forms.
4. The amount bid.
5. Proposed date of completion and the ability to meet intermediate milestones that may have been established for the project.

C. The contract will be awarded based upon the Basis of Award described in the Bid Form.

D. Each Bidder agrees to waive any claim it has or may have against the Owner, the Engineer, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any bid.

1.12 EXECUTION OF CONTRACT

A. The successful Bidder must execute the formal Contract Agreement and required bonds on the forms prepared and submitted by the Owner within fifteen (15) days after the Notice of Award.

B. A Notice to Proceed authorizing the Contractor to commence work will be issued after the Contract Documents have been executed.

1.13 WAGE RATES

A. Contractor must pay no less than the general prevailing rates for the Project location as determined in accordance with statutory requirements. The minimum rates for various labor classifications as established by the Owner are included in the Contract Documents.

1.14 BONDS

A. Performance and Payment Bonds are required for this project and shall be provided in accordance with the General Conditions.

1.15 SALES TAXES

A. The Owner qualifies as an exempt agency as defined by the statutes of the State of Texas. Owner's purchasing department will issue exemption certificates. Comply with all statutes and rulings of the State Comptroller.

1.16 PRE-BID SOILS INVESTIGATION

A. In the event bidders desire soils data using backhoe, drilling rig, or other equipment, the following procedure will be required:

1. Bidders desiring this information shall contact **Jason Snyder** at the North Texas Municipal Water District office in Wylie, Texas, at (972) 770-1364 or at JSnyder@NTMWD.com .
2. The soils investigation will be done only one time. The time and locations will be coordinated with the Owner.
3. The soils investigation will be entirely at the bidder's expense.

1.17 BID PROPOSAL

A. Bids are to be submitted for the following Pipe Material Options Items

Bid Item	Description of Pipe Material Option
A	BUFFALO CREEK PARALLEL INTERCEPTOR, BASE BID RTRP PIPE
B	MANHOLE REHABILITATION - BASE BID
C	LAST MINUTE ADD / DEDUCTION – BASE BID
D	BASE BID (A + B + C)
E	BID ITEMS FRP PIPE (Shall be identical to Bid Items 4A thru 9A)
F	ALTERNATE BID ITEMS PVC PIPE
G	LAST MINUTE ADD / DEDUCTION – ALTERNATE BID

B. Bidders shall submit bids for the following combinations:

Alternative Bid No.	Items included in Alternative Bids
H	ALTERNATE BID PVC PIPE (A + B - E + F + G)

Bids must be submitted for all pipe material options to be considered responsive. The Owner intends to award one of the two options.

END OF SECTION

ARTICLE 1 - BID RECIPIENT

1.01 This Bid is submitted to:

North Texas Municipal Water District
Office of the Executive Director
505 E. Brown Street,
Wylie, Texas 75098
Attention: Mr. Jason Snyder, PE

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 - BIDDER'S ACKNOWLEDGMENTS

2.01 Bidder accepts all of the terms and conditions of the Invitation for Bids and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. The Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

2.02 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of its failure to complete Work in accordance with the schedule set forth in the Agreement.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents, as set forth in the Agreement, that:

A. Bidder has examined and carefully studied the Bidding Documents, the other related data identified in the Bidding Documents, and the following Addenda, receipt of all of which is hereby acknowledged.

Addendum No.	Addendum Date	Signature Acknowledging Receipt

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress and the furnishing of Goods and Special Services.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) which have been identified in SC-4.02, and (2) reports and drawings of Hazardous Environmental Conditions that have been identified in SC-4.06.

E. Bidder has obtained and carefully studied all additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions including surface,

subsurface and Underground Facilities at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents to be employed by Bidder, and safety precautions and programs incident thereto or accepts the consequences for not doing so.

F. Bidder does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the prices bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.

G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

H. Bidder has correlated the information known to Bidder, information and observations obtained from visits to the Site, reports and drawings identified in the Bidding Documents, and all additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents.

I. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by Engineer is acceptable to Bidder.

J. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Agreement.

L. Bidder further represents that this Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity 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 individual or entity to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

ARTICLE 4 – BASIS OF BID

4.01 Bidder will complete the Work in accordance with the Contract Documents for the prices shown in the attached 00 42 23 Bid Form:

A. Extended amounts have been computed in accordance with Paragraph 11.03 of the General Conditions

B. Bidder acknowledges that the estimated quantities are not guaranteed, and final payment for all Unit Price Bid items will be based on actual quantities provided, measured as provided in the contract documents

C. Unit Price and figures column will be used to compute the actual bid price.

ARTICLE 5 – TIME OF COMPLETION

5.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions within the number of calendar days indicated in the Agreement.

ARTICLE 6 – ATTACHMENTS TO THIS BID

6.01 The following documents are attached to and made a condition of this Bid:

A. 00 42 23 Bid Form.
B. Required Bid Security.
C. 00 42 24 Vendor Compliance to State Law Certificate.
D. Required Bidder Qualification Statement with Supporting Data
E. List of Proposed Subcontractors
F. List of Proposed Suppliers
G. Conflict of Interest Questionnaire Form CIQ

ARTICLE 7 – BASIS OF AWARD

7.01 The contract will be awarded to the Bidder with the lowest base bid price or alternate bid price, who is also a qualified bidder as described in Section 00 21 16, INSTRUCTIONS TO BIDDERS, Article 1.02

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid have the meanings indicated in the General Conditions and the Supplementary Conditions. The significance of terms with initial capital letters is described in the General Conditions.

ARTICLE 9 – STATEMENT OF MATERIALS AND OTHER CHARGES

9.01 Provide the following information with this Bid:

Statement of Materials and Other Charges	
Materials Incorporated into the Project	$
All Other Charges	$
Total Contract Amount	$

ARTICLE 10 – VENUE

10.01 Bidder agrees that venue shall lie exclusively in Collin County, Texas for any legal action.

ARTICLE 11 – BID SUBMITTAL

11.01 This Bid submitted by:

If Bidder is:

An Individual

Name: _____
(typed or printed)

By _____
(Individual's Signature)

Doing business as: _____

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Bid Submitted on the following Date _____

A Partnership

Partnership Name: _____
(typed or printed)

Name of General Partner: _____
(typed or printed)

By _____
(Signature of general partner -- attach evidence of authority to sign)

Doing business as: _____

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Bid Submitted on the following Date _____

A Corporation

Corporation Name: _____
(typed or printed)

State of Incorporation: _____

Type: _____
(General Business, Professional, Service, Limited Liability)

Date of Qualification to do business in Texas is _____

By _____
(Signature -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____

Attest: _____
(Signature of Corporate Secretary)

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Bid Submitted on _____

Joint Venture

Joint Venturer Name: _____
(typed or printed)

By _____
(Signature of joint venture partner -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Bid Submitted on _____

Joint Venturer Name: _____
(typed or printed)

By _____
(Signature of joint venture partner -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Bid Submitted on _____

Contact for receipt of official communications

Name: _____
(typed or printed)

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Each joint venturer must sign. The manner of signing for each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS

D - BASE BID (A + B + C)

Total D - Base Bid (A + B + C) Base Bid Total (Words and Figures)	FIGURES
DOLLARS	
CENTS	

H - ALTERNATE BID (A + B - E + F + G)

Total H - ALTERNATED BID (A + B - E + F + G) Alternate Bid Total (Words and Figures)	FIGURES
DOLLARS	
CENTS	

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
A - BUFFALO CREEK INTERCEPTOR - BASE BID RTRP PIPE						
1A	00 61 13.13 00 61 13.16 00 61 13.19 00 72 00	Mobilization, Bonds, Insurance, General Conditions (Maximum 3% of Total Amount Bid), the sum of _____ _____ Dollars and Cents	LS	1		
2A	01 57 00	Comply with TPDES Construction General Permit TXR15000 for Temporary Erosion, Sedimentation and Water Pollution Prevention and Control as Shown and Specified, Complete in Place, the sum of _____ _____ Dollars and Cents	LS	1		
3A	31 10 00	Site Preparation, Clear, Grub & Dispose of Bushes, Shrubs & Trees, Complete in Place, the sum of _____ _____ Dollars and Cents	100' Sta	434		
4A	01 45 16.16 31 23 33 33 31 13	48 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and Cents	LF	23,928		
5A	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 13	48 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	836		
6A	01 45 16.16 31 23 33 33 31 13	42 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and Cents	LF	12,767		
7A	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 13	42 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and Cents	LF	4,095		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
8A	01 45 16.16 31 23 33 33 31 13	36 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and Cents	LF	1,460		
9A	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 13	36 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ Dollars and Cents	LF	370		
10A	01 74 19 31 23 33	Sanitary Sewer Crossing Connection (Remove & Dispose of Old Pipe) - 6-8 Inch, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	5		
11A	01 74 19 31 23 33	Sanitary Sewer Crossing Connection (Remove & Dispose of Old Pipe) - 10-12 Inch, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	5		
12A	01 74 19 31 23 33	Sanitary Sewer Crossing Connection (Remove & Dispose of Old Pipe) - 24 Inch, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	1		
13A	31 41 33	Sanitary Sewer Line Trench Safety, Complete in Place, the sum of _____ _____ Dollars and Cents	LF	38,155		
14A	33 01 30.02 31 23 33 33 39 21	Standard 6 foot Diameter Type "S" Polymer Concrete Manhole - Rim to Flow Line ≤ 20 Feet, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	35		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
15A	33 01 30.02 31 23 33 33 39 21	Standard 6 foot Diameter Type "S" Polymer Concrete Manhole - Rim to Flow Line > 20 Feet ≤ 25 Feet, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	13		
16A	33 01 30.02 31 23 33 33 39 21	Standard 6 foot Diameter Type "S" Polymer Concrete Manhole - Rim to Flow Line > 25 Feet, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	4		
17A	33 01 30.02 31 23 33 33 39 21	Standard 6 foot Diameter Type "S" Polymer Concrete Manhole with Vent and Odor Control - Rim to Flow Line ≤ 20 Feet, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	19		
18A	33 01 30.02 31 23 33 33 39 21	Standard 6 foot Diameter Type "S" Polymer Concrete Manhole with Vent and Odor Control - Rim to Flow Line > 20 Feet ≤ 25 Feet, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	9		
19A	33 01 30.02 31 23 33 33 39 21	Standard 6 foot Diameter Type "S" Polymer Concrete Manhole - over existing 36" Sanitary Sewer, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	1		
20A	33 01 30.02 31 23 33 33 39 21	Standard 8 foot Diameter Type "S" Polymer Concrete Manhole - Rim to Flow Line ≤ 20 Feet, Complete in Place, the sum of _____ _____ Dollars and Cents	EA	1		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
21A	33 01 30.02 31 23 33 33 39 21	Standard 10 foot Diameter Type "S" Polymer Concrete Manhole - Rim to Flow Line > 20 Feet ≤ 25 Feet, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	1		
22A	33 01 30.02 31 23 33 33 39 21	Standard 10 foot Diameter Type "S" Polymer Concrete Manhole - over existing 42" Sanitary Sewer, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	1		
23A	31 23 33	Interconnect Sta. 656+19.31, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	1		
24A	33 01 30.16 33 04 50	Post Construction TV Inspection and Cleaning, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LS	1		
25A	02 41 50	Removal of 4 foot Diameter Manhole, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	6		
26A	02 41 50	Removal of 6 foot Diameter Manhole, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	1		
27A	02 41 50	Removal of Existing City of Heath 10" Sanitary Sewer, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LF	1,545		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
28A	33 03 10	Bypass Pumping Operations, including set ups, equipment rentals, labor, and other related items for bypass pumping operations, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LS	1		
29A	32 13 19	Furnish and Install pavestone in Low Water Crossings, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	SY	2,778		
30A	31 37 00	Medium Stone Rip Rap to be used at NTMWD's Discretion and Direction, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	CY	100		
31A	03 20 00 03 30 53 03 35 00 03 80 00	Concrete Pavement (Traffic Control, Remove and Replace, Restore Disturbed areas to Pre-Construction Condition or better), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	SY	2,116		
32A	03 20 00 03 30 53 03 35 00 03 80 00	Kings Road Flexbase Pavement (Traffic Control, Remove and Replace, Restore Disturbed areas to Pre-Construction Condition or better), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	SY	245		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
33A	31 10 00	All Widths Pavement / Trails (Traffic Control, Remove and Replace, Restore Disturbed areas to Pre-Construction Condition or better), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	SY	4,026		
34A	03 20 00 03 30 53 03 35 00 03 80 00	Install and Maintain Temporary Flexbase Golf Cart Path (Traffic Control, Restore Disturbed areas to Pre-Construction Condition or better), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	SY	1,975		
35A	32 92 16	Furnish and Install Hydromulch, Seed, and Fertilizer, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	100' Sta	404		
36A	33 92 23	Furnish and Install Sod, Seed, and Fertilizer, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	SY	737		
37A	01 35 00 32 90 16.13	Golf Course Restoration Allowance, Complete in Place, the sum of _____ Five Hundred Thousand Dollars and 00 Cents	LS	1	$ 500,000.00	$ 500,000.00

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
38A	01 35 00	Allowance to Install New Electric Line from Switchgear to Transformer Pad at Pump House Adjacent to Golf Course Pond, Complete in Place, the sum of Fifteen Thousand Dollars and 00 Cents	LS	1	$ 15,000.00	$ 15,000.00
39A	01 35 00	4" Schedule 80 PVC, Complete in Place, the sum of Dollars and Cents	LF	246		
40A	03 34 13	Controlled Low Strength Material (CLSM) to be used at each bore, Complete in Place, the sum of Dollars and Cents	CY	4,050		
41A	31 23 23.33	Flowable Fill to be used at NTMWD's Discretion and Direction, Complete in Place, the sum of Dollars and Cents	CY	250		
42A	03 30 53	Concrete Encasement to be used at NTMWD's Discretion and Direction, Complete in Place, the sum of Dollars and Cents	CY	250		
43A	31 41 16	Steel Sheet Piles, Complete in Place, the sum of Dollars and Cents	TN	270		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
44A	03 30 53	Concrete Cap for Retaining Wall, Complete in Place, the sum of _____ Dollars and _____ Cents	CY	56		
45A	01 35 00 31 20 00	Pond Excavation and Fill (Approximately 2,200 CY), Complete in Place, the sum of _____ Dollars and _____ Cents	LS	1		
Total A - Buffalo Creek Intercepter RTRP Pipe Base BidBase Bid Total (Words and Figures)					**FIGURES**	
					DOLLARS	
					CENTS	

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
B - MANHOLE REHABILITATION - BASE BID						
1B	33 05 20.01 33 05 20.02 33 05 20.03	Remove and Replace Manhole Cover and Frame (existing 24-inch) Paved, and replace with 32-inch Manhole Cover and Frame, including related items, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	4		
2B	33 05 20.01 33 05 20.02 33 05 20.03	Remove and Replace Manhole Cover and Frame (existing 24-inch) Non-Paved, and replace with 32-inch Manhole Cover and Frame, including related items, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	18		
3B	33 05 20.01 33 05 20.02 33 05 20.03	Remove and Replace Manhole Cover and Frame (existing 32-inch) Paved, including all related items, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	1		
4B	33 05 20.01 33 05 20.02 33 05 20.03	Remove and Replace Manhole Cover and Frame (existing 32-inch) Non-Paved, including all related items, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	68		
5B	33 39 50	Manhole Grouting, including all related items, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	120		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
6B	33 39 60 33 39 61	For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes meauring 48" Diameter or less, Complete in Place, the sum of _____ _____ Dollars and_____Cents	VF	415		
7B	33 39 60 33 36 61	For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes meauring 48" - 60" Diameter, Complete in Place, the sum of _____ _____ Dollars and_____Cents	VF	17		
8B	33 39 60 33 36 61	For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes meauring 60" - 72" Diameter, Complete in Place, the sum of _____ _____ Dollars and_____Cents	VF	800		
9B	33 39 60 33 36 61	For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes meauring 72" Diameter or greater, Complete in Place, the sum of _____ _____ Dollars and_____Cents	VF	1,000		
10B	33 05 20	Remove and Replace Manhole with Pre-cast Manhole (Includes Epoxy Coating) for 72" - 76" Manhole Diameter for 13' Manhole Depth, Complete in Place, the sum of _____ _____ Dollars and_____Cents	EA	7		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
11B	33 05 20	Additional Manhole Depth, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	VF	10		
12B	TS-1	For all materials, equipment, and labor to install new Fiberglass Manhole Insert to all manholes measuring 72"-76" Manhole Diameter for 13' Manhole Depth, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	8		
13B	TS-1	Additional Fiberglass Manhole Insert to all manholes measuring 72"-76" Manhole Diameter, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	VF	34		
14B	33 03 10	Bypass Pumping Operations, including set ups, equipment rentals, labor, and other related items for bypass pumping operations, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LS	1		
15B		Manhole Location Assistance, including location and exposure of the structure and other related items for location manhole operations assistance to the North Texas Municipal Water District, Complete in Place, the sum of _____ _____ Dollars and _____ Cents	EA	18		
Total B - Manhole Rehabilitation Base Bid Base Bid Total (Words and Figures)					**FIGURES**	
					DOLLARS	
					CENTS	

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
C - LAST MINUTE ADD / DEDUCTION						
		Add (+)/Deduct (-), , Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LS	1		
Provision is made for Bidder to include an addition or deduction in his bid, if he wishes, to reflect any last minute adjustments in price. The addition or deduction, if made, will be applied proportionally to Bid Item [4A thru 9A].						
Total C - LAST MINUTE ADD / DEDUCTION Base Bid Total (Words and Figures)					**FIGURES**	
_____					DOLLARS	
					CENTS	
E - BID ITEMS FRP PIPE (Shall be identical to Bid Items 4A thru 9A)						
4E	01 45 16.16 31 23 33 33 31 13	48 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LF	23,928		
5E	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 13	48 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LF	836		
6E	01 45 16.16 31 23 33 33 31 13	42 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and _____ Cents	LF	12,767		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
7E	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 13	42 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	4,095		
8E	01 45 16.16 31 23 33 33 31 13	36 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	1,460		
9E	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 13	36 Inch Diameter ASTM D3262 SN 72 Fiberglass Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	370		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
		E - BID ITEMS FRP PIPE (Bid Items 4E thru 9E) Bid Total (Words and Figures)				**FIGURES**
						DOLLARS
						CENTS

F - ALTERNATE BID ITEMS PVC PIPE

4F	01 45 16.16 31 23 33 33 31 20	48 Inch Diameter ASTM F679 PS115 PVC Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	23,928		
5F	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 20	48 Inch Diameter ASTM F679 PS115 PVC Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	836		
6F	01 45 16.16 31 23 33 33 31 20	42 Inch Diameter ASTM F679 PS115 PVC Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	12,767		

00 42 23.01 Bid Form Exhibit A
North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
Project Number 507-0484-17
Basis of Bid

ITEM NO.	SPEC	DESCRIPTION OF ITEMS AND PRICE IN WORDS	UNITS	QUANTITY	UNIT PRICE IN NUMERALS	EXTENDED AMOUNT IN NUMERALS
7F	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 20	42 Inch Diameter ASTM F679 PS115 PVC Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	4,095		
8F	01 45 16.16 31 23 33 33 31 20	36 Inch Diameter ASTM F679 PS115 PVC Sewer Pipe (By Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	1,460		
9F	01 45 16.16 33 05 22 33 05 23 33 35 24 33 31 20	36 Inch Diameter ASTM F679 PS115 PVC Sewer Pipe in Steel Casing Pipe (By Other Than Open Cut), Complete in Place, the sum of _____ _____ Dollars and_____Cents	LF	370		
Total F - Alternate Bid Items PVC Pipe						
					DOLLARS	
					CENTS	

G - LAST MINUTE ADD / DEDUCTION ALTERNATE BID

		Add (+)/Deduct (-), , Complete in Place, the sum of _____ _____ Dollars and_____Cents	LS	1		
Provision is made for Bidder to include an addition or deduction in his bid, if he wishes, to reflect any last minute adjustments in price. The addition or deduction, if made, will be applied proportionally to Bid Item [4F thru 9F].						
Total G - LAST MINUTE ADD / DEDUCTION Alternate Bid Total (Words and Figures)					**FIGURES**	
					DOLLARS	
					CENTS	

Chapter 2252 of the Texas Government Code applies to the award of government contract to non-resident bidders. This law provides that:

> "a government entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lower bid submitted by a responsible resident bidder by an amount that is not less that 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."
>
> "Nonresident Bidder" refers to a person who is not a resident of Texas
>
> "Resident Bidder" refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Check the statement that is correct for Bidder.

[___] Non-resident bidders 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 bidders in _____(give state), our principal place of business, are not required to under bid resident bidders.

[___] Our principal place of business or corporate offices are in the State of Texas.

Bidder:

Company Name: _____
(typed or printed)

By _____
(Signature -- attach evidence of authority to sign)

Name: _____
(typed or printed)

Title: _____
(Signature of Corporate Secretary)

Business address: _____

_____

Phone: _____ Facsimile: _____ E-mail _____

Contractor must pay no less than the general prevailing rates for the Project location in accordance with the following:

"General Decision Number: TX20200020 08/28/2020

Superseded General Decision Number: TX20190020

State: Texas

Construction Type: Heavy

Counties: Collin, Ellis, Kaufman and Rockwall Counties in Texas.

Heavy Construction, Including Treatment Plants (Does not include water/sewer lines)

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2020. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/03/2020
1	02/14/2020
2	08/28/2020

ASBE0021- 003 06/01/2016

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Includes application of all insulating materials, protective coverings, coatings, and finishings to all types of mechanical systems)		
	$ 24.32	7.52

---

* ELEC0020-003 07/01/2020

	Rates	Fringes
Electricians:		
Cable Splicer	$ 30.20	8.91
Electrician	$ 31.10	9.92

---

* ELEC0220-001 06/29/2020

	Rates	Fringes
Line Construction:		
CABLE SPLICERS	$ 17.12	14.5%+3.75
EQUIPMENT OPERATORS	$ 22.95	20.5%+6.50
GROUNDMAN	$ 17.13	4.5%+6.75
LINEMAN	$ 34.26	20.5%+6.50
TRUCK DRIVER	$ 20.56	9.5%+6.50

---

* ENGI0178-001 06/01/2020

	Rates	Fringes
Cranes:		
Hydraulic Crane (35 ton &under)	$ 23.70	9.35
Hydraulic Crane (35 tons & under)	$ 32.35	13.10
Hydraulic over 35 tons, Derricks, Overhead Gentry, Stiffleg, Tower, etc., and Cranes with Pile driving or Caisson attachments	$ 32.60	13.10
Hydraulic over 35 tons, Derricks, Overhead Gentry, Stiffleg, Tower, etc., and Cranes with Pile driving or Caisson attachments	$ 24.70	9.35

IRON0263-011 06/01/2017

	Rates	Fringes
Ironworkers: Reinforcing & Structural	$ 23.25	7.32

PLUM0100-002 11/01/2017

	Rates	Fringes

Plumbers and Pipefitters	$ 30.84	11.51

SHEE0068-002 11/01/2012

	Rates	Fringes
Sheet metal worker	$ 27.64	8.84

SUTX1990-038 08/01/1990

	Rates	Fringes
CARPENTER	$ 10.536	
Concrete Finisher	$ 9.603	
Form Builder	$ 8.036	
Form Setter	$ 9.578	
Laborers:		
Common	$ 7.25	
Utility	$ 7.25	
Pipelayer	$ 7.961	
Power equipment operators:		
Backhoe	$ 10.971	
Bulldozer	$ 9.942	
Front End Loader	$ 10.771	
Mechanic	$ 9.88	
Motor Grader	$ 11.633	
Oiler	$ 9.183	
Scraper	$ 8.00	
TRUCK DRIVER	$ 7.465	

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

==========

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or

other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

==========

END OF GENERAL DECISION"

"REGISTER OF WAGE DETERMINATIONS UNDER | U.S. DEPARTMENT OF LABOR

THE SERVICE CONTRACT ACT | EMPLOYMENT STANDARDS ADMINISTRATION

By direction of the Secretary of Labor | WAGE AND HOUR DIVISION

| WASHINGTON D.C. 20210
| Wage Determination No.: 2015-5228

Daniel W. Simms Division of | Revision No.: 12
Director Wage Determinations | Date of Last Revision: 05/27/2020

Note: Under Executive Order (EO) 13658 an hourly minimum wage of $10.80 for calendar year 2020 applies to all contracts subject to the Service Contract Act for which the contract is awarded (and any solicitation was issued) on or after January 1 2015. If this contract is covered by the EO the contractor must pay all workers in any classification listed on this wage determination at least $10.80 per hour (or the applicable wage rate listed on this wage determination if it is higher) for all hours spent performing on the contract in calendar year 2020. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

State: Texas

Area: Texas Counties of Collin Dallas Denton Ellis Hunt Kaufman Rockwall

---

Fringe Benefits Required Follow the Occupational Listing

OCCUPATION CODE – TITLE	FOOTNOTE	RATE
01000 - Administrative Support And Clerical Occupations		
01011 - Accounting Clerk I		16.60
01012 - Accounting Clerk II		18.64
01013 - Accounting Clerk III		20.84
01020 - Administrative Assistant		29.11
01035 - Court Reporter		20.54
01041 - Customer Service Representative I		14.02
01042 - Customer Service Representative II		15.77
01043 - Customer Service Representative III		17.21
01051 - Data Entry Operator I		14.39
01052 - Data Entry Operator II		15.70

01060 - Dispatcher Motor Vehicle 21.36
01070 - Document Preparation Clerk 15.89
01090 - Duplicating Machine Operator 15.89
01111 - General Clerk I 13.63
01112 - General Clerk II 14.87
01113 - General Clerk III 16.69
01120 - Housing Referral Assistant 22.46
01141 - Messenger Courier 14.29
01191 - Order Clerk I 16.47
01192 - Order Clerk II 17.96
01261 - Personnel Assistant (Employment) I 16.99
01262 - Personnel Assistant (Employment) II 19.01
01263 - Personnel Assistant (Employment) III 21.19
01270 - Production Control Clerk 23.27
01290 - Rental Clerk 15.30
01300 - Scheduler Maintenance 18.01
01311 - Secretary I 18.01
01312 - Secretary II 20.14
01313 - Secretary III 22.46
01320 - Service Order Dispatcher 17.47
01410 - Supply Technician 29.11
01420 - Survey Worker 17.29
01460 - Switchboard Operator/Receptionist 14.27
01531 - Travel Clerk I 15.19
01532 - Travel Clerk II 16.37
01533 - Travel Clerk III 17.52
01611 - Word Processor I 15.15
01612 - Word Processor II 17.01
01613 - Word Processor III 19.02

05000 - Automotive Service Occupations

05005 - Automobile Body Repairer Fiberglass 22.70
05010 - Automotive Electrician 23.04
05040 - Automotive Glass Installer 20.93
05070 - Automotive Worker 22.02
05110 - Mobile Equipment Servicer 18.52
05130 - Motor Equipment Metal Mechanic 22.16
05160 - Motor Equipment Metal Worker 20.93
05190 - Motor Vehicle Mechanic 22.99
05220 - Motor Vehicle Mechanic Helper 17.27
05250 - Motor Vehicle Upholstery Worker 19.82
05280 - Motor Vehicle Wrecker 20.93
05310 - Painter Automotive 24.22
05340 - Radiator Repair Specialist 20.93

05370 - Tire Repairer	13.78
05400 - Transmission Repair Specialist	22.16

07000 - Food Preparation And Service Occupations

07010 - Baker	12.15
07041 - Cook I	12.89
07042 - Cook II	14.81
07070 - Dishwasher	10.52
07130 - Food Service Worker	11.32
07210 - Meat Cutter	13.34
07260 - Waiter/Waitress	10.03

09000 - Furniture Maintenance And Repair Occupations

09010 - Electrostatic Spray Painter	18.54
09040 - Furniture Handler	10.24
09080 - Furniture Refinisher	15.32
09090 - Furniture Refinisher Helper	12.02
09110 - Furniture Repairer Minor	13.78
09130 - Upholsterer	16.57

11000 - General Services And Support Occupations

11030 - Cleaner Vehicles	11.77
11060 - Elevator Operator	11.77
11090 - Gardener	19.56
11122 - Housekeeping Aide	12.12
11150 - Janitor	12.12
11210 - Laborer Grounds Maintenance	14.56
11240 - Maid or Houseman	11.19
11260 - Pruner	12.87
11270 - Tractor Operator	17.89
11330 - Trail Maintenance Worker	14.56
11360 - Window Cleaner	13.72

12000 - Health Occupations

12010 - Ambulance Driver	20.65
12011 - Breath Alcohol Technician	21.21
12012 - Certified Occupational Therapist Assistant	35.61
12015 - Certified Physical Therapist Assistant	35.12
12020 - Dental Assistant	20.20
12025 - Dental Hygienist	39.40
12030 - EKG Technician	30.40
12035 - Electroneurodiagnostic Technologist	30.40
12040 - Emergency Medical Technician	20.65
12071 - Licensed Practical Nurse I	18.96

12072 - Licensed Practical Nurse II 21.21
12073 - Licensed Practical Nurse III 23.64
12100 - Medical Assistant 16.37
12130 - Medical Laboratory Technician 25.58
12160 - Medical Record Clerk 18.40
12190 - Medical Record Technician 20.58
12195 - Medical Transcriptionist 19.66
12210 - Nuclear Medicine Technologist 39.84
12221 - Nursing Assistant I 12.72
12222 - Nursing Assistant II 14.30
12223 - Nursing Assistant III 15.60
12224 - Nursing Assistant IV 17.51
12235 - Optical Dispenser 19.50
12236 - Optical Technician 16.25
12250 - Pharmacy Technician 16.82
12280 - Phlebotomist 16.83
12305 - Radiologic Technologist 29.53
12311 - Registered Nurse I 25.82
12312 - Registered Nurse II 31.58
12313 - Registered Nurse II Specialist 31.58
12314 - Registered Nurse III 38.19
12315 - Registered Nurse III Anesthetist 38.19
12316 - Registered Nurse IV 45.78
12317 - Scheduler (Drug and Alcohol Testing) 26.27
12320 - Substance Abuse Treatment Counselor 22.82

13000 - Information And Arts Occupations

13011 - Exhibits Specialist I 20.65
13012 - Exhibits Specialist II 25.58
13013 - Exhibits Specialist III 31.28
13041 - Illustrator I 24.95
13042 - Illustrator II 30.91
13043 - Illustrator III 36.18
13047 - Librarian 31.56
13050 - Library Aide/Clerk 14.33
13054 - Library Information Technology Systems Administrator 27.42
13058 - Library Technician 16.29
13061 - Media Specialist I 19.78
13062 - Media Specialist II 22.13
13063 - Media Specialist III 24.67
13071 - Photographer I 18.15
13072 - Photographer II 20.31
13073 - Photographer III 25.16

13074 - Photographer IV 30.77
13075 - Photographer V 37.24
13090 - Technical Order Library Clerk 17.28
13110 - Video Teleconference Technician 21.59
14000 - Information Technology Occupations
14041 - Computer Operator I 18.34
14042 - Computer Operator II 20.50
14043 - Computer Operator III 22.87
14044 - Computer Operator IV 27.14
14045 - Computer Operator V 30.04
14071 - Computer Programmer I (see 1)
14072 - Computer Programmer II (see 1)
14073 - Computer Programmer III (see 1)
14074 - Computer Programmer IV (see 1)
14101 - Computer Systems Analyst I (see 1)
14102 - Computer Systems Analyst II (see 1)
14103 - Computer Systems Analyst III (see 1)
14150 - Peripheral Equipment Operator 18.34
14160 - Personal Computer Support Technician 27.14
14170 - System Support Specialist 39.80
15000 - Instructional Occupations
15010 - Aircrew Training Devices Instructor (Non-Rated) 35.04
15020 - Aircrew Training Devices Instructor (Rated) 41.90
15030 - Air Crew Training Devices Instructor (Pilot) 46.09
15050 - Computer Based Training Specialist / Instructor 35.04
15060 - Educational Technologist 34.30
15070 - Flight Instructor (Pilot) 46.09
15080 - Graphic Artist 25.28
15085 - Maintenance Test Pilot Fixed Jet/Prop 45.10
15086 - Maintenance Test Pilot Rotary Wing 45.10
15088 - Non-Maintenance Test/Co-Pilot 45.10
15090 - Technical Instructor 26.98
15095 - Technical Instructor/Course Developer 33.00
15110 - Test Proctor 21.78
15120 - Tutor 21.78

16000 - Laundry Dry-Cleaning Pressing And Related Occupations

16010 - Assembler 10.59
16030 - Counter Attendant 10.59
16040 - Dry Cleaner 13.60
16070 - Finisher Flatwork Machine 10.59
16090 - Presser Hand 10.59
16110 - Presser Machine Drycleaning 10.59
16130 - Presser Machine Shirts 10.59

16160 - Presser Machine Wearing Apparel Laundry 10.59
16190 - Sewing Machine Operator 14.43
16220 - Tailor 15.51
16250 - Washer Machine 11.64

19000 - Machine Tool Operation And Repair Occupations

19010 - Machine-Tool Operator (Tool Room) 21.10
19040 - Tool And Die Maker 25.34

21000 - Materials Handling And Packing Occupations

21020 - Forklift Operator 16.95
21030 - Material Coordinator 23.27
21040 - Material Expediter 23.27
21050 - Material Handling Laborer 14.38
21071 - Order Filler 13.57
21080 - Production Line Worker (Food Processing) 16.95
21110 - Shipping Packer 16.13
21130 - Shipping/Receiving Clerk 16.13
21140 - Store Worker I 12.54
21150 - Stock Clerk 18.18
21210 - Tools And Parts Attendant 16.95
21410 - Warehouse Specialist 16.95

23000 - Mechanics And Maintenance And Repair Occupations

23010 - Aerospace Structural Welder 38.23
23019 - Aircraft Logs and Records Technician 31.02
23021 - Aircraft Mechanic I 36.48
23022 - Aircraft Mechanic II 38.23
23023 - Aircraft Mechanic III 40.02
23040 - Aircraft Mechanic Helper 26.15
23050 - Aircraft Painter 34.57
23060 - Aircraft Servicer 31.02
23070 - Aircraft Survival Flight Equipment Technician 34.57
23080 - Aircraft Worker 32.80
23091 - Aircrew Life Support Equipment (ALSE) Mechanic I 32.80
23092 - Aircrew Life Support Equipment (ALSE) Mechanic II 36.48
23110 - Appliance Mechanic 19.52
23120 - Bicycle Repairer 18.50
23125 - Cable Splicer 27.55
23130 - Carpenter Maintenance 18.47
23140 - Carpet Layer 19.04
23160 - Electrician Maintenance 23.75
23181 - Electronics Technician Maintenance I 25.82

23182 - Electronics Technician Maintenance II 27.21
23183 - Electronics Technician Maintenance III 29.34
23260 - Fabric Worker 24.43
23290 - Fire Alarm System Mechanic 22.28
23310 - Fire Extinguisher Repairer 18.50
23311 - Fuel Distribution System Mechanic 21.32
23312 - Fuel Distribution System Operator 16.71
23370 - General Maintenance Worker 19.40
23380 - Ground Support Equipment Mechanic 36.48
23381 - Ground Support Equipment Servicer 31.02
23382 - Ground Support Equipment Worker 32.80
23391 - Gunsmith I 18.50
23392 - Gunsmith II 21.25
23393 - Gunsmith III 23.60
23410 - Heating Ventilation And Air-Conditioning Mechanic 22.55
23411 - Heating Ventilation And Air Contidioning Mechanic (Research Facility) 23.63
23430 - Heavy Equipment Mechanic 24.71
23440 - Heavy Equipment Operator 19.87
23460 - Instrument Mechanic 25.41
23465 - Laboratory/Shelter Mechanic 22.40
23470 - Laborer 14.38
23510 - Locksmith 22.46
23530 - Machinery Maintenance Mechanic 25.26
23550 - Machinist Maintenance 20.24
23580 - Maintenance Trades Helper 16.17
23591 - Metrology Technician I 25.41
23592 - Metrology Technician II 26.64
23593 - Metrology Technician III 27.88
23640 - Millwright 24.70
23710 - Office Appliance Repairer 18.66
23760 - Painter Maintenance 17.32
23790 - Pipefitter Maintenance 26.55
23810 - Plumber Maintenance 25.20
23820 - Pneudraulic Systems Mechanic 23.60
23850 - Rigger 26.09
23870 - Scale Mechanic 21.25
23890 - Sheet-Metal Worker Maintenance 20.11
23910 - Small Engine Mechanic 19.51
23931 - Telecommunications Mechanic I 27.34
23932 - Telecommunications Mechanic II 28.64
23950 - Telephone Lineman 23.54
23960 - Welder Combination Maintenance 18.96

23965 - Well Driller	21.63
23970 - Woodcraft Worker	23.60
23980 - Woodworker	18.50

24000 - Personal Needs Occupations

24550 - Case Manager	18.06
24570 - Child Care Attendant	10.73
24580 - Child Care Center Clerk	13.39
24610 - Chore Aide	9.75
24620 - Family Readiness And Support Services Coordinator	18.06
24630 - Homemaker	18.06

25000 - Plant And System Operations Occupations

25010 - Boiler Tender	27.73
25040 - Sewage Plant Operator	20.18
25070 - Stationary Engineer	27.73
25190 - Ventilation Equipment Tender	19.37
25210 - Water Treatment Plant Operator	20.18

27000 - Protective Service Occupations

27004 - Alarm Monitor	20.64
27007 - Baggage Inspector	14.10
27008 - Corrections Officer	23.01
27010 - Court Security Officer	25.65
27030 - Detection Dog Handler	16.92
27040 - Detention Officer	23.01
27070 - Firefighter	28.28
27101 - Guard I	14.10
27102 - Guard II	16.92
27131 - Police Officer I	31.05
27132 - Police Officer II	34.51

28000 - Recreation Occupations

28041 - Carnival Equipment Operator	14.21
28042 - Carnival Equipment Repairer	15.54
28043 - Carnival Worker	10.22
28210 - Gate Attendant/Gate Tender	14.18
28310 - Lifeguard	11.19
28350 - Park Attendant (Aide)	15.86
28510 - Recreation Aide/Health Facility Attendant	11.57
28515 - Recreation Specialist	18.53
28630 - Sports Official	12.63
28690 - Swimming Pool Operator	21.99

29000 - Stevedoring/Longshoremen Occupational Services

29010 - Blocker And Bracer	25.86
29020 - Hatch Tender	25.86
29030 - Line Handler	25.86
29041 - Stevedore I	24.46
29042 - Stevedore II	27.26

30000 - Technical Occupations

30010 - Air Traffic Control Specialist Center (HFO) (see 2)	43.00
30011 - Air Traffic Control Specialist Station (HFO) (see 2)	29.64
30012 - Air Traffic Control Specialist Terminal (HFO) (see 2)	32.64
30021 - Archeological Technician I	20.07
30022 - Archeological Technician II	22.40
30023 - Archeological Technician III	27.75
30030 - Cartographic Technician	27.75
30040 - Civil Engineering Technician	24.42
30051 - Cryogenic Technician I	26.83
30052 - Cryogenic Technician II	29.63
30061 - Drafter/CAD Operator I	20.07
30062 - Drafter/CAD Operator II	22.40
30063 - Drafter/CAD Operator III	24.97
30064 - Drafter/CAD Operator IV	30.73
30081 - Engineering Technician I	17.56
30082 - Engineering Technician II	19.70
30083 - Engineering Technician III	22.03
30084 - Engineering Technician IV	27.30
30085 - Engineering Technician V	33.40
30086 - Engineering Technician VI	40.41
30090 - Environmental Technician	24.73
30095 - Evidence Control Specialist	24.23
30210 - Laboratory Technician	25.44
30221 - Latent Fingerprint Technician I	26.76
30222 - Latent Fingerprint Technician II	29.57
30240 - Mathematical Technician	30.53
30361 - Paralegal/Legal Assistant I	19.49
30362 - Paralegal/Legal Assistant II	24.15
30363 - Paralegal/Legal Assistant III	29.54
30364 - Paralegal/Legal Assistant IV	35.74
30375 - Petroleum Supply Specialist	29.63
30390 - Photo-Optics Technician	27.75
30395 - Radiation Control Technician	29.63
30461 - Technical Writer I	25.69
30462 - Technical Writer II	31.42
30463 - Technical Writer III	38.01

30491 - Unexploded Ordnance (UXO) Technician I		27.32
30492 - Unexploded Ordnance (UXO) Technician II		33.06
30493 - Unexploded Ordnance (UXO) Technician III		39.62
30494 - Unexploded (UXO) Safety Escort		27.32
30495 - Unexploded (UXO) Sweep Personnel		27.32
30501 - Weather Forecaster I		26.83
30502 - Weather Forecaster II		32.63
30620 - Weather Observer Combined Upper Air Or Surface Programs	(see 2)	24.97
30621 - Weather Observer Senior	(see 2)	25.23

31000 - Transportation/Mobile Equipment Operation Occupations

31010 - Airplane Pilot	33.06
31020 - Bus Aide	14.54
31030 - Bus Driver	21.23
31043 - Driver Courier	16.94
31260 - Parking and Lot Attendant	10.60
31290 - Shuttle Bus Driver	18.53
31310 - Taxi Driver	12.70
31361 - Truckdriver Light	18.53
31362 - Truckdriver Medium	20.13
31363 - Truckdriver Heavy	22.14
31364 - Truckdriver Tractor-Trailer	22.14

99000 - Miscellaneous Occupations

99020 - Cabin Safety Specialist	16.12
99030 - Cashier	10.77
99050 - Desk Clerk	11.33
99095 - Embalmer	24.05
99130 - Flight Follower	27.32
99251 - Laboratory Animal Caretaker I	13.18
99252 - Laboratory Animal Caretaker II	14.42
99260 - Marketing Analyst	36.10
99310 - Mortician	24.42
99410 - Pest Controller	22.97
99510 - Photofinishing Worker	14.89
99710 - Recycling Laborer	19.52
99711 - Recycling Specialist	23.99
99730 - Refuse Collector	17.25
99810 - Sales Clerk	13.65
99820 - School Crossing Guard	10.80
99830 - Survey Party Chief	26.65
99831 - Surveying Aide	15.97
99832 - Surveying Technician	20.46

99840 - Vending Machine Attendant	15.50
99841 - Vending Machine Repairer	18.73
99842 - Vending Machine Repairer Helper	15.46

Note: Executive Order (EO) 13706 Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Service Contract Act for which the contract is awarded (and any solicitation was issued) on or after January 1 2017. If this contract is covered by the EO the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness injury or other health-related needs including preventive care; to assist a family member (or person who is like family to the employee) who is ill injured or has other health-related needs including preventive care; or for reasons resulting from or to assist a family member (or person who is like family to the employee) who is the victim of domestic violence sexual assault or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

ALL OCCUPATIONS LISTED ABOVE RECEIVE THE FOLLOWING BENEFITS:

HEALTH & WELFARE: Life accident and health insurance plans sick leave pension plans civic and personal leave severance pay and savings and thrift plans. Minimum employer contributions costing an average of $4.54 per hour computed on the basis of all hours worked by service employees employed on the contract.

HEALTH & WELFARE EO 13706: Minimum employer contributions costing an average of $4.22 per hour computed on the basis of all hours worked by service employees employed on the covered contracts. *

*This rate is to be used only when compensating employees for performance on an SCA-covered contract also covered by EO 13706 Establishing Paid Sick Leave for Federal Contractors. A contractor may not receive credit toward its SCA obligations for any paid sick leave provided pursuant to EO 13706.

VACATION: 2 weeks paid vacation after 1 year of service with a contractor or successor 3 weeks after 5 years and 4 weeks after 15 years. Length of service includes the whole span of continuous service with the present contractor or successor wherever employed and with the predecessor contractors in the performance of similar work at the same Federal facility. (Reg. 29 CFR 4.173)

HOLIDAYS: A minimum of ten paid holidays per year: New Year's Day Martin Luther King Jr.'s Birthday Washington's Birthday Memorial Day Independence Day Labor Day Columbus Day Veterans' Day Thanksgiving Day and Christmas Day. (A contractor may substitute for any of the named holidays another day off with pay in accordance with a plan communicated to the employees involved.) (See 29 CFR 4.174)

THE OCCUPATIONS WHICH HAVE NUMBERED FOOTNOTES IN PARENTHESES RECEIVE THE FOLLOWING:

1) COMPUTER EMPLOYEES: Under the SCA at section 8(b) this wage determination does not apply to any employee who individually qualifies as a bona fide executive administrative or professional employee as defined in 29 C.F.R. Part 541. Because most Computer System Analysts and Computer Programmers who are compensated at a rate not less than $27.63 (or on a salary or fee basis at a rate not less than $455 per week) an hour would likely qualify as exempt computer professionals (29 C.F.R. 541.400) wage rates may not be listed on this wage determination for all occupations within those job families. In addition because this wage determination may not list a wage rate for some or all occupations within those job families if the survey data indicates that the prevailing wage rate for the occupation equals or exceeds $27.63 per hour conformances may be necessary for certain nonexempt employees. For example if an individual employee is nonexempt but nevertheless performs duties within the scope of one of the Computer Systems Analyst or Computer Programmer occupations for which this wage determination does not specify an SCA wage rate then the wage rate for that employee must be conformed in accordance with the conformance procedures described in the conformance note included on this wage determination.

   Additionally because job titles vary widely and change quickly in the computer industry job titles are not determinative of the application of the computer professional exemption. Therefore the exemption applies only to computer employees who satisfy the compensation requirements and whose primary duty consists of:

   (1) The application of systems analysis techniques and procedures including consulting with users to determine hardware software or system functional specifications;

   (2) The design development documentation analysis creation testing or modification of computer systems or programs including prototypes based on and related to user or system design specifications;

   (3) The design documentation testing creation or modification of computer programs related to machine operating systems; or

   (4) A combination of the aforementioned duties the performance of which requires the same level of skills. (29 C.F.R. 541.400).

2) AIR TRAFFIC CONTROLLERS AND WEATHER OBSERVERS - NIGHT PAY & SUNDAY PAY: If you work at night as part of a regular tour of duty you will earn a night differential and receive an additional 10% of basic pay for any hours worked between 6pm and 6am. If you are a full-time employed (40 hours a week) and Sunday is part of your regularly scheduled workweek you are paid at your rate of basic pay plus a Sunday premium of 25% of your basic rate for each hour of Sunday work which is not overtime (i.e. occasional work on Sunday outside the normal tour of duty is considered overtime work).

   ** HAZARDOUS PAY DIFFERENTIAL **

An 8 percent differential is applicable to employees employed in a position that represents a high degree of hazard when working with or in close proximity to ordnance explosives and incendiary materials. This includes work such as screening blending dying mixing and pressing of sensitive ordnance explosives and pyrotechnic compositions such as lead azide black powder and photoflash powder. All dry-house activities involving propellants or explosives. Demilitarization modification renovation demolition and maintenance operations on sensitive ordnance explosives and incendiary materials. All operations involving re-grading and cleaning of artillery ranges.

A 4 percent differential is applicable to employees employed in a position that represents a low degree of hazard when working with or in close proximity to ordnance (or employees possibly adjacent to) explosives and incendiary materials which involves potential injury such as laceration of hands face or arms of the employee engaged in the operation irritation of the skin minor burns and the like; minimal damage to immediate or adjacent work area or equipment being used. All operations involving unloading storage and hauling of ordnance explosive and incendiary ordnance material other than small arms ammunition. These differentials are only applicable to work that has been specifically designated by the agency for ordnance explosives and incendiary material differential pay.

** UNIFORM ALLOWANCE **

If employees are required to wear uniforms in the performance of this contract (either by the terms of the Government contract by the employer by the state or local law etc.) the cost of furnishing such uniforms and maintaining (by laundering or dry cleaning) such uniforms is an expense that may not be borne by an employee where such cost reduces the hourly rate below that required by the wage determination. The Department of Labor will accept payment in accordance with the following standards as compliance:

The contractor or subcontractor is required to furnish all employees with an adequate number of uniforms without cost or to reimburse employees for the actual cost of the uniforms. In addition where uniform cleaning and maintenance is made the responsibility of the employee all contractors and subcontractors subject to this wage determination shall (in the absence of a bona fide collective bargaining agreement providing for a different amount or the furnishing of contrary affirmative proof as to the actual cost) reimburse all employees for such cleaning and maintenance at a rate of $3.35 per week (or $.67 cents per day). However in those instances where the uniforms furnished are made of ""wash and wear"" materials may be routinely washed and dried with other personal garments and do not require any special treatment such as dry cleaning daily washing or commercial laundering in order to meet the cleanliness or appearance standards set by the terms of the Government contract by the contractor by law or by the nature of the work there is no requirement that employees be reimbursed for uniform maintenance costs.

** SERVICE CONTRACT ACT DIRECTORY OF OCCUPATIONS **

The duties of employees under job titles listed are those described in the ""Service Contract Act Directory of Occupations"" Fifth Edition (Revision 1) dated September 2015 unless otherwise indicated.

** REQUEST FOR AUTHORIZATION OF ADDITIONAL CLASSIFICATION AND WAGE RATE Standard Form 1444 (SF-1444) **

Conformance Process:

The contracting officer shall require that any class of service employee which is not listed herein and which is to be employed under the contract (i.e. the work to be performed is not performed by any classification listed in the wage determination) be classified by the contractor so as to provide a reasonable relationship (i.e. appropriate level of skill comparison) between such unlisted classifications and the classifications listed in the wage determination (See 29 CFR 4.6(b)(2)(i)). Such conforming procedures shall be initiated by the contractor prior to the performance of contract work by such unlisted class(es) of employees (See 29 CFR 4.6(b)(2)(ii)). The Wage and Hour Division shall make a final determination of conformed classification wage rate and/or fringe benefits which shall be paid to all employees performing in the classification from the first day of work on which contract work is performed by them in the classification. Failure to pay such unlisted employees the compensation agreed upon by the interested parties and/or fully determined by the Wage and Hour Division retroactive to the date such class of employees commenced contract work shall be a violation of the Act and this contract. (See 29 CFR 4.6(b)(2)(v)). When multiple wage determinations are included in a contract a separate SF-1444 should be prepared for each wage determination to which a class(es) is to be conformed.

The process for preparing a conformance request is as follows:

1) When preparing the bid the contractor identifies the need for a conformed occupation(s) and computes a proposed rate(s).

2) After contract award the contractor prepares a written report listing in order the proposed classification title(s) a Federal grade equivalency (FGE) for each proposed classification(s) job description(s) and rationale for proposed wage rate(s) including information regarding the agreement or disagreement of the authorized representative of the employees involved or where there is no authorized representative the employees themselves. This report should be submitted to the contracting officer no later than 30 days after such unlisted class(es) of employees performs any contract work.

3) The contracting officer reviews the proposed action and promptly submits a report of the action together with the agency's recommendations and pertinent information including the position of the contractor and the employees to the U.S. Department of Labor Wage and Hour Division for review (See 29 CFR 4.6(b)(2)(ii)).

4) Within 30 days of receipt the Wage and Hour Division approves modifies or disapproves the action via transmittal to the agency contracting officer or notifies the contracting officer that additional time will be required to process the request.

5) The contracting officer transmits the Wage and Hour Division's decision to the contractor.

6) Each affected employee shall be furnished by the contractor with a written copy of such determination or it shall be posted as a part of the wage determination (See 29 CFR 4.6(b)(2)(iii)).

Information required by the Regulations must be submitted on SF-1444 or bond paper.

When preparing a conformance request the ""Service Contract Act Directory of Occupations"" should be used to compare job definitions to ensure that duties requested are not performed by a classification already listed in the wage determination. Remember it is not the job title but the required tasks that determine whether a class is included in an established wage determination. Conformances may not be used to artificially split combine or subdivide classifications listed in the wage determination (See 29 CFR 4.152(c)(1))."

00 45 16 STATEMENT OF QUALIFICATIONS

1.00 GENERAL

A. The statement of qualifications must be submitted **with the Bid** and include, as a minimum, the information as described in this section of the Contract Documents. Failure to submit the required information in the statement of qualifications may result in the Owner considering the Bid non-responsive and result in rejection of the Bid by the Owner. Bidders may be required to provide supplemental information if requested by the Owner to clarify, enhance or supplement the information provided in the statement of qualifications.

B. Bidders must provide the information requested in the statement of qualifications using the forms attached to this Section. A copy of these forms can be provided by the Engineer in Microsoft Word to assist with the preparation of the statement of qualifications. Information in these forms must be provided completely and in detail. Information that cannot be totally incorporated in the form may be included in an appendix to the form. This appendix must be clearly referenced by appendix number in the form, and the appended material must include the appendix number on every sheet of the appendix. The appendix must include only the information that responds to the question or item number to which the appended information applies.

C. Bidders may provide supplemental information to the statement of qualifications using AIA, AGC or other industry standard statement of qualification forms and / or Bidders may submit additional information such as organizational brochures or other marketing information to help demonstrate the ability to provide best value to the Owner. This information may not be submitted as a substitute to the information specifically requested in this Section, or in the statement of qualifications forms.

General Information

Organization doing business as							
Business address of principle office							
Telephone numbers							
Main number							
Fax number							
Web site address							
Form of business (check one)		A corporation		A partnership		An individual	
If a corporation							
Date of incorporation							
State of incorporation							
Chief Executive Manager's name							
President's name							
Vice President's name(s)							
Secretary's name							
Treasurer's name							
If a Partnership							
Date of organization							
State whether partnership is general or limited							
If an Individual							
Name							
Business address							
Identify all individuals not previously named which exert a significant amount of business control over the organization							
Indicators of organization size							
Average number of current full time employees		Average estimate of revenue for the current year					

Organizational Experience

Organization doing business as	
Business address of regional office	
Name of regional office manager	
Telephone numbers	
Main number	
Fax number	
Web site address	

Organization History

List of names that this organization currently, has or anticipates operating under over the history of the organization, including the names of related companies presently doing business:

Names of organization	From date	To date

List of companies, firms or organizations that own any part of the organization.

Name of companies, firms or organization.	Percent ownership

Construction Experience

Years experience in projects similar to the proposed project:

As a general contractor		As a joint venture partner	

Has this or a predecessor organization ever defaulted on a project or failed to complete any work awarded to it?	
If yes provide full details in a separate attachment. See attachment No.	
Has this or a predecessor organization been released from a bid or proposal in the past ten years?	
If yes provide full details in a separate attachment. See attachment No.	
Has this or a predecessor organization ever been disqualification as a bidder or proposer by any local, state, or federal agency within the last five years?	
If yes provide full details in a separate attachment. See attachment No.	
Is this organization or your proposed surety currently in any litigation or contemplating litigation?	
If yes provide full details in a separate attachment. See attachment No.	
Has this or a predecessor organization ever refused to construct or refused to provide materials defined in the contract documents?	
If yes provide full details in a separate attachment. See attachment No.	

Proposed Key Personnel

Organization doing business as:	

Proposed project organization

Provide a brief description of the managerial structure of the organization and illustrate with an organizational cart. Include the title and names of key personnel. Include this chart at an attachment to this description. See attachment No.

Provide a brief description of the managerial structure proposed for this project and illustrate with an organizational cart. Include the title and names of proposed key personnel and alternates. Include this chart at an attachment to this description. See attachment No.

Experience of Key Personnel

Provide information on the key personnel proposed for this project that will provide the following key functions. Provide information for candidates for each of these positions on the pages for each of these key personnel. Also provide biographical information for each primary and alternate candidate as an attachment. The biographical information must include the following as a minimum: technical experience, managerial experience, education and formal training, work history which describes project experience, including the roles and responsibilities for each assignment, and primary language. Additional information highlighting experience which makes them the best candidate for the assignment should also be included.

Role	Primary candidate	Alternate candidate
Project manager		
Project superintendent		
Project safety manager		
Quality control manager		

If key personnel are to fulfill more than one of the roles listed above, provide a written narrative describing how much time will be devoted to each function, their qualifications to fulfill each role and the percentage of their time that will be devoted to each role. If the individual is not to be devoted solely to this project, indicate how time it to be divided between this project and their other assignments.

Proposed Project Managers

Organization doing business as			
Primary candidate			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/ position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidates role on project	
Alternate candidate			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/ position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidate role on project	

Proposed Project Superintendent

Organization doing business as			
Primary candidate			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as superintendent			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/ position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidate role on project	
Alternate candidate			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as superintendent			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/ position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidate role on project	

Proposed Project Safety Manager

Organization doing business as			
Primary candidate			
Name of individual			
Years of experience as project safety manager			
Years of experience with this organization			
Number of similar projects as safety manager			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidate role on project	
Alternate candidate			
Name of individual			
Years of experience as project safety manager			
Years of experience with this organization			
Number of similar projects as safety manager			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/ position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidate role on project	

Proposed Project Quality Control Manager

Organization doing business as			
Primary candidate			
Name of individual			
Years of experience as quality control manager			
Years of experience with this organization			
Number of similar projects as quality manager			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ position		Title/ position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on project		Candidate role on project	
Alternate candidate			
Name of individual			
Years of experience as quality control manager			
Years of experience with this organization			
Number of similar projects as quality manager			
Number of similar projects in other positions			
Current project assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference contact information (listing names indicates approval to contacting the names individuals as a reference)			
Name		Name	
Title/ Position		Title/ Position	
Organization		Organization	
Telephone		Telephone	
E-mail		E-mail	
Project		Project	
Candidate role on Project		Candidate role on Project	

Project Experience and Resources

Organization doing business as:	

Projects

Provide a list of major projects that are currently underway, or have been completed within the last ten years on Attachment A.

Provide a completed Project Information form (Attachment B) for projects that have been completed in the last five years which specifically illustrate the organizations capability to provide best value to the Owner for this project.

Include a completed Project Information form (Attachment B) for projects which illustrate the experience of the proposed key personnel.

Provide a description of your organizations approach to completing this project to provide best value for the Owner. Including a description of your approach in the following areas:

1. Contract administration
2. Management of subcontractor and suppliers
3. Time management
4. Cost control
5. Quality management
6. Project site safety
7. Managing changes to the project
8. Managing equipment
9. Meeting HUB / MWBE Participation Goal

Equipment

Provide a list of major equipment proposed for use on this project. Attach additional information if necessary

Equipment item	Primary use on project	Own	Will buy	Lease

Division of work between organization and subcontractor

What work will the organization complete using its own resources?

What work does the organization propose to subcontract on this project?

Subcontractors and Suppliers

Organization doing business as:	

Project subcontractors

Provide a list of subcontractors that will provide more than 10 percent of the work (based on contract amounts

Name	Work to be provided	Est. percent of contract	HUB/MWBE firm

Provide information on the proposed key personnel, project experience and a description of past relationship and work experience for each subcontractor listed above using the Project Information forms.

Suppliers

Provide a list of major equipment or materials proposed for use on this project. Attach additional information if necessary.

Supplier name	Equipment / material provided	Furnish only	Furnish and install	HUB/MWBE firm

Current Projects and Project Completed within the last 10 Years

Project owner		Project name	
General description of project:			
Project cost		Date project completed	

Key project personnel	Project manager	Project superintendent	Safety manager	Quality control manager
Name				

Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/ position	Organization	Telephone	E-mail
Owner					
Designer					
Construction manager					

Project owner		Project name	
General description of project:			
Project cost		Date project completed	

Key project personnel	Project manager	Project superintendent	Safety manager	Quality control manager
Name				

Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/ position	Organization	Telephone	E-mail
Owner					
Designer					
Construction manager					

Project owner		Project name	
General description of project:			
Project cost		Date project completed	

Key project personnel	Project manager	Project superintendent	Safety manager	Quality control manager
Name				

Reference contact information (listing names indicates approval to contacting the names individuals as a reference)

	Name	Title/ position	Organization	Telephone	E-mail
Owner					
Designer					
Construction manager					

Project Information

Project owner		Project name	
General description of project			

Project Budget and Schedule Performance					
Budget history			Schedule performance		
	Amount	% of Bid Amount		Date	Days
Bid			Notice to Proceed		
Change orders			Contract Substantial Completion date at Notice to Proceed		
Owner enhancements			Contract final completion date at Notice to Proceed		
Unforeseen conditions			Change Order authorized Substantial Completion date		
Design issues			Change Order authorized final completion date		
Total			Actual / estimated Substantial Completion date		
Final cost			Actual / estimated final completion date		

Key Project Personnel				
	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager
Name				
Percentage of time devoted to the project.				
Proposed for this project.				
Did Individual start and complete the project?				
If not, who started or completed the project in their place.				
Reason for change.				

Reference contact information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/ position	Organization	Telephone	E-mail
Owner					
Designer					
Construction Manager					
Surety					

Issues / disputes resolved or pending resolution by arbitration, litigation or dispute review boards

Number of issues resolved:		Total amount involved in resolved issues:		Number of issues pending:		Total amount involved in resolved Issues:	

Affidavits

One of the following four affidavits shall be executed and provided with this information. The individual signing the affidavit shall attach evidence of their authority to bind the organization to an agreement.

AFFIDAVIT FOR CORPORATION

State_____) §

County of_____) §

_____, being duly sworn deposes and says
(Name)

that he is _____ of the
(Title)

_____ corporation submitting the foregoing qualification form and related information; that he has read such documents; and that such documents are true and correct and contain no material misrepresentations; and that he is authorized to make this affidavit on behalf of the Corporation.

_____
Signature

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

_____
Notary Public

My commission expires:

AFFIDAVIT FOR PARTNERSHIP

State_____) §

County of_____) §

_____, being duly sworn deposes and says
(Name)

that he is _____ of the
(Title)

_____ company submitting the foregoing qualification form and related information; that he has read such documents; and that such documents are true and correct and contain no material misrepresentations; and that he is authorized to make this affidavit on behalf of the Partnership.

_____
Signature

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

_____
Notary Public

My commission expires:

AFFIDAVIT FOR INDIVIDUAL

State _____) §

County of _____) §

_____, being duly sworn deposes and says
(Name)

that he is _____ of the
(Title)

_____ company submitting the foregoing qualification form and related information; that he has read such documents; and that such documents are true and correct and contain no material misrepresentations.

_____
Signature

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

_____
Notary Public

My commission expires:

JOINT VENTURE STATEMENT

We the undersigned do hereby give notice to our agreement to bid as a joint venture on the Project.

_____

Name of Joint Venture

_____

Name of Firm

_____

Signature

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

_____

Notary Public

My commission expires:

_____

Name of Firm

_____

Signature

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

_____

Notary Public

My commission expires:

END OF SECTION

00 52 23 AGREEMENT

This Agreement is between North Texas Municipal Water District ("Owner") and _____ _____ ("Contractor").

Owner and Contractor, in consideration of the mutual covenants set forth herein, agree as follows:

ARTICLE 1 - WORK

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

This project is located in Rockwall County Texas. The project is a linear project from FM 740 to Buffalo Creek Wastewater Treatment Plant includes construction of **Approximately 43,600 LF of 36"- 48" diameter wastewater pipe with associated appurtenances including manholes, a retaining wall, Concrete Trails and Pavement restoration. Portions of the new pipe are to be installed by other than open cut with steel casing pipe, numerous existing manholes and existing wastewater lines to be rehabilitated / repaired**, from Wiser Road to Buffalo Creek Wastewater Treatment Plant**.**

ARTICLE 2 - THE PROJECT

2.01 The Project for which the Work under the Contract Documents may be the whole or only a part is generally described as follows:

North Texas Municipal Water District
Buffalo Creek Parallel Interceptor, Phase I
NTMWD Project No. 507-0484-17

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by

Huitt ~ Zollars, Inc.
Attn: Ken Roberts, PE
1717 McKinney Avenue, Suite 1400
Dallas Texas 75202-1236
Phone: (214) 871-3311
FAX: (214) 871-0757
E-mail: kar@huitt-zollars.com

Engineer, who is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIMES

4.01 Time of the Essence

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 Dates for Substantial Completion and Final Payment

A. The Work will be substantially completed on or before **550 Days** after the Notice to Proceed, and completed and ready for final payment in accordance with Paragraph 14.07 of the General Conditions on or before **610 Days** after the Notice to Proceed.

4.03 Liquidated Damages

A. Contractor and Owner recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration preceding 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 **$ 2,500.00** for each calendar day that expires after the time specified in Paragraph 4.02 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 Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner **$ 2,500.00** for each calendar day that expires after the time specified in Paragraph 4.02 for completion and readiness for final payment until the Work is completed and ready for final payment. In addition, liquidated damages are stipulated in Section 01 35 00, SPECIAL PROCEDURES, for failure to meet milestone completions. The Owner will be the sole judge as to whether the work has been completed within the allotted time. Assessment of liquidated damages by the Owner shall not constitute a waiver of the Owner's right to sue and collect additional damages which Owner may sustain by the failure of the Contractor to perform in accordance with the terms of its Contract.

ARTICLE 5 - CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents for the unit prices shown in the attached 00 42 23 Bid Form. Unit Prices have been computed in accordance with Paragraph 11.03.B of the General Conditions. Bidder acknowledges that estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 - PAYMENT PROCEDURES

6.01 Submittal and Processing of Payments

A. Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 Progress Payments; Retainage

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about the **25th** day of each month during performance of the Work as provided in Paragraph 2.07A of the General Conditions. To facilitate approvals and processing, Contractor shall submit Applications for Payment no later than the first working day following the **10th day of the previous month.**

B. For contracts that include major pipeline bid items, the value of Work completed for progress payments (exclusive of retainage) shall be made on the following basis:

1. Prior to Restoration: Upon installation of the pipe and full-height backfill of the trench, payment will be allowed for eighty percent (80%) of the unit contract price per linear foot actually installed.
2. After Restoration: Upon completion of restoration of the disturbed areas, the Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver over such materials and equipment in a bright, clean, polished and new-appearing condition. The remaining twenty percent (20%) of payment will be allowed when the property has been completely restored to its original or required condition as defined above. Grass establishment is covered under separate bid items and is not included under "restoration".

C. Prior to Final Completion, progress payments will be made in an amount equal to ninety-five (95%) percent of the total amount of Work completed and properly stored materials on hand, with the balance being retainage.

D. Payment will be less the aggregate of payments previously made and less such amounts as Construction Manager may determine or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 14.02 of the General Conditions. In addition to the amount retained above, the OWNER may retain additional amounts as set forth elsewhere in the Contract Documents.

6.03 Final Payment

A. Upon final completion and acceptance of the Work in accordance with Paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 14.07.

ARTICLE 7 - INTEREST

7.01 The Owner is not obligated to pay interest on moneys not paid except as provided in Section 49.276(d) of the Texas Water Code.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Agreement Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Proposal Documents.

B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all federal, state, and local Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site including Underground Facilities which have been identified in the Supplementary Conditions as provided in Paragraph 4.02 of the General Conditions and (2) reports and drawings of a Hazardous Environmental Condition, if any, at the Site which has been identified in the Supplementary Conditions as provided in Paragraph 4.06 of the General Conditions.

E. Contractor has obtained and carefully studied all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions including surface,

subsurface, and Underground Facilities at or contiguous to the Site which may affect cost, progress, or performance of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Proposal Documents, and safety precautions and programs incident thereto or assumes responsibility for doing so.

F. Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract Documents.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has correlated the information known to Contractor, 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.

I. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

J. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 Contents

A. The Contract Documents consist of the following:

1. Invitation for Bids
2. Instructions to Bidders
3. This Agreement
4. Performance Bond
5. Payment Bond
6. General Conditions
7. Supplementary Conditions
8. Specifications
9. Drawings
10. Addenda
11. Exhibits to this Agreement (enumerated as follows):
    a. Contractor’s Bid.
    b. Documentation submitted by Contractor prior to Notice of Award.

B. The following are also Contract Documents which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
1. Notice to Proceed
2. Written Amendment(s)
3. Change Order(s)
4. Field Order(s)
5. Work Change Directive(s)
6. Engineers Written Interpretation(s)

C. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).

D. There are no Contract Documents other than those listed above in this Article 9.

E. The Contract Documents may only be amended, modified, or supplemented as provided in Paragraph 3.04 of the General Conditions.

ARTICLE 10 - MISCELLANEOUS

10.01 Terms

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 Assignment of Contract

A. No assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; 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 to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 Successors and Assigns

A. 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.

10.04 Severability

A. 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.

10.05 Venue

A. Owner and Contractor agree that venue shall lie exclusively in the State district courts of Collin County, Texas for any legal action arising out of and/or relating to this Agreement, the Contract Documents, the Project, and/or the Work.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement in duplicate. One counterpart each has been delivered to Owner and Contractor. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

This Agreement will be effective on _____

Owner:	North Texas Municipal Water District	Contractor:	
			(typed or printed)
By:		By:	
	(Individual's signature)		(Individual's signature)
Name:	Larry Parks	Name:	
	(typed or printed)		(typed or printed)
Title:	President	Title:	
			(typed or printed
Attest:		Attest:	
	Phil Dyer, Secretary		(Individual's signature)
Address for giving notice:			
505 E. Brown Street			
Wylie, TX 75098			
Designated representative:		Designated representative:	
Name:	Rodney Rhoades	Name:	
Title:	Interim Executive Director	Title:	
Address:	505 E. Brown Street	Address:	
Wylie, TX 75098			
Phone:	(972) 442-5405	Phone:	
Facsimile:	(972) 295-6440	Facsimile:	
E-mail:	rrhoades@ntmwd.com	E-mail:	
		(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)	

Contractor as Principal Name: . Mailing address (principal place of business):	**Surety** Name: Mailing address (principal place of business): Physical address(principal place of business):
Owner Name: North Texas Municipal Water District Mailing address (principal place of business): 505 E. Brown Street, Wylie, Texas 75098	Surety is a corporation organized and existing under the laws of the state of: _____ *By submitting this bond, Surety affirms their authority to do business in the State of Texas and their license to execute bonds in the State of Texas.*
Contract Project name and location: Effective Date of the Agreement: Contract Amount:	Telephone (main number): Telephone (for notice of claim):
	Local Agent for Surety Name: Address: Telephone:
Bond Date of Bond *(Date of Bond cannot be earlier than Effective Date of Agreement)* Bond Amount:	***The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Department of Insurance by calling the following toll-free telephone number: 1-800-252-3439***

Surety and Contractor, intending to be legally bound and obligated to Owner do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative. The Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if the Contractor as Principal faithfully performs the work required by the Contract then this obligation shall be null and void; otherwise the obligation is to remain in full force and effect. Provisions of the bond shall be pursuant to the terms and provisions of Chapter 2253 of the Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein. Venue shall lie exclusively in Collin County, Texas for any legal action.

Contractor as Principal Signature: _____ Name and Title:	**Surety** Signature: _____ Name and Title: (Attach Power of Attorney)

Contractor as Principal
Name: .
Mailing address (principal place of business):

Owner
Name: North Texas Municipal Water District

Mailing address (principal place of business):

505 E. Brown Street, Wylie, Texas 75098

Contract
Project name and location:

Effective Date of the Agreement:

Contract Amount:

Bond
Date of Bond
(Date of Bond cannot be earlier than Effective Date of Agreement)
Bond Amount:

Surety
Name:
Mailing address (principal place of business):

Physical address(principal place of business):

Surety is a corporation organized and existing under the laws of the state of: _____
By submitting this bond, Surety affirms their authority to do business in the State of Texas and their license to execute bonds in the State of Texas.

Telephone (main number):

Telephone (for notice of claim):

Local Agent for Surety
Name:
Address:

Telephone:

The address of the surety company to which any notice of claim should be sent may be obtained from the Texas Department of Insurance by calling the following toll-free telephone number: 1-800-252-3439

Surety and Contractor, intending to be legally bound and obligated to Owner do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative. The Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally to this bond. The condition of this obligation is such that if the Contractor as Principal pays all claimants providing labor or materials to him or to a subcontractor in the prosecution of the work required by the Contract then this obligation shall be null and void; otherwise the obligation is to remain in full force and effect. Provisions of the bond shall be pursuant to the terms and provisions of Chapter 2253 of the Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein. Venue shall lie exclusively in Collin County, Texas for any legal action.

Contractor as Principal

Signature: _____
Name and Title:

Surety

Signature: _____
Name and Title:
(Attach Power of Attorney)

Supply a bid security in the amount of five (5%) percent of the amount of the maximum total bid as stated in the Instruction to Bidders Section 00 21 16.

00 62 16 CERTIFICATE OF INSURANCE

If awarded the contract, provide the Certificate(s) of Insurance to the Owner prior to conforming of documents for execution. Certificate(s) will be included in the documents to be executed by the Owner and in the conformed construction contract documents.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by

CONSTRUCTION SPECIFICATIONS INSTITUTE

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

Page

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda* - Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement* - The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

3. *Application for Payment* - The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Asbestos* - Any material that contains more than one percent 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.

5. *Bid* - The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

6. *Bidder* - The individual or entity who submits a Bid directly to Owner.

7. *Bidding Documents* - The Bidding Requirements and the proposed Contract Documents (including all Addenda).

8. *Bidding Requirements* - The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

9. *Change Order* - A document recommended 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.

10. *Claim* - A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

11. *Contract* - The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents* - Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

13. *Contract Price* - The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

14. *Contract Times* - The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.

15. *Contractor* - The individual or entity with whom Owner has entered into the Agreement.

16. *Cost of the Work* - See Paragraph 11.01 for definition.

17. *Drawings* - That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

18. *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.

19. *Engineer* - The individual or entity named as such in the Agreement.

20. *Field Order* - A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.

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

22. *Hazardous Environmental Condition* - The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

23. *Hazardous Waste* - The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

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.

25. *Liens* - Charges, security interests, or encumbrances upon Project funds, real property, or personal property.

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.

27. *Notice of Award* - The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.

28. *Notice to Proceed* - A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

29. *Owner* - The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

30. *PCBs* - Polychlorinated biphenyls.

31. *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 Waste and crude oils.

32. *Progress Schedule* - A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

33. *Project* - The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

34. *Project Manual* - The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.

35. *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.

36. *Resident Project Representative* - The authorized representative of Engineer who may be assigned to the Site or any part thereof.

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.

38. *Schedule of Submittals* - A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

39. *Schedule of Values* - A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *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.

41. *Site* - Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

42. *Specifications* - That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

43. *Subcontractor* - An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

44. *Substantial Completion* - The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) 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.

45. *Successful Bidder* - The Bidder submitting a responsive Bid to whom Owner makes an award.

46. *Supplementary Conditions* - That part of the Contract Documents which amends or supplements these General Conditions.

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

48. *Underground Facilities* - All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

50. *Work* - The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce

such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

51. *Work Change Directive* - A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered 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.

1.02 *Terminology*

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the 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 is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

a. does not conform to the Contract Documents; or

b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.

F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the

Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:

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. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one is as binding as if required by all.

B. 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 labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.

C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the 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.

2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents before Starting Work*: Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.

2. *Contractor's Review of Contract Documents During Performance of Work*: 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 (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, 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:

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

b. the provisions of any 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).

3.04 *Amending and Supplementing Contract Documents*

A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.

B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;

2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or

3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. 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 its consultants, including electronic media editions; or

2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to electronic files submitted to the project delivery management system. Documents in hard copy format are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such hard copy documents will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the electronic copies govern.

B. Electronic documents and submittals submitted through the project delivery management system cannot be modified as a new record after submittal. Therefore, all documents and submittals into the project delivery management system are deemed record on file upon receipt.

C. All electronic records will be archived upon project delivery completion.

ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

4.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must

comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings 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

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

2. is of such a nature as to require a change in the Contract Documents; or

3. differs materially from that shown or indicated in the Contract Documents; or

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 thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review*: After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, 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 Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

b. 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 9.07 and 11.03.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

b. 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 final commitment; or

c. Contractor failed to give the written notice as required by Paragraph 4.03.A.

3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer,

or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *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 or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all such information and data;

b. locating all Underground Facilities shown or indicated in the Contract Documents;

c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy 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 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. 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 location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with

reasonable accuracy 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 on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

A. 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 property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings 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

2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.

D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall

immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.

E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (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 on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.

F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment 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 Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.

G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate

Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish performance and payment bonds, 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 until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.

B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.

C. If the surety on any bond furnished by Contractor is declared 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 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

A. 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 which the Project is located 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.

5.03 *Certificates of Insurance*

A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee 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.

B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.

C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.

E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

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

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

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

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

b. by any other person for any other reason;

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

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.

B. The policies of insurance required by this Paragraph 5.04 shall:

1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;

2. include at least 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;

3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;

4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 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 5.03 will so provide);

5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and

6. include completed operations coverage:

a. Such insurance shall remain in effect for two years after final payment.

b. 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.

5.05 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, 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.

5.06 *Property Insurance*

A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;

2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.

3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);

4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;

6. include testing and startup; and

7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.

B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.

D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property

insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.

E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss 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 loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) 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.

B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B 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 Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it 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.

B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary 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 as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof 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.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

A. 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 not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, 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 performance, testing, start-up, and completion of the Work.

B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

A. 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, appearance, 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 submitted to Engineer for review under the circumstances described below.

1. *"Or-Equal" Items:* If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that:

1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

3) it has a proven record of performance and availability of responsive service.

b. Contractor certifies that, if approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.

c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.

d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

1) shall certify that the proposed substitute item will:

a) perform adequately the functions and achieve the results called for by the general design,

b) be similar in substance to that specified, and

c) be suited to the same use as that specified;

2) will state:

a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,

b) whether use of the proposed substitute item 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 other work on the Project) to adapt the design to the proposed substitute item, and

c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

3) will identify:

a) all variations of the proposed substitute item from that specified, and

b) available engineering, sales, maintenance, repair, and replacement services; and

4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.

C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.

D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

E. *Engineer's Cost Reimbursement*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

F. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner'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 individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or

entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.

C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor

2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.

F. 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 delineating the Work to be performed by any specific trade.

G. 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 and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

A. 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 or copyrights held by others. 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 or Engineer, its

use is subject to patent rights or copyrights 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.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights 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.

6.08 *Permits*

A. 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. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner

and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

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

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas 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.

2. 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 by arbitration or other dispute resolution proceeding or at law.

3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to 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.

B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

1. all persons on the Site or who may be affected by the Work;

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

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.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property 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 other 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.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer 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 individual or entity directly or indirectly employed by any of them).

F. 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 Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

A. 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.

6.15 *Hazard Communication Programs*

A. 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 Laws or Regulations.

6.16 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer 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.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

a. Submit number of copies specified in the General Requirements.

b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

a. Submit number of Samples specified in the Specifications.

b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

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

c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.

3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if 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.

2. 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.

3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.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. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. 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 specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

A. 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 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. 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:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;

6. any inspection, test, or approval by others; or

7. any correction of defective Work by Owner.

6.20 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable .

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A 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 individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

1. written notice thereof will be given to Contractor prior to starting any such other work; and

2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer 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.

C. 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 Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

2. the specific matters to be covered by such authority and responsibility will be itemized; and

3. the extent of such authority and responsibilities will be provided.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.

C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The 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 performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. 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, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site 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 observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's 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 performance of the Work.

9.03 *Project Representative*

A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents 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 Owner and also 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 Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.

D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations

on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.

B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by 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 Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. 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 performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A 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.

E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by 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).

B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:

1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;

2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety 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), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

A. *Engineer's Decision Required*: All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

C. *Engineer's Action*: Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

1. deny the Claim in whole or in part;

2. approve the Claim; or

3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

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 Work. 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, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' 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.

3. Payments made by Contractor to Subcontractors for Work performed 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 Engineer, which bids, if any, will be acceptable. If any

subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's 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 this Paragraph 11.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

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

b. 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.

c. 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 Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be 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.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than 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, and royalty payments and fees for permits and licenses.

f. 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 of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than 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. 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.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

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.

4. 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.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 *Allowances*

A. 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 performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances:*

1. Contractor agrees that:

a. the cash 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

b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash 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.

C. *Contingency Allowance:*

1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 *Unit Price Work*

A. 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 unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of 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 Engineer subject to the provisions of Paragraph 9.07.

C. 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.

D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

2. there is no corresponding adjustment with respect to any other item of Work; and

3. 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 PRICE; CHANGE OF CONTRACT TIMES

12.01 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. 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:

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 11.03); or

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 12.01.C.2); or

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 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee:* The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

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:

a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

c. 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 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

e. 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 percent of such net decrease; and

f. 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 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times 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 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.

D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 *Notice of Defects*

A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article13.

13.02 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

A. Contractor shall give Engineer 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.

B. 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:

1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;

2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

3. as otherwise specifically provided in the Contract Documents.

C. 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 shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in

the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.

E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.

F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

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

B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.

D. If the uncovered 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 both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to 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, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed 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, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or

2. correct such defective Work; or

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, 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.

E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer'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, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, 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 days written notice to Contractor, correct, or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or 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, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 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; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties

are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, 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.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out 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. 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 equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. *Review of Applications:*

1. Engineer will, within 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 Engineer's reasons for

refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

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

a. the Work has progressed to the point indicated;

b. 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, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

b. 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.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. *Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:

a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

c. there are other items entitling Owner to a set-off against the amount recommended; or

d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.

2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

A. 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 free and clear of all Liens.

14.04 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.

E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, 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, subject to the following conditions:

1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.

2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;

b. consent of the surety, if any, to final payment;

c. a list of all Claims against Owner that Contractor believes are unsettled; and

d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 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 might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, 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.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Payment Becomes Due:*

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 *Final Completion Delayed*

A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment

(for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, 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 completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, 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 Engineer 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.

14.09 *Waiver of Claims*

A. The making and acceptance of final payment will constitute:

1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and

2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);

2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

3. Contractor's repeated disregard of the authority of Engineer; or

4. Contractor's violation in any substantial way of any provisions of the Contract Documents.

B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);

2. 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

3. complete the Work as Owner may deem expedient.

C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to 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. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

E. 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.

F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. 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;

2. 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;

3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

4. reasonable expenses directly attributable to termination.

B. 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.

15.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or

2. agrees with the other party to submit the Claim to another dispute resolution process; or

3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. 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

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

A. 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 by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. 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.

17.04 *Survival of Obligations*

A. 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, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

00 73 00 **SUPPLEMENTARY CONDITIONS**

These Supplementary Conditions amend or supplement Section 00 72 00 – Standard General Conditions of the Construction Contract prepared by the Engineers Joint Contract Documents Council (EJCDC C-700, 2007 edition) 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.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

SC-1.01 Make the following modifications to 1.01 *Defined Terms*

A. Delete Paragraph 1.01 A. 5. entirely and insert the following in its place:

"5. Bid - The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices and schedule for the Work to be performed."

B. Modify 1.01 A. 19. Add the following:

"For this Agreement the *Engineer* is

Huitt ~ Zollars, Inc.
Attention: Ken Roberts, PE
1717 McKinney Avenue, Suite 1400
Dallas TX 75202-1236
Phone: (214) 871-3311
Fax: (214) 871-0757
E-mail: kar@huitt-zollars.com

C. Add a new paragraph 1.01 A. 52:

"52. *Construction Manager* – The authorized representative of Owner who may be assigned to the Site or any part thereof. The individual or entity will be responsible for administration of the Contract as a representative of the Owner. This individual may also serve as the Resident Project Representative. For this project the Owner will designate a member of their staff to serve as Construction Manager

SC-1.02 Make the following modifications to 1.02 *Terminology*.

A. Add a new paragraph "B.2" as follows:

"2. At no additional cost to Owner", "With no extra compensation to Contractor", "At Contractor's own expense", or similar words mean that the Contractor will perform or provide specified operation of work without any increase in the Contract Amount. It is understood that the cost for performing all work is included in the amount bid and will be performed at no additional cost to the Owner unless specifically stated otherwise.

B. Delete Paragraph C. Add the following:

"C. Day

1. A “calendar day” shall be a day of twenty-four hours measured from midnight to the next midnight, and is any day of the year, with no days being excluded.

2. A “working day” shall be a day which permits construction of the principal units of the work for a period of not less than seven hours between 7:00 a.m. and 6:00 p.m. Working days do not include days on which weather or other conditions not under the control of the Contractor prevent Contractor from working the seven hours defining a working day. Working days do not include Saturdays, Sundays or any of the following holidays: New Year, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the day after Thanksgiving and Christmas Eve and Christmas Day.

C. Add new paragraphs “E.5 and E.6” as follows:

“5. Specifications are written in modified brief style. Requirements apply to all work of the same kind, class, and type even though the word "all" is not stated.

6. Simple imperative sentence structure is used which places a verb as the first word in the sentence. It is understood that the words "furnish", "install", "provide", or similar words include the meaning of the phrase "The Contractor shall..." before these words.

SC-2.02 Make the following modifications to 2.02 *Copies of Documents*.

A. Amend the first sentence of paragraph GC-2.02 A. by deleting “ten” and inserting “three”.

SC-2.05 Make the following modifications to 2.05 *Before Starting Construction*

A. Add a new paragraph immediately after paragraph 2.05.A.3

“ B. 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 all applicable field measurements. Contractor shall promptly report in writing to the Engineer any conflict, error, ambiguity or discrepancy which the Contractor may discover and shall obtain a written interpretation from the Engineer before proceeding with any work affected thereby. In the event of a conflict in the Drawings, Specifications, or other portions of the Contract Document which were not reported prior to the Award of the Contract, the Contractor shall be deemed to have included the most expensive item in their bid.”

SC-3.01 Make the following modifications to 3.01 *Intent*.

A. Add the following to 3.01 A

“Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer. Provide any work, materials or equipment required for a complete and functional system even if they are not detailed or specified.”

1. The contract requirements described in the General Conditions, Supplementary Conditions and General Requirements apply to each and all specification sections unless specifically noted otherwise.

2. Organization of Contract Documents is not intended to control or to lessen the responsibility of the Contractor when dividing work among Subcontractors, or to

establish the extent of work to be performed by any trade, Subcontractor or Supplier. Specifications or details do not need to be indicated or specified in each specification or drawing. Items shown in the contract documents are applicable regardless of location in the Contract Documents.

3. Standard paragraph titles and other identifications of subject matter in the specifications are intended to aid in locating and recognizing various requirements of the specifications. Titles do not define, limit, or otherwise restrict specification text.

B. Add new paragraphs "D - F" as follows:

"D. Comply with the most stringent requirements where compliance with two (2) or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, unless Contract Documents indicate otherwise.

1. Quantity or quality level shown or indicated shall be minimum to be provided or performed in every instance.
2. Actual installation may comply exactly with minimum quality indicated, or it may exceed that minimum within reasonable limits.
3. In complying with these requirements, indicated numeric values are minimum or maximum values, as noted, or appropriate for context of requirements.
4. Refer instances of uncertainty to the Engineer for a decision before proceeding.

E. Provide materials and equipment comparable in quality to similar materials and equipment incorporated in the project or as required to meet the minimum requirements of the application if the materials and equipment are shown in the drawings but are not included in the specifications.

F. The Contract Documents comprise the entire Agreement between Owner and Contractor. The Contract Documents may be modified only by Field Order or Change Order."

SC-3.02 Make the following modifications to 3.02 *Reference Standards*.

A. Add a new paragraph "B" as follows:

"B. Comply with applicable construction industry standards as if bound or copied directly into the Contract Documents regardless of lack of reference in the Contract Documents. Apply provisions of the Contract Documents where Contract Documents include more stringent requirements than the referenced standards.

1. Standards referenced directly in the Contract Documents take precedence over standards that are not referenced but recognized in the construction industry as applicable.
2. Comply with standards not referenced but recognized in the construction industry as applicable for performance of the work except as otherwise limited by the Contract Documents. The Engineer determines whether code or standard is applicable, or which of several are applicable.
3. Make copies of reference standards available as requested by Engineer or Owner."

SC-3.03 Make the following modifications to 3.03 *Reporting and Resolving Discrepancies.*

A. Add the following new Subparagraph immediately after Subparagraph 3.03.A.1:

"Contractor represents that he has familiarized himself with the nature and extent of the Contract Documents, Work, location, all local conditions, and Laws and Regulations

that in any manner may affect performance of the Work, and represents that he has correlated his study and observations with the requirements of the Contract Documents. Contractor also represents that he has studied all conditions referred to in the Contract Documents and will make such additional surveys and investigations as he deems necessary for the performance of the Work at the Contract price in accordance with the requirements of the Contract Documents and that he has correlated the results of all such data with the requirements of the Contract Documents."

B. Delete Paragraph 3.03.A.3 entirely and insert the following in its place:

3. "In the event of a conflict in the Drawings, Specifications, or other portions of the Contract Documents which were not reported prior to the Bidding of the Contract, the Contractor shall be deemed to have included the most expensive item, system, procedure, etc in his Bid."

SC-3.05 Make the following modifications to 3.05 *Reuse of Documents*

A. Delete the last sentence of 3.05 B entirely and insert the following in its place:

"Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes, unless specifically prohibited in writing by the Owner for security reasons. If the Owner so directs, Contractor shall surrender all copies of the construction contract documents and other related documents, in paper or digital format and remove these documents from computer equipment or storage devices as a condition of final payment."

SC-4.01 Make the following modifications to 4.01 *Availability of Lands*

A. Delete Paragraphs 4.01.C entirely and insert the following in its place:

"Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment. A copy of the written agreements for the use of such land shall be provided to the Owner for record purposes."

SC-4.02 Make the following modifications to 4.02 *Subsurface and Physical Conditions*

A. Add the following new paragraphs immediately after Paragraph 4.02.B:

"C. The following reports of explorations and tests of subsurface conditions at or contiguous to the Site are known to Owner:

1. Geotechnical Engineering Report, Buffalo Creek Parallel Interceptor Sewer, Phase I FM 740 to Buffalo Creek Wastewater Treatment Plant in Rockwall and Kaufman Counties, Texas, dated August 21, 2018 Terracon Project No. 94175317

2. Geotechnical Engineering Report, Country Club Pond Retaining Wall in Heath, Texas, dated October 30, 2019 Terracon Project No. 94195999

The "technical data" contained in such report upon which Contractor may rely is findings of the subsurface exploration and provides recommendations concerning trench excavation and boring of the Project.

E. The reports and drawings identified above are not part of the Contract Documents, but the "technical data" contained therein upon which Contractor may rely, as expressly identified and established above, are incorporated in the Contract Documents by reference. Contractor is not entitled to rely upon any other information and data known to or identified by Owner or Engineer.

F. Copies of reports and drawings identified in SC-4.02.C and SC-4.02.D that are not included with the Bidding Documents may be examined at the Owner's and Engineer's offices during regular business hours."

SC-4.03 Make the following modifications to 4.03 *Differing Subsurface or Physical Conditions*.

A. Amend paragraph 4.03 A. by deleting "promptly" and inserting "promptly but no later than within three (3) days."

SC-4.04 Make the following modifications to 4.04 *Underground Facilities.*

A. Amend paragraph 4.03.B. by deleting "promptly" and inserting "promptly but no later than within three (3) days."

SC-4.06 Make the following modifications to 4.06 *Hazardous Environmental Conditions at Site*

A. Delete Paragraphs 4.06.A and 4.06.B in their entirety and insert the following:

"A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner."

B. Delete Paragraphs 4.06.G. entirely and insert the following in its place:

"**G. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, OWNER SHALL INDEMNIFY AND HOLD HARMLESS CONTRACTOR, SUBCONTRACTORS, AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS, AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO A HAZARDOUS ENVIRONMENTAL CONDITION, PROVIDED THAT SUCH HAZARDOUS ENVIRONMENTAL CONDITION: (I) WAS NOT SHOWN OR INDICATED IN THE DRAWINGS OR SPECIFICATIONS OR IDENTIFIED IN THE CONTRACT DOCUMENTS TO BE INCLUDED WITHIN THE SCOPE OF THE WORK, AND (II) WAS NOT CREATED BY CONTRACTOR OR BY ANYONE FOR WHOM CONTRACTOR IS RESPONSIBLE. NOTHING IN THIS PARAGRAPH 4.06.G SHALL OBLIGATE OWNER TO INDEMNIFY ANY INDIVIDUAL OR ENTITY FROM AND AGAINST THE CONSEQUENCES OF THAT INDIVIDUAL'S OR ENTITY'S OWN NEGLIGENCE."**

B. Delete Paragraphs 4.06.H. entirely and insert the following in its place:

"**H. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS, AND SUBCONTRACTORS OF**

EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO A HAZARDOUS ENVIRONMENTAL CONDITION CREATED BY CONTRACTOR OR BY ANYONE FOR WHOM CONTRACTOR IS RESPONSIBLE. NOTHING IN THIS PARAGRAPH 4.06.H SHALL OBLIGATE CONTRACTOR TO INDEMNIFY ANY INDIVIDUAL OR ENTITY FROM AND AGAINST THE CONSEQUENCES OF THAT INDIVIDUAL'S OR ENTITY'S OWN NEGLIGENCE."

SC-5.01 Make the following modifications to 5.01 *Performance, Payment and Other Bonds*

A. Add the following to Paragraph 5.01.C."

"Failure of the Contractor to provide a satisfactory replacement bond may be considered an event of default under Article 15, Paragraph 15.02."

SC-5.02 Make the following modifications to 5.02 *Licensed Sureties and Insurers*

A. Add a new paragraph "B." as follows:

"B. Insurance companies providing insurance required by Contract Documents shall have a minimum rating of A-VIII according to A.M. Best Company."

SC-5.03 Make the following modifications to 5.03 *Certificates of Insurance*

A. Add the following to the end of the last sentence of Paragraph 5.03.A:

"in accordance with Paragraph 5.04 and as amended in these Supplementary Conditions."

B. Delete Paragraph 5.03.B entirely.

SC-5.04 The following additional information is provided as required by paragraph 5.04 *Contractor's Liability Insurance.*

A. Worker's Compensation and Employer's Liability Insurance required by Paragraph 5.04.A.1 and 5.04.A.2 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

Workers' Compensation, etc.,	
1) State:	Statutory
2) Applicable Federal (e.g., Longshore)	Statutory
Employers' Liability	
1) Bodily Injury by Accident	$500,000
2) Bodily Injury by Disease - Each Employee	$500,000
3) Bodily Injury by Disease - Policy Limit	$500,000
4) Maritime Coverage Endorsement	
Insurance shall include a waiver of subrogation in favor of the Additional Insured identified in Paragraph 5.04 B.1.	

B. Contractor's Liability Insurance required by Paragraph 5.04.A.3, through 5.04.A.5 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

Insurance for Claims of Damages	
1) General Aggregate (Except Products - Completed Operations)	$1,000,000 / Occurrence $2,000,000 / Aggregate
2) Products - Completed Operations Aggregate	$1,000,000 / Occurrence $2,000,000 / Aggregate
3) Personal and Advertising Injury (One Person/Organization)	$1,000,000
4) Each Occurrence (Bodily Injury and Property Damage)	$1,000,000
5) Limit Per Person - Medical Expense	$5,000
6) Personal Injury Liability coverage will include claims arising out of Employment Practices Liability, limited to coverage provided under standard contract.	$1,000,000
7) Property Damage Liability insurance will provide explosion, collapse and underground coverage where applicable	$1,000,000
8) Watercraft Liability Policy. Coverage shall apply to all self propelled vessels	$1,000,000
9) Excess Liability, Umbrella Form to include coverage of Watercraft Liability. General Aggregate - Each Occurrence	$1,000,000

Contractor's Liability Insurance shall also include completed operations and product liability coverage, and eliminate the exclusion with respect to property under the care, custody and control of Contractor. In lieu of elimination of the exclusion, Contractor may provide and maintain Installation Floater insurance for property under the care, custody, or control of Contractor. The Installation Floater insurance shall be a broad form or “All Peril” policy providing coverage for all materials, supplies, machinery, fixture, and equipment which will be incorporated into the Work. Coverage under the Contractors Installation Floater will include:

- faulty or defective workmanship, materials, maintenance or construction,
- cost to remove defective or damaged Work from the project site or to protect it from loss or damage,
- cost to cleanup and remove pollutants,
- coverage for testing and start up,
- any loss to property while in transit,
- any loss at the Project Site,
- any loss while in storage, both on-site and off-site, and
- any loss to temporary project works if their value is included in the Contract Price.

Coverage cannot be contingent on an external cause or risk or limited to property for which the Contractor is legally liable. Contractor’s Installation Floater will provide limits of

insurance adequate to cover the value of the installation. The Contractor will be solely responsible for any deductible carried under this coverage and claims on materials, supplies, machinery, fixture, and equipment which will be incorporated into the Work while in transit or in storage. This policy will include a waiver of subrogation for those listed as additional insured in these Supplemental Conditions.

C. Contractor's Automobile Liability Insurance required by Paragraph 5.04.A.6 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

Bodily Injury:	
1) Each Person	$1,000,000
2) Each Accident	$1,000,000
Property Damage:	
1) Each Accident	$1,000,000
Or	
2) Combined Single Limit (Bodily Injury and Property Damage)	$1,000,000

D. Additional insured on all insurance policies in accordance with Paragraph 5.04 B.1 include:

North Texas Municipal Water District
Huitt ~ Zollars, Inc.
Terracon Consultants, Inc.
RJN Group, Inc.
Survey and Mapping, LLC
Dallas Aerial Surveys, Inc.
ONCOR
TxDOT
ATMOS Gas
Rockwall County
Farmers Electric
Buffalo Creek Golf Course

E. Contractor’s Contractual Liability Insurance required by Paragraph 5.04.B.3 is to provide coverage for not less than the following amounts or greater where required by Laws and Regulations.

Contractor’s Contractual Liability Insurance	
1) General Aggregate	$1,000,000
2) Each Occurrence (Bodily Injury and Property Damage)	$1,000,000

SC-5.05 Make the following modifications to 5.05 *Owner’s Liability Insurance*

A. Delete Paragraph 5.05.A entirely and insert the following in its place:

“ A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Contractor shall purchase and maintain for Owner, at no additional cost, Owner’s

Protective Liability insurance naming Owner as the named insured with insurance that will protect said parties against claims which may arise from operations under the Contract Documents. This coverage shall be from the same company that provides Contractor's liability insurance coverage, and in the same minimum amounts. The Engineer and Engineer's consultants are additional insured as their interest may appear including their officers, directors, agents and employees."

SC-5.06 Make the following modifications to 5.06 *Property Insurance.*

A. Delete Paragraph 5.06.A entirely and insert the following in its place; Subparagraphs 1 through 7 shall remain:

" A. Contractor shall purchase and maintain property insurance upon the work at the site in the amount of the full replacement cost thereof (subject to deductible amounts as may be provided by the Supplementary Conditions or required by Laws and regulations). The policies of insurance required to be purchased and maintained by Contractor in accordance with this Paragraph 5.06 shall comply with requirements of Paragraph 5.08. This insurance shall:"

B. Amend paragraph 5.06.A.4 by inserting the following language after the word "location" in the second line:

"and in transit for incorporation in the Work from such storage locations"

C. Delete Paragraph 5.06.B entirely and insert the following in its place:

"B. Contractor shall purchase and maintain such boiler and machinery insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of those listed as an insured or listed as an additional insured in Paragraph 5.04 B.1."

D. Delete Paragraph 5.06.D entirely.

E. Delete Paragraph 5.06.E entirely.

SC-5.07 Make the following modifications to 5.07 *Waiver of Rights.*

A. Delete Paragraph 5.07.B entirely.

SC-5.08 Make the following modifications to 5.08 *Receipt and Application of Insurance Proceeds*

A. Delete Paragraph 5.08 entirely.

SC-5.11 Make the following modifications to ARTICLE 5 – BONDS AND INSURANCE

A. Add a new paragraph "5.11" as follows:

"5.11 *Owner's Insurance for Project*

A. Owner shall not be responsible for purchasing and maintaining any insurance to protect the interest of the Contractor, Subcontractors, or others in the Work. The stated limits of insurance required are minimum only. Contractor shall determine the limits that are adequate. These limits may be basic policy limits or any combination of basic limits and umbrella limits. In any event, Contractor

is fully responsible for all losses arising out of, resulting from or connected with operations under this contract whether or not said losses are covered by insurance. The acceptance of certificates or other evidence of insurance by the Owner, Engineer, and/or others listed as additional insured in Paragraph 5.04 B.1 that in any respect do not comply with the Contract requirements does not release the Contractor from compliance herewith."

SC-6.01 Make the following modifications to 6.01 *Supervision and Superintendence*

A. Amend paragraph 6.01.A by inserting the following language after the word "Documents" in the last sentence:

"and properly executed by the Contractor."

SC-6.02 Make the following modifications to 6.02 *Labor; Working Hours*

A. Delete paragraph 6.02 B. and insert the following in its place:

"B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, no Work shall be performed at the Site between 6:00 p.m. and 7:00 a.m. Contractor will not permit the performance of Work on a Saturday, Sunday, or any District holiday without Owner's written consent. Should Contractor desire to work on these days, he shall contact the Owner, in writing, for approval at least 48 hours in advance. Emergency work may be done without prior permission. Tie-ins and connections to existing facilities will be made at time authorized by the Owner.

SC-6.05 Make the following modifications to 6.05 *Substitutes and "Or-equals"*

A. Delete paragraph 6.05 A. and insert the following in its place:

"A. Where equipment and products are specified by name, no substitutes or "or-equal" will be considered or approved unless the term "or-equal" is included in the individual Specification. If substitutes or "or equals" are specifically permitted for consideration by the individual Specifications, they must be submitted and will be reviewed and evaluated in accordance with the provisions established in Paragraph 6.05 and in the General Requirements of the Specifications."

Subparagraphs 6.05.A.1 and 6.05.A.2 remain intact.

B. Amend paragraph 6.05 C. by deleting the fourth sentence and inserting the following in its place:

"No "or-equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by either a Change Order or Field Order."

C. Amend paragraph 6.05 E. by deleting the word "substitute" in all locations and replacing it with the phrase "substitute or "or-equal"".

SC-6.06 Make the following modifications to 6.06 *Concerning Subcontractors, Suppliers and Others*

A. Amend paragraph 6.06 B. by deleting the words "Supplementary Conditions" and inserting the words "Contract Documents" it their place.

C. Add a new paragraph "H." as follows:

"H. Owner or Engineer may furnish to any such Subcontractor, Supplier, or other person or organization, to the extent practicable, information about amounts paid to Contractor in accordance with Contractor's Application for Payment on account of the particular Subcontractor's, Supplier's, other person's or other organization's Work."

SC-6.07 Make the following modifications to 6.07 *Patent Fees and Royalties*

A. Delete Paragraphs 6.07.B. entirely and insert the following in its place:

"**B. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, OWNER SHALL INDEMNIFY AND HOLD HARMLESS CONTRACTOR, AND ITS OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS, AND SUBCONTRACTORS FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS, AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO ANY INFRINGEMENT OF PATENT RIGHTS OR COPYRIGHTS 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 SPECIFIED IN THE CONTRACT DOCUMENTS, BUT NOT IDENTIFIED AS BEING SUBJECT TO PAYMENT OF ANY LICENSE FEE OR ROYALTY TO OTHERS REQUIRED BY PATENT RIGHTS OR COPYRIGHTS.**

B. Delete Paragraphs 6.07.C. entirely and insert the following in its place:

"**C. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO ANY INFRINGEMENT OF PATENT RIGHTS OR COPYRIGHTS 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.**"

SC-6.09 Make the following modifications to 6.09 *Laws and Regulations*

A. Delete paragraph 6.09 B. and insert the following in its place:

"B. If Contractor performs any Work that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work."

B. Add a new paragraph "D" as follows:

"D. All Bidders are required to complete and submit with their Bid the Vendor Compliance to State Law form, which follows the proposal."

C. Add a new paragraph "E" as follows. Definitions included in this paragraph pertain only to this paragraph which is included verbatim as a statutory requirement of the State of Texas. The paragraph is to read as follows:

"E. Workers Compensation Statement for Building or Construction Projects for Government entities in Texas

A. Definitions:

Certificate of coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, 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 406.096) - 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" does 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 agreements, which meets the statutory requirements of Texas Labor Code, Section 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 governmental entity 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 governmental entity showing that coverage has been extended.

E. The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

(1) a certificate of coverage, prior to that person beginning work on the project, so the governmental entity 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 for the duration of the project and for one year thereafter.

G. The Contractor shall notify the governmental entity 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 Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of 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, Section 401.011(44) for all of 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 coverage, 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 governmental entity 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 person with whom it contracts, to perform as required by paragraphs (1) - (7), with the certificates 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 governmental entity 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 commission'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 governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

SC-6.10 Make the following modifications to 6.10 *Taxes*

A. Add the following to Paragraph 6.10.A."

"The Owner qualifies as an exempt agency as defined by the statutes of the State of Texas. The Contractor shall comply with all statutes and rulings of the State Comptroller."

SC-6.11 Make the following modifications to 6.11 *Use of Site and Other Areas*

A. Delete Paragraphs 6.11.A.3 entirely and insert the following in its place:

"**3. TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO 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.**

SC-6.13 Make the following modifications to 6.13 *Safety and Protection.*

A. Add the following to Paragraph 6.13.F."

"The Contractor's duties and responsibilities for the safety or protection of persons or the Work or property at the Site or adjacent thereto shall be reinstated when any additional efforts are required during the one year correction period to correct defects in the Work."

SC-6.16 Make the following modifications to 6.16 *Emergencies*

A. Amend paragraph 6.16.A by deleting the third sentence and inserting the following in its place:

"If Engineer determines that the incident giving rise to the emergency action was not the responsibility of the Contractor and that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Change Order, Field Order or Work Change Directive will be issued."

SC-6.17 Make the following modifications to 6.17 *Shop Drawings and Samples*

A. Delete paragraph 6.17.C.3. entirely and insert the following in its place:

"3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents on a Shop Drawing Deviation Request form provided by the Engineer and request that a Field Order or Change Order be issued for each of the specific variations submitted for approval. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation. "

B. Delete paragraph 6.17.D.3. entirely and insert the following in its place:

"3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation issuing a Field Order or Change Order. If the proposed modification is approved by the Engineer, the submittal will be considered to be in strict compliance with the Contract Documents and it will be reviewed in accordance with the Contract Documents. If the proposed Modification is not approved, the submittal will be returned to the Contractor with appropriate comments. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1."

C. Delete paragraph 6.17 E.1. entirely and insert the following in its place:

"1. 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. Re-submittals shall reference and respond directly to Engineer's previous comments. Any variations from strict compliance with the Contract Documents will be identified in the same manner as required in paragraph 6.17.C.3 and will require the same approvals."

D. Add the following new paragraphs immediately after Paragraph 6.17.E:

"F. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than two submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples, or other items requiring approval and Contractor shall reimburse Owner for Engineer's charges for such time.

G. In the event that Contractor requests a change of a previously approved item, Contractor shall reimburse Owner for Engineer's charges for its review time unless the need for such change is beyond the control of Contractor."

SC-6.18 Make the following modifications to 6.18. *Continuing the Work*

A. Add the following to Paragraph 6.18.A.

"Contractor assumes and bears responsibility for all costs and time delays associated with any variation from the requirements of the Contract Documents."

SC-6.20 Make the following modifications to 6.20 *Indemnification*

A. Delete paragraph 6.20.A entirely and insert the following in its place:

"A. **TO THE FULLEST EXTENT PERMITTED BY LAWS AND REGULATIONS, CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS OWNER AND ENGINEER, AND THE OFFICERS, DIRECTORS, MEMBERS, PARTNERS, EMPLOYEES, AGENTS, CONSULTANTS AND SUBCONTRACTORS OF EACH AND ANY OF THEM FROM AND AGAINST ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING BUT NOT LIMITED TO ALL FEES AND CHARGES OF ENGINEERS, ARCHITECTS, ATTORNEYS, AND OTHER PROFESSIONALS AND ALL COURT OR ARBITRATION OR OTHER DISPUTE RESOLUTION COSTS) ARISING OUT OF OR RELATING TO THE PERFORMANCE OF THE WORK, PROVIDED THAT ANY SUCH CLAIM, COST, LOSS, OR DAMAGE IS ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE, OR DEATH, OR TO INJURY TO OR DESTRUCTION OF TANGIBLE PROPERTY (OTHER THAN THE WORK ITSELF), INCLUDING THE LOSS OF USE RESULTING THEREFROM BUT ONLY TO THE EXTENT CAUSED BY ANY NEGLIGENT ACT OR OMISSION OF CONTRACTOR, ANY SUBCONTRACTOR, ANY SUPPLIER, OR ANY INDIVIDUAL OR ENTITY DIRECTLY OR INDIRECTLY EMPLOYED BY ANY OF THEM TO PERFORM ANY OF THE WORK OR ANYONE FOR WHOSE ACTS ANY OF THEM MAY BE LIABLE."**

B. Delete paragraph 6.20.C entirely.

SC-7.03 Make the following modifications to 7.03 *Legal Relationships.*

A. Delete Paragraph 7.03 B entirely.

SC-9.03 Make the following modifications to 9.03 *Project Representative*

A. Add the following new paragraphs immediately after Paragraph 9.03.A:

"B. The Resident Project Representative (RPR) will be Engineer's employee or agent at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions. RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall be through or with the full knowledge and approval of Contractor. The RPR shall:

1. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and schedule of values prepared by Contractor and consult with Engineer concerning acceptability.

2. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.

3. Liaison:

   a. Serve as Engineer's liaison with Contractor, working principally through Contractor's authorized representative, assist in providing information regarding the intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

4. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.

5. Shop Drawings and Samples:

   a. Record date of receipt of Samples and approved Shop Drawings.

   b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

6. Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.

7. Review of Work and Rejection of Defective Work:

   a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

   b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress will not produce a completed Project that conforms generally to the Contract Documents or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

8. Inspections, Tests, and System Startups:

   a. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.

   b. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

9. Records:

   a. Record names, addresses, fax numbers, e-mail addresses, web site locations, and telephone numbers of all Contractors, Subcontractors, and major Suppliers of materials and equipment.

   b. Maintain records for use in preparing Project documentation.

10. Reports:

a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawing and Sample submittals.

b. Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.

c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, damage to property by fire or other causes, or the discovery of any Hazardous Environmental Condition.

11. Payment Requests: Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

12. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

13. Completion:

a. Participate in a Substantial Completion inspection, assist in the determination of Substantial Completion and the preparation of lists of items to be completed or corrected.

b. Participate in a final inspection in the company of Engineer, Owner, and Contractor and prepare a final list of items to be completed and deficiencies to be remedied.

c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the Notice of Acceptability of the Work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or Contractor's superintendent.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of Contractor's work unless such advice or directions are specifically required by the Contract Documents.

5. Advise on, issue directions regarding, or assume control over safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part."

SC-9.04 Make the following modifications to 9.04 *Authorized Variations in Work*

A. Add the following to Paragraph 9.04.A:

"The Contractor shall notify the Engineer in writing prior to beginning any Work addressed in a Field Order if the Contractor does not agree that the Work involved represents no additional cost and/or time change in the Contract Documents."

SC-10.03 Make the following modifications to 10.03 *Execution of Change Orders*

A. Add a new paragraph "B" as follows:

"B. Contractor assumes and bears responsibility for all costs and time delays associated with any variation from the requirements of the Contract Documents unless the variation is specifically approved by Change Order."

SC-10.05 Make the following modifications to 10.05 *Claims*

A. Amend paragraph 10.05.B. by deleting "30" and inserting "7" in its place and by deleting "60" and inserting "30" in its place.

SC-11.01 Make the following modifications to 11.01 *Cost of the Work*

A. Amend paragraph 11.01.A by deleting the following words in the third sentence:

" those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:"

and insert the following in its place:

"those paid for the Work included in the Contract Price, shall include only the following items, and shall not include any of the costs itemized in paragraph 11.01 B. Contractor shall provide certified payroll records listing personnel classifications and salaries for all individuals involved in additional Work. Salaries for those not included in the certified payroll will be considered as being compensated under paragraph 11.01 B, and shall include only the following items:"

B. Amend paragraph 11.01.A.1 by deleting the following words in the second sentence:

"without limitation superintendents, foreman"

and inserting the following in its place:

"one foreman (unless agreed upon prior to beginning Work)"

C. Amend paragraph 11.01.A.1 by deleting the following words in the last sentence:

"be included in the above"

and inserting the following in its place:

"not exceed 1.5 times regular pay and shall be included in the above"

D. Amend paragraph 11.01.B.1 by adding "superintendents" to the list of excluded personnel in the first sentence:

E. Amend paragraph 11.01.D by inserting "and at intervals" in the last sentence as shown below:

"..... and submit in a form **and at intervals** acceptable to Engineer ..."

SC-11.03 Make the following modifications to 11.03 *Unit Price Work*

A. Delete paragraph 11.03.D entirely and insert the following in its place:

"D. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. If the total cost of a particular item of Unit Price Work amounts to twenty percent (20%) or more of the total Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by the Contractor differs by more than twenty percent (20%) from the estimated quantity of such item indicated in the Agreement; and

2. if there is no corresponding adjustment with respect to any other item of Work; and

3. if Contractor believes that Contractor has incurred additional expense as a result thereof; or if Owner believes that the quantity variation entitles Owner to an adjustment in the Unit Price, either the Owner or Contractor may make a claim for an adjustment in the Contract Price in accordance with Article 11 if the parties are unable to agree as to the effect of any such variation in the quantity of the Unit Price Work performed."

SC-12.03 Make the following modifications to 12.03 *Delays*

A. Add the following to Paragraph 12.03.A.

"No time extensions will be allowed for weather conditions for Projects using calendar days for the Contract Time."

SC-12.04 Make the following modifications to ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIME

A. Add a new paragraph "12.04" as follows:

"12.04 *No Damage for Delays*

A. The Contractor agrees to make no claims for damage for delay in the performance of the Contract occasioned by any act or omission to act of the Owner, Engineer, or any of the Engineer's or Owner's agents, and agrees that any such claim shall be fully compensated by an extension of time, as set forth in a Change Order, to complete performance of the work as provided herein."

SC-13.03 Make the following modifications to 13.03 *Tests and Inspections*

A. Delete paragraph 13.03 B entirely and insert the following in its place:

"B. Employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents. The Contractor is solely responsible for maintaining that the quality of work is in accordance with the Contract Documents. The Contractor shall be responsible for the notification and scheduling required assuring that a certified technician from the testing laboratory is present during all sampling and testing procedures required in the Contract Documents. The Contractor shall not proceed with construction work requiring such testing without the presence of the laboratory's certified technician. The Owner, at his option, may perform additional tests as quality monitoring. Quality monitoring activities of the Owner and Engineer, or failure on the part of the Owner or Engineer to perform tests on constructed works, in no way relieves the Contractor of the obligation to perform work and furnish materials conforming to the Contract Documents.

1 Contractor's Responsibilities

a. Control the quality of work produced and verify that the work performed meets the standards of quality established in the Contract Documents.
   1. Inspect and verify conformance of all materials furnished and work performed, whether by the Contractor, its subcontractors or its suppliers.
   2. Provide and pay for the services of a testing laboratory approved by Owner to insure that products proposed for use fully comply with the Contract Documents.
   3. Perform tests as indicated in this and other sections of the specifications. Schedule the time and sequence of testing with the Owner and Engineer. Testing is to be observed by the Owner, Engineer, or designated representative.
   4. Promptly replace any defective materials and/or construction work incorporating defective materials or workmanship.
   5. Provide Certified Test Reports as required by the SUBMITTALS section. Reports are to indicate that materials and construction are in compliance with the Contract Documents.

b. Assist the Engineer, Owner, and Owner's testing organization to perform quality monitoring activities.

2. Quality Monitoring Activities by the Owner

a. Quality Monitoring activities of the Owner and Engineer through their own forces or through contracts with materials testing laboratories and survey crews are for the Owner's use in monitoring the results of the Contractor's work and quality control activities, if deemed necessary by the Owner and Engineer. The Quality Monitoring activities of the Owner do not relieve the Contractor of its responsibility to provide testing in accordance with the requirements of the

Contract Documents or to provide materials and construction work complying with the Contract Documents.

3. Submittals

   a. Submittals shall be accordance with the SUBMITTALS section, and shall include:

      1. The name of the proposed primary and secondary testing laboratories along with documentation of qualifications, a list of tests that can be performed, and a list of the certified laboratory technicians and the licensed engineers who will be performing the sampling and testing for the Construction Work along with their certifications and licenses.
      2. Test reports per Paragraph 7, TEST REPORTS of this supplementary condition.

4. Standards

   a. Provide a testing laboratory that complies with the ASTM (American Society of Testing Materials) and/or ACIL (American Council of Independent Laboratories) “Recommended Requirements for Independent Laboratory Qualifications”, or other specified testing organizations.
   b. Perform tests listed in the specifications.

5. Delivery and Storage

   Handle and protect test specimens of products and construction materials at the construction site in accordance with ASTM or other applicable testing procedures.

6. Verification Testing

   a. Provide verification testing when tests performed by the Owner indicate that materials or the results of construction activities are not in conformance with Contract Documents.
   b. Verification testing is to be provided at the Contractor’s expense to verify products or constructed works are in compliance after corrections have been made.

   c. Tests must comply with recognized methods or with methods recommended by the Owner’s testing laboratory and approved by the Engineer.

7. Test Reports

   A. Test reports are to be prepared for all tests.

      1. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:

         a. Name of the Owner, project title and number, equipment installer and general contractor.
         b. Name of the laboratory, address, and telephone number.
         c. Name and signature of the certified laboratory personnel performing the sampling and testing.
         d. Date and time of sampling, inspection, and testing.

c. Date the report was issued.
d. Description of the test performed.
e. Weather conditions and temperature at time of test or sampling.
f. Location at the site or structure where the test was taken.
g. Standard or test procedure used in making the test.
h. A description of the results of the test.
i. Statement of compliance or non-compliance with Contract Documents.
j. Interpretations of test results, if appropriate.

B Distribute copies of the test reports to:

Owner	2 copies
Resident Project Representative	1 copy
Engineer	1 copy
Contractor	1 copy

8. Non-Conforming Work

a. Contractor shall promptly correct any work that is not in compliance with the Contract Documents and shall immediately notify the Owner when the corrective work will be performed.

b. Payment for non-conforming work shall be withheld until such work is corrected or replaced with work complying with the Contract Documents.

SC-13.07 Make the following modifications to 13.07 *Correction Period*

A. Amend paragraph 13.07.A by adding:

"When early acceptance of a Substantially Completed portion of the Work is accomplished in the manner indicated, the correction period for that portion of the Work shall commence at the time of substantial completion of that Work."

SC-14.02 Make the following modifications to 14.02 *Progress Payments*

A. Amend paragraph 14.02.A.1 by deleting "At least 20 days before the date established in the agreement for each progress payment (but no more than once a month)" and inserting in its place "In accordance with dates established in the AGREEMENT for progress payments (but no more than once per month)".

B. Amend paragraph 14.02 C.1. by deleting "Ten" and inserting "Thirty" in its place.

C. Amend paragraph 14.02.D.1. by deleting "or" in paragraph 14.02.D.1.c. and adding new paragraphs "e", "f", "g", and "h" as follows:

"e. Owner has been notified of failure to make payments to Subcontractors or Suppliers or for labor, or

f. failure to submit up-to-date record documents as required by GC-6.12, or

g. failure to submit monthly progress schedule updates or revised schedules as requested by the Owner or Engineer, or

h. failure to provide Project photographs required by Specifications."

D. Amend paragraph 14.02.D.2. by adding “to Owner’s satisfaction.”

E. Amend paragraph 14.02.D.3 by deleting “and subject to interest as provided in the Agreement.”

F. Add a new paragraph “14.02.D.4” as follows:

“4. Owner may permanently withhold payment from Contract Price for

a. liquidated damages incurred by Contractor, or

b. compensation for Engineer for third review of submittals, review of substitutions, re-inspection fees, inspections or designs related to correction of defective Work, or other Services identified as requiring payment by the Contractor. Compensation will be based on the following rates:

Position	Hourly Rate
Principal in Charge	$280.00
Project Manager	$225.00
Project Engineer	$220.00
Construction Manager	$210.00
Resident Engineer	$165.00
Resident Project Representative	$150.00
Senior Resident Representative	$175.00
Design Engineer	$180.00
Engineering Technician	$145.00
Clerk	$100.00
Expenses will be billed at the actual cost multiplied by 1.15.	

c. Costs for tests performed by the Owner to verify that work previously tested and found to be defective has been corrected. Verification testing is to be provided at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.”

SC-15.02 Make the following modifications to 15.02 *Owner May Terminate for Cause*

A. Add a new paragraph “A.5” as follows:

“5. If Contractor fails to provide the replacement bond required by General Conditions, Section 5.01.C or insurance coverage as required by General Conditions Article 5 and as amended by Supplemental Conditions.”

B. Add a new paragraph “A.6” as follows:

"6. If any petition of bankruptcy is filed by or against Contractor, or if Contractor is adjudged as bankrupt or insolvent or makes a general assignment for the benefit of creditors, or if a receiver is appointed for the benefit of Contractor's creditors, or if a receiver is appointed on account of Contractor's insolvency, upon the occurrence of any such event, Owner shall be entitled to request of Contractor or its successor in interest adequate assurance of future performance in accordance with the terms and conditions hereof. Failure to comply with such request within seven (7) days of delivery of the request shall entitle Owner to terminate this agreement and to the accompanying rights set forth in Paragraphs 15.02 and 15.03 hereof. In all events pending receipt of adequate assurance of performance and actual performance in accordance therewith, Owner shall be entitled to proceed with the Work with its own forces or with other Contractors on a time and material or other appropriate basis. The cost of work by Owner or other Contractors will be back charged against the Contract Sum hereof."

C. Delete paragraph 15.02.F. entirely.

SC-15.04 Make the following modifications to 15.04 *Contractor May Stop Work or Terminate*

A. Add a new paragraph "C" as follows:

"C. This Contract may not be assigned in whole or in part by the Contractor without the previous written consent of the Owner."

SC-16.01 Make the following modifications to 16.01 *Methods and Procedures*

A. Delete paragraph 16.01 entirely and insert the following in its place:

"16.01 *Methods and Procedures*

A. Owner and Contractor may exercise such rights or remedies as either may otherwise have under the Contract Documents or by Law."

SC-17.02 Make the following modification to 17.02 *Computation of Times*

A. Add a new paragraph "B" as follows:

"B. All references and conditions for a "calendar day contract" in the General Conditions and Supplementary Conditions shall apply for a "Fixed Date Contract." A "Fixed Date Contract" is one in which the calendar dates for reaching substantial completion and/or final completion are specified in lieu of identifying the actual calendar days involved.

END OF SECTION

1.00 GENERAL

1.01 WORK INCLUDED

A. Construct work as described in the Contract Documents.

1. Provide the materials, equipment, and incidentals required to make the project completely operable.
2. Provide the labor, equipment, tools, and consumable supplies required for a complete project.
3. Provide the civil, architectural, structural, mechanical, electrical, instrumentation and all other work required for a complete and operable project.
4. Test and place the completed project in operation.
5. Provide the special tools, spare parts, lubricants, supplies, or other materials as indicated in Contract Documents for the operation and maintenance of the Project.
6. Install Owner provided products and place in operation.
7. Drawings and specifications do not indicate or describe all of the work required to complete the project. Additional details required for the correct installation of selected products are to be provided by the Contractor and coordinated with the Engineer.

1.02 JOB CONDITIONS

A. The General Conditions, the Supplementary Conditions, and General Requirements apply to each specification sections.

B. Comply with all applicable state and local codes and regulations pertaining to the nature and character of the work being performed.

1.03 DESCRIPTION OF WORK

A. Work is described in general, non-inclusive terms as:

The project is a linear project from FM 740 to Buffalo Creek Wastewater Treatment Plant and includes but is not limited to:

1. Approximately 43,600 LF of 36” - 48” diameter wastewater pipe – Portions installed by open cut and portions to be by other than open cut with 60” diameter steel casing pipe
2. Manholes
3. Retaining Wall
4. Associated appurtenances
5. Manhole rehabilitation/repairs

1.04 WORK UNDER OTHER CONTRACTS

A. There is no other work performed concurrently under other contracts.

1.05 WORK BY OWNER

A. Owner will provide normal operation and maintenance of the existing facilities during construction, unless otherwise stated.

1.06 OWNER-SELECTED PRODUCTS

A. Owner has not selected Suppliers for any products.

1.07 OWNER-PROVIDED PRODUCTS

A. Owner will not purchase or provide any products to the Contractor for Installation.

1.08 CONSTRUCTION OF UTILITIES

A. Existing utilities will be used for this project.

B. Power and Electrical Services

1. Contractor shall pay for temporary power, including but not limited to construction cost, meter connection, fees and permits (if needed).
2. When permanent power is available at the site, the Contractor may use this power source in lieu of temporary power source he has been using.

   1) Notify Engineer and Owner of intent to use the permanent power source.
   2) Arrange with the power utility and pay the charges for connections and monthly charges for use of this power.

3. Pay for the power consumed until the project has been accepted as substantially complete.

1.09 OCCUPANCY

A. As soon as any portion of the structure and equipment are ready for use, the Owner shall have the right to operate the portion upon written notice to the Contractor.

B. Testing of equipment and appurtenances including specified test periods, training, and start-up does not constitute acceptance for operation.

C. Owner may accept the facility for continued use after start-up and testing at the option of the Owner. If acceptance is delayed at the option of the Owner, shut down facilities per approved Operation and Maintenance procedures.

D. The execution of bonds is understood to indicate the consent of the surety to these provisions.

E. Provide an endorsement from the insurance carrier permitting occupancy of the structures and use of equipment during the remaining period of construction.

F. Conduct operations to insure the least inconvenience to the Owner and general public.

2.00 PRODUCTS

2.01 MATERIALS

Provide materials and products per the individual sections of the specifications.

END OF SECTION

1.00 GENERAL

1.01 REQUIREMENTS

A. Alternates:

1. This Section describes each alternate by number and describes the basic changes to be incorporated into the Work when this alternate is made a part of the Work in the Agreement.
2. Drawings and Specifications will outline the extent of Work to be included in the alternate Contract Price.
3. Coordinate related Work and modify surrounding Work as required to properly integrate the Work under each alternate, and provide a complete and functional system as required by the Contract Documents.
4. Alternates will be accepted or rejected at the option of the Owner.
5. Owner has 120 days from the date of the Notice of Award (or effective Date of Agreement) to elect to modify the Contract Documents by Change Order to add Alternate items at the cost indicated in Section 00 42 23.01 “Proposal Form Exhibit A.”

B. Allowances:

1. Include specified allowance amount in Contract Price.
2. The amount of each allowance includes:
   a. The cost of the product to the Contractor less any applicable trade discounts.
   b. Delivery to the Site.
   c. Applicable taxes.
3. Include in the Contract Price all costs for:
   a. Handling at the Site, including unloading, uncrating, and storage per Section 01 31 00 “Project Management and Coordination.”
   b. Cost for labor and equipment for installation and finishing.
   c. Cost for related products not specifically listed in the allowance required for installation, including consumable supplies and materials.
   d. All overhead, profit, and related costs.
4. Assist Owner in the selection of products.
   a. Determine qualified Suppliers.
   b. Obtain proposals from qualified Suppliers.
   c. Present available alternates to the Owner through the Engineer. Notify Engineer of:
      1) Any objections to a particular Supplier or product.
      2) Effect on the Construction Schedule anticipated by the selection of each option.
      3) Cost of each option.
5. Upon selection of the product:
   a. Purchase and install the product.
   b. Contractor’s responsibilities for products shall be the same as for products selected by the Contractor.
6. Submit a Contract Modification Request per Section 01 31 13 “Project Coordination” to adjust Contract Price if the net cost of the product is more or less than the specified amount.
   a. For products specified as Unit Price Work, the unit cost shall apply to the quantities installed per the method of payment described in Section 01 29 00 “Payment Procedures.”

b. Do not perform Work until selection of alternate has been approved in writing by the Owner.
c. Provide actual invoices for the materials.

1.02 SUBMITTALS

A. Provide submittals for materials furnished as part of the alternate in accordance with Section 01 33 00 “Submittal Procedures.”

1.03 DESCRIPTION OF ALTERNATES

A. No alternates are included in the Project.

1.04 DESCRIPTION OF ALLOWANCES

A. No allowances are included in the Project.

1.05 GUARANTEES

B. Provide guarantees for products furnished under alternate bids / proposals or purchased by allowances as required by the Contract Documents.

2.00 PRODUCTS (NOT APPLICABLE)

3.00 EXECUTION (NOT APPLICABLE)

END OF SECTION

1.00 GENERAL

1.01 WORK INCLUDED

A. Payments for Work shall conform to the provisions of the General Conditions, the Supplementary Conditions, the Agreement, and this Section.

B. Submit Applications for Payment at the prices indicated in the Agreement

1. Prices for each item in the Agreement shall include but not be limited to cost for:

a. Mobilization, demobilization, cleanup, bonds, and insurance,
b. Professional services including but not limited to engineering and legal fees,
c. The products to be permanently incorporated into the project,
d. The products consumed during the construction of the project,
e. The labor and supervision to complete the project,
f. The equipment, including tools, machinery, and appliances required to complete the project,
g. The field and home office administration and overhead costs related directly or indirectly to the project, and
h. Any and all kinds, amount or class of excavation, backfilling, pumping or drainage, sheeting, shoring and bracing, disposal of any and all surplus materials, permanent protection of all overhead, surface or underground structures; removal and replacement of any poles, conduits, pipelines, fences, appurtenances and connections, cleaning up, overhead expense, bond, public liability and compensation and property damage insurance, patent fees, and royalties, risk due to the elements, and profits, unless otherwise specified.

2. Provide work not specifically set forth as an individual payment item but required to provide a complete and functional system. These items are a subsidiary obligation of the Contractor and are to be included in the Contract Price.

3. Payment will be made for materials on hand.

a. Store materials properly on site per Section 01 31 00, PROJECT MANAGEMENT AND COORDINATION.

1) Payment will be made for the invoice amount less the specified retainage.
2) Provide invoices at the time materials are included on the materials-on-hand tabulation.

b. Provide documentation of payment for materials-on-hand with the next payment request. Adjust payment to the amount actually paid if this differs from the invoice amount. Remove items from the materials on hand tabulation if this documentation is not provided so payment will not be made.
c. Payment for materials-on-hand is provided for the convenience of the Contractor and does not constitute acceptance of the product.

4. The work covered by progress payments becomes the property of the Owner at the time of payment.

1.02 SCHEDULE OF VALUES AND PAYMENTS

A. Submit a detailed Schedule of Values for the Work to be performed on the project within 15 days after the NTP.

1. Submit schedule within 10 days prior to submitting the first Application for Payment.
2. Line items in the Agreement are to be used as line items in the schedule.

3. Payment will be made on the quantity of Work completed per Contract Documents during the payment period and as measured per this Section.

    a. Payment amount is the Work quantity measured multiplied by the unit prices for that line item in the Agreement.
    b. Payment on a unit price basis will not be made for work outside finished dimensions
    c. Partial payments will be made for lump sum line items in the Agreement.

        1) Lump sum line items in the Agreement are to be divided into smaller unit prices to allow more accurate determination of the percentage of the item that has been completed.

            a) Provide adequate detail to allow more accurate determination of the percentage of work completed for each item.
            b) Provide prices for items that do not exceed $50,000.00. An exception may be made for equipment packages that cannot be subdivided into units or subassemblies.
            c) Separate product costs and installation costs.

                1. Product costs include cost for product, delivery and unloading costs, royalties and patent fees, taxes, and other cost paid directly to the Subcontractor or Supplier.
                2. Installation costs include cost for the supervision, labor and equipment for field fabrication, erection, installation, start-up, initial operation and Contractor's overhead and profit. For equipment or systems that exceed $50,000 the costs reported for startup activation shall not be less than 10 percent of the total item cost.

            d) Lump sum items may be divided into an estimated number of units.

                1. The estimated number of units times the cost per unit must equal the lump sum amount for that line item.
                2. Contractor will receive payment for all of the lump sum line item.

            e) Include a directly proportional amount of Contractor's overhead and profit for each line item.
            f) Divide principal subcontract amounts into an adequate number of line items to allow determination of the percentage of work completed for each item.

        2) These line items may be used to establish the value of work to be added or deleted from the project.

        3) Correlate line items with other administrative schedules and forms:

            a) Progress schedule,
            b) List of Subcontractors,
            c) Schedule of allowances,
            d) Schedule of alternatives,
            e) List of products and principal Suppliers, and
            f) Schedule of Submittals

        4) Costs for mobilization shall be listed as a separate line item and shall be actual cost for:

            a) Bonds and insurance,
            b) Transportation and setup for equipment,
            c) Transportation and/or erection of all field offices, sheds and storage facilities,
            d) Salaries for preparation of submittals required before the first Application for Payment,
            e) Salaries for field personnel assigned to the project related to the mobilization of the project,

f) Mobilization may not exceed 3 percent of the total contract amount. Cost for mobilization may be submitted only for work completed

5) The sum of all values listed in the schedule must equal the total contract amount.

4. Submit a schedule indicating the anticipated schedule of payments to be made by the Owner. Schedule shall indicate:

   a. The Application for Payment number,
   b. Date the request is to be submitted, and
   c. Anticipated amount of payment to be requested.

5. Update the Schedule of Values quarterly or more often if necessary to provide a reasonably accurate indication of the funds that the Owner will need to have available to make payment to the Contractor for the Work performed.

B. Provide written approval of the Schedule of Values, Application for Payment form, and method of payment by the Surety Company providing performance, **and** payment bonds prior to submitting the first Application for Payment. Payment will not be made without this approval.

1.03 PAYMENT PROCEDURES

A. Submit Applications for Payment per the procedures indicated in Section 01 33 00, SUBMITTALS. Submit a Schedule of Values in the Application for Payment format to be used.

B. Applications for Payment may be submitted on a pre-printed form as indicated in Section 01 31 13.13, FORMS or may be generated by computer. Computer generated payment requests must have the same format and information indicated in the pre-printed form and be approved by the Engineer.

   a. Indicate the total contract amount and the work completed to date on the Tabulation of Values for Original Contract Performed (Attachment "A".)
   b. Include only approved Change Order items in the Tabulation of Extra Work on Approved Change Orders (Attachment "B".)
   c. List all materials on hand that are presented for payment on the Tabulation of Materials on Hand (Attachment "C".) Once an item has been entered on the tabulation it is not to be removed.
   d. Include the Project Summary Report (Attachment "D") with each Application for Payment. Data included in the Project Summary Report are to be taken from the other tabulations. Include a completed summary as indicated in with each Applications for Payment submitted.

      1) Number each application sequentially and indicate the payment period.
      2) Show the total amounts for value of original contract performed, extra work on approved Change Orders, and materials on hand on the Project Summary Report. Show total amounts that correspond to totals indicated on the attached tabulation for each.
      3) Note the number of pages in tabulations in the blank space on the Project Summary Report to allow a determination that all sheets have been submitted.
      4) Execute Contractor's certification by the Contractor's agent of authority and notarize for each Application for Payment.

   e. Do not alter the schedule of values and the form for the submission of requests without the written approval of the Engineer once these have been approved by the Engineer.

   f. Final payment requires additional procedures and documentation per Section 01 70 00, EXECUTION AND CLOSEOUT REQUIREMENTS.

C. Progress payments shall be made as the work progresses on a monthly basis.

1. End the payment period on the day indicated in the Agreement and submit an Application for Payment for Work completed and materials received since the end of the last payment period.

2. At the end of the payment period, submit a draft copy of the Application for Payment for that month to the Engineer. Agreement is to be reached on:

a) The percentage of work completed for each lump sum item,
b) The quantity of work completed for each unit price item,
c) The percentage of work completed for each approved Change Order item, and
d) The amount of materials on hand.

3. On the basis of these agreements the Contractor is to prepare a final copy of the Application for Payment and submit it to the Engineer for approval.

4. The Engineer will review the payment request and if appropriate will recommend payment of the request to the Owner.

D. Provide a revised and up-to-date progress schedule per Section 01 32 16 CONSTRUCTION PROGRESS SCHEDULES with each Application for Payment.

E. Provide project photographs per Section 01 32 33, PHOTOGRAPHIC DOCUMENTATION with each Application for Payment.

1.04 ALTERNATES AND ALLOWANCES

A. Include amounts for specified Alternate Work in the Agreement in accordance with Section 01 23 10 ALTERNATES AND ALLOWANCES.

B. Include amounts for specified Allowances for Work in the Agreement in accordance with Section 01 23 10 ALTERNATES AND ALLOWANCES.

1.05 MEASUREMENT PROCEDURES

A. Measure the Work described in the Agreement for payment. Payment will be made only for the actual measured and/or computed length, area, solid contents, number and weight, unless otherwise specifically provided. No extra or customary measurements of any kind will be allowed.

1.06 BASIS OF PAYMENT

A. Base Bid – Description of Base Bid Items

Item 1A: Mobilization, Bonds, Insurance, General Conditions (Maximum 3% of Total Bid)

The Work under this item shall include the establishment of offices and other facilities on the Site and the movement of personnel, construction equipment and supplies to the Site or to the vicinity of the Site in order to enable the Contractor to begin the Work. The cost of all bonds and insurance, for the Project will also be considered part of this specification.

Mobilization will be measured as a lump sum item as the Work progresses. Partial payments for mobilization shall be paid for at the Total Unit Price as shown in the Proposal with the regular monthly estimates as follows: The adjusted contract amount for construction items as used below is defined as the total contract amount less the lump sum bid for Mobilization, Bond and Insurance.

a. When 1% and less than 5% of the adjusted contract amount for construction items is completed, 50% of the mobilization lump sum bid will be paid.

b. When 5% and less than 10% of the adjusted contract amount for construction items is

completed, 75% of the mobilization lump sum bid will be paid. Previous payments under this section will be deducted from this amount.

c. When 10% or more of the adjusted contract amount for construction items is completed, 95% of the mobilization lump sum bid will be paid. Previous payments under this section will be deducted from this amount

d. Payment for the remainder of the lump sum bid for "Mobilization, Bond and Insurance" will be made on the final estimate

This pay item shall encompass cost for the entire project.

Item 2A: Comply with TPDES Construction General Permit TXR15000 for Temporary Erosion, Sedimentation and Water Pollution Prevention and Control as Shown and Specified

This item shall consist of all the work, labor, equipment, and materials necessary for preparing and implementing control measures as described in the specifications and for preparing and implementing a Storm Water Pollution Prevention Plan in accordance with 01 57 00. The specific items, estimated quantities, and location of the control measures, including silt fences, straw bale dikes, etc. are not shown in the construction plans. The contractor shall be responsible for determination of adequate and appropriate control measure items, quantities, and locations and shall include this information in the submitted Storm Water Pollution Prevention Plan. The contractor shall be responsible for preparing and submitting all permits required, including but not limited to Notice of Intents and Notice of Terminations.

a. Payment shall be made monthly based on the ratio determined on number of months to final completion until 98% of the lump sum payment has been made. The final 2% will be paid upon receipt of Notice of Termination from TCEQ.

This pay item shall encompass cost for the entire project.

Item 3A: Site Preparation, Clear, Grub & Dispose of Bushes, Shrubs & Trees

This item shall consist of all the work, labor, materials and equipment necessary for the preparation of the permanent sanitary sewer easements and temporary construction easements for construction operations in accordance with Section 31 10 00. This work shall include the removal of all obstructions not designated in the plan set, general notes, or specifications to remain in place. This shall include, but not be limited to, trees, fences, above ground.and below ground utilities, and storm drain and structures. The cost of saw cutting and removing existing pavement shall be subsidiary to this item. Any existing improvement shown to remain, which is damaged or destroyed by these operations, shall be replaced at the Contractor's expense.

Measurement for payment shall be on a 100’ Stations cleared and grubbed as specified.

Item 4A through 9A: ASTM D3262 SN 72 Fiberglass Sewer Pipe with or without Steel Casing Pipe (By Open Cut or By Other than Open Cut, respectfully) – Complete in Place

This item shall consists of all the work, labor, equipment, and materials necessary for installing ASTM D3262 Fiberglass Sewer Pipe by Open Cut or by Other than Open Cut. This item shall include furnishing, hauling and laying of sewer line, trench excavation, backfilling, installing the required marking tape shall be subsidiary to the pipe installation, and embedment material in accordance with Section 31 23 33, dewatering trench, removal and disposal of unsuitable or excess excavated material, replacement of topsoil, protecting existing structures or utilities {where applicable), clean-up and maintenance , surveying and replacement of monuments, property restoration, testing of sewer line in accordance with Section 01 45 16.16, and any incidental work and materials not otherwise provided for in these specifications.

Installing the sewer pipe in the contractor's choice of Steel Casing as approved in the contractor's submittal for the various bores required for this project. This item shall include furnishing, hauling and laying of sewer line, bore pits, casing installation, annular backfill, backfilling and embedment material in accordance with Section 31 23 33, dewatering trench and ground water control, removal and disposal or abandoning existing sewers, removal and disposal of unsuitable or excess excavated material, replacement of topsoil, protecting existing structures or utilities (where applicable), clean-up and maintenance, surveying and replacement of monuments, property restoration, installing pipeline markers, testing of sewer line in accordance with Section 33 30 00, and any incidental work and materials not otherwise provided for in these specifications.

This item shall also include the work, labor, equipment, and materials for furnishing and placing pipeline markers at all new manholes, and locations specified by and in accordance to the Utility Marker Detail and Part 3 (Execution) in Section 33 05 26. This item shall also include 10 extra markers to be given to the owner. This work is subsidiary to the cost of installing the pipe.

Payment will be made at the applicable unit price bid in Section 00 42 23.01 as it corresponds in size and depth to the constructed facility. Payment for sewer line shall include any and all extra precautions or construction requirements necessary to adequately protect and support existing utilities. Payment for sewer line shall include all costs required to have utility companies or other parties, repair any damage inflicted to their lines by the Contractor and any cleanup, property damages, fines, etc. resulting from damage inflicted to any utility line by the Contractor. The Contractor is responsible for any damage to existing property or fences.

Measurement for payment shall be on a horizontal linear foot basis.

Item 10A through 12A: Sanitary Sewer Crossing Connection (Remove & Dispose of Old Pipe) various sizes

This item shall consists of all the work, labor, equipment, and materials necessary for installing the Sanitary Sewer Crossing Pipe by Open Cut or by Other than Open Cut. This item shall include furnishing, hauling and laying of sewer line, trench excavation, backfilling, installing the required marking tape shall be subsidiary to the pipe installation, and embedment material in accordance with Section 31 23 33, dewatering trench, removal and disposal of unsuitable or excess excavated material, replacement of topsoil, protecting existing structures or utilities {where applicable), clean-up and maintenance , surveying and replacement of monuments, property restoration, testing of sewer line in accordance with Section 01 45 16.16, and any incidental work and materials not otherwise provided for in these specifications.

This item shall also include the removal and disposal of the existing sanitary sewer pipe, complete, in a legal disposal site, including all incidental costs that may be incurred to legally dispose of the pipe.

Payment will be made at the applicable unit price bid in Section 00 42 23.01 as it corresponds in size and depth to the constructed facility. Payment for sewer line shall include any and all extra precautions or construction requirements necessary to adequately protect and support existing utilities. Payment for sewer line shall include all costs required to have utility companies or other parties, repair any damage inflicted to their lines by the Contractor and any cleanup, property damages, fines, etc. resulting from damage inflicted to any utility line by the Contractor. The Contractor is responsible for any damage to existing property or fences.

Measurement for payment shall be per each connection installed, complete, accepted in in service.

Item 13A: Sanitary Sewer Line Trench Safety

This item shall consist of the work, labor, equipment, and materials necessary to provide a trench safety system in accordance with Section 31 41 33. Payment made at the unit price bid shall be full compensation for all trench safety including installation and removal.

Measurement for payment shall be per horizontal linear foot of trench safety installed.

Item 14A through 22A: Standard 6 to 10 foot Diameter Type "S" Polymer Concrete Manhole with or without Vent and with or without Odor Control – Rim to Flow Line ≤ 20 Feet through > 25 Feet

This item shall consist of the work, labor, equipment, and materials necessary for installing a 6-foot Dia. Std. Polymer Concrete Manhole with or without manhole venting and / or odor control as shown on the plans and construction details. This item shall include excavation and backfilling in accordance with Section 31 23 33, manhole ring and cover, protective interior coating in accordance with Section 33 39 60, testing in accordance with Section 33 01 30, 6' diameter polymer concrete manhole, and all other incidental work.

Measurement for payment for polymer concrete **manholes shall be on a per each basis.**

Item 23A: Interconnect Sta. 656+19.31 – Complete in Place

This item shall consist of the work, labor, equipment, and materials required to locate and connect the proposed sanitary sewer pipe to the proposed manhole in the existing sanitary line at the locations shown in the plans.

Measurement for payment shall be on a per each basis.

Item 24A: Post Construction TV Inspection and Cleaning

Pipe will be cleaned in accordance with Section 33 04 50. A Television Inspection will be performed on the entire length of the pipe post-construction to ensure that pipe has been cleaned to an appropriate level in accordance with Section 33 01 30.16.

Measurement for payment for shall be on Lump Sum basis.

Item 25A through 26A: Removal of Manholes (Remove & Dispose of Manholes) various sizes

This item shall consists of all the work, labor, equipment, and materials necessary for the removal and disposal of the existing sanitary sewer manholes, complete, in a legal disposal site, including all incidental costs that may be incurred to legally dispose of the manhole.

Measurement for payment shall be per each removed and disposed.

Item 27A: Removal of Existing City of Heath 10" Sanitary Sewer

This item shall consists of all the work, labor, equipment, and materials necessary for the removal and disposal of the existing 10" sanitary sewer main, in a legal disposal site, including all incidental costs that may be incurred to legally dispose of the pipe.

Measurement for payment shall be on a horizontal linear foot basis.

Item 28A: Bypass Pumping Operations, including set ups, equipment rentals, labor, and other related items for bypass pumping operations

Payment for the installation, maintenance and removal of the require Bypass Pumping, shall be made at the unit price each as listed in the Bid Proposal and as shown on the Drawings. Bypass pumping shall include furnishing all labor, materials, equipment, and incidentals to install and remove the bypass pumping operations. This item includes, but is not limited to, dewatering, shoring, diversion/bypass pumping, plugging of existing sanitary sewer main(s), compliance with OASHA regulations and installation of all piping and appurtenances to the bypass pumping at the location(s) indicated on the drawings in compliance with the specifications and details shown in the Drawings.

Measurement for payment shall be pro-rated based on the overall number of bypass operations proposed by the contractor for the new trunk main installation and the lump sum amount shown in the Bid Tab Form.

Item 29A: Furnish & Install pavestone in Low Water Crossings

This item shall consist of the work, labor, materials and equipment required to install pavestone at the low water crossings shown at the location specified in the plan set, according to the Details shown in the plans and Section 32 13 19. This item shall include earthwork, clearing, drainage structures, and incidentals required to place the pavestone at the low water crossing. The contractor is responsible for any permits associated with the lower water crossing not provided to the contractor. This item shall include the restoration of the site to equal or better than preconstruction condition.

Measurement for payment shall be on a Square Yard – measured in place.

Item 30A: Medium Stone Rip Rap to be used at NTMWD's Discretion and Direction

This item shall consist of the work, labor, materials and equipment required to install riprap at the locations shown in the plan set in accordance with the details in the construction plans and Section 31 37 00 or at locations and areas as requested by NTMWD. This item shall include any earthwork, clearing, and incidentals required to place the riprap.

If the quantity required exceeds the bid form quantity, contractor shall inform NTMWD for approval and submit change order to modify contract.

Measurement for payment shall be on a Cubic Yard – measured in place.

Item 31A: Concrete Pavement (Traffic Control, Remove and Replace, Restore Disturbed areas to Pre-Construction Condition or better)

This item shall consist of the work, labor, materials, and equipment for the removal, replacement and restoration of existing concrete pavement throughout the project. This item shall include any earthwork, minor grading, and clearing required to restore / replace the concrete pavement. Pavement thickness shall match the original pavement thickness that was removed. This item shall include all work and labor required for coordination with property owners and shall include any incidentals required by property owners. This pay item shall include removal and disposal of concrete pavement and other improvements and the restoration of any areas disturbed by construction traffic to equal or better than pre-construction condition in accordance with the construction details.

Measurement for payment shall be per square yard – measured in place (regardless of pavement thickness).

Item 32A: Kings Road Flexbase Pavement (Traffic Control, Restore Disturbed areas to Pre-Construction Condition or better)

This item shall consist of the work, labor, materials, and equipment for the installation of flexbase pavement for Kings Road. This item shall include any minor grading, and clearing required to restore / replace the existing pavement. Pavement thickness shall match the original pavement thickness that was removed. This item shall include all work and labor required for coordination with property owners and shall include any incidentals required by property owners. This pay item shall include traffic control and the restoration of any areas disturbed by construction traffic to equal or better than pre-construction condition in accordance with the construction details.

Measurement for payment shall be per square yard – measured in place (regardless of

pavement thickness).

Item 33A: All Widths Pavement/Trails (Traffic Control, Remove and Restore Disturbed areas to Pre-Construction Condition or better) – Complete in Place

This item shall consist of the work, labor, materials, and equipment for the removal, replacement and maintenance of existing pavement, trails sidewalks throughout the project. This item shall include any sawcutting, removal, earthwork, minor grading, and clearing required for construction. This item shall include all work and labor required for coordination with property / infrastructure owners and shall include any incidentals required by infrastructure owner(s). This pay item shall include removal, disposal and replacement of existing roads and other improvements and the restoration of any areas disturbed by construction traffic to equal or better than pre-construction condition in accordance with the construction details and Section 31 10 00.

Measurement for payment shall be per square yard – measured in place (regardless of pavement thickness).

Item 34A: Install and Maintain Temporary Flexbase Golf Cart Path (Traffic Control, Restore Disturbed areas to Pre-Construction Condition or better) - Complete in Place

This item shall consist of the work, labor, materials, and equipment for the installation, removal, and maintenance of the Temporary Golf Cart Path within the Golf Club facility. This item shall include any minor grading, and clearing required for construction. This item shall include all work and labor required for coordination with Golf Course and shall include any incidentals as required, and restoration of the disturbed to equal or better than pre-construction condition in accordance with the construction details.

Measurement for payment shall be per square yard – measured in place (regardless of thickness).

Item 35A: Furnish and Install Hydromulch, Seed, and Fertilizer as Shown – Complete in Place

This item shall consist of the work, labor and materials necessary for revegetation in areas disturbed by construction. The Contractor shall revegetate unpaved areas disturbed by construction prior to acceptance of the project. Revegetation shall consist of seed sowing, straw mulching, fertilizing, and watering. This bid item does not include quantity for access road restoration. If this quantity is exceeded, the cost of the extra hydromulch seeding shall be borne by the contractor. This quantity does not include the area within the Golf Club – that area will be stabilized by others.

Measurement for payment shall be on a 100' Stations stabilized as specified.

Item 36A: Furnish and Install Sod, and Fertilizer as Shown – Complete in Place

This item shall consist of the work, labor and materials necessary for revegetation in selected areas disturbed by construction. The Contractor shall revegetate unpaved areas disturbed by construction prior to acceptance of the project. Revegetation shall consist of sodding, fertilizing, and watering.

Measurement for payment shall be per square yard as specified.

Item 37A: Golf Course Improvements/Grading/Removal/Replacement/Repair – Complete in Place

This item shall consist of the work, labor and materials by others (hired and monitored by the Golf Club) necessary to stake and obtain a topographic survey the easement area within the Golf Club. The Golf Club's contractor shall reestablish the original grades from the pre-

construction topographic survey and restore a minimum of 6 inches of topsoil for revegetation by others in areas of the golf course disturbed by construction. The Golf Club's contractor shall revegetate unpaved areas outside of the Golf Club disturbed by construction prior to acceptance of the project to the requirements of the Owner/Manager of the Golf Course. Reestablish of elevations shall consist of compaction, placing top soil, fine grading and removal of rocks and other undesirables. This work shall be accepted by Golf Course personnel before final payment is made. This bid item also includes all other restoration activities required and completed by contractor's hired by the Owner/Manager of the Golf Course.

Measurement for payment for shall be an allowance of $500,000 – Contractor to submit original invoice(s) received from the Golf Club (or their contractor's) with the actual cost of installation and connections for each contractor / sub-contractor hired and paid for by the Golf Club or if work is performed by the Golf Club. NTMWD pays invoiced amount (no markups) to Contractor when work is completed and accepted. Contractor is to then to pay the Golf Club's Invoice (contractor's and sub-contractor's invoices).

Contractor is to notify NTMWD if the allowance will be exceeded as soon as possible.

Item 38A: Allowance to Install New Electric Line from Switchgear to Transformer Pad at Pump House Adjacent to Golf Course Pond

This item is to pay others (ONCOR) to install the necessary sized wire in the 4" schedule 80 PVC direct bury conduit (Item 39A) install between the transformer (switchgear) and the pump house and make the necessary connections at both locations.

Measurement for payment for shall be an allowance of $15,000 – Contractor to submit original invoice(s) received from ONCOR (or their contractor's) with the actual cost of installation and connections for each contractor / sub-contractor hired and paid for by ONCOR or if work is performed by ONCOR. NTMWD pays invoiced amount (no markups) to Contractor when work is completed and accepted. Contractor is to then to pay ONCOR's Invoice (contractor's and sub-contractor's invoices).

Contractor is to notify NTMWD if the allowance will be exceeded as soon as possible.

Item 39A: 4" Schedule 80 PVC

4" schedule 80 PVC Pipe will be installed by direct bury between the existing switchgear and the transformer pad adjacent to the pump house as shown in the construction detail. This item shall include furnishing, hauling and laying of the PVC conduit, trench excavation, backfilling, installing the required marking tape shall be subsidiary to the conduit installation, and embedment material in accordance with the construction detail, dewatering trench, removal and disposal of unsuitable or excess excavated material, replacement of topsoil, protecting existing structures or utilities {where applicable), clean-up and maintenance , surveying and replacement of monuments, property restoration, and any incidental work and materials not otherwise provided for in these specifications.

Measurement for payment for shall be on a horizontal linear foot – measured in place.

Item 40A: Controlled Low Strength Material (CLSM) to be used at NTMWD's Discretion and Direction

This item shall consist of the work, labor, materials and equipment required to install controlled low strength material (CLSM) at the locations shown in the plan set in accordance with details in the plans and Section 03 34 13 or at locations and areas as requested by NTMWD. This item shall include any earthwork, clearing, and incidentals required to place the controlled low strength material (CLSM).

If the quantity required exceeds the bid form quantity, contractor shall inform NTMWD for approval

and submit change order to modify contract.

Measurement for payment shall be per Cubic Yard – complete in place.

Item 41A: Flowable Fill to be used at NTMWD's Discretion and Direction

This item shall consist of the work, labor, equipment, materials, and incidentals required to install Flowable Fill at the locations shown in the plans for trench backfill and pipe embedment in accordance with Details shown in the plans and Section 03 23 23.33 or at locations and areas as requested by NTMWD. This item shall include any earthwork, clearing, and incidentals required to place the Flowable Fill.

If the quantity required exceeds the bid form quantity, contractor shall inform NTMWD for approval and submit change order to modify contract.

Measurement for payment shall be per Cubic Yard – complete in place.

Item 42A: Concrete Encasement to be used to NTMWD's Discretion and Direction

This item shall consist of the work, labor, equipment, materials, and incidentals required to install concrete encasement at the locations shown in the plans for pipe embedment in accordance with details shown in the plans and Section 03 30 53 or at locations and areas as requested by NTMWD. This item shall include any earthwork, clearing, and incidentals required to place the concrete encasement.

If the quantity required exceeds the bid form quantity, contractor shall inform NTMWD for approval and submit change order to modify contract.

Measurement for payment shall be per Cubic Yard – complete in place.

Item 43A: Steel Sheet Piles – Complete in Place

This item shall consist of the work, labor, materials, and equipment for the installation and maintenance of steel sheet piles for the project. This item shall include any earthwork, minor grading, and clearing required to provide a stable sheet pile driving surface, wall painting, wall drains and PVC removal and connections to the wall. This item shall include all work and labor required for coordination with property owners and shall include any incidentals required by property owners. This pay item shall include removal and disposal of access roads and other improvements and the restoration of any areas disturbed by construction traffic to equal or better than pre-construction condition in accordance with the construction details and Sections 31 10 00 and 31 41 16.

Measurement for payment shall be per TON of steel sheet pile – complete in place.

Item 44A: Concrete Cap for Retaining Wall – Complete in Place

This item shall consist of the work, labor, materials, and equipment for the installation and maintenance of the concrete cap for the retaining wall as shown in the plans. This item shall include any earthwork, minor grading, and clearing required to provide forms and necessary construction access. This item shall include all work and labor required for coordination with property owners and shall include any incidentals required by property owners. This pay item shall include removal and disposal of access roads and other improvements and the restoration of any areas disturbed by construction traffic to equal or better than pre-construction condition in accordance with the construction details and Sections 31 10 00 and 03 30 53.

Measurement for payment shall be per Cubic Yard – complete in place.

Item 45A: Pond Excavation and Fill – Complete in Place

This item shall consist of the work, labor, materials and equipment required to excavate and install controlled backfill at the locations shown in the plan set in accordance with Section 31 20 00. The Engineer estimates this quantity to be 2,200 CY (no expansion / contraction factors included). This item shall include any earthwork, clearing, and incidentals required to excavate and place the backfil material to the plan grades and profile.

Measurement for payment shall be per Lump Sum – complete in place.

B. Manhole Rehabilitation – Base Bid

Item 1B: Remove and Replace Manhole Cover and Frame (existing 24-inch) Paved, and replace with 32-inch Manhole Cover and Frame, including related items – Complete in Place

Replacement of existing paved 24-inch manhole cover and frames with a 32-inch manhole cover and frame, including all materials, equipment, labor and related items, complete and in place, for, in accordance with specifications, drawings and plans, shall be measured by the each and paid for at the per-each bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Each – complete in place.

Item 2B: Remove and Replace Manhole Cover and Frame (existing 24-inch) Non-Paved, and replace with 32-inch Manhole Cover and Frame, including related items – Complete in Place

Replacement of existing non-paved 24-inch manhole cover and frames with a 32-inch manhole cover and frame, including all materials, equipment, labor and related items, complete and in place, for, in accordance with specifications, drawings and plans, shall be measured by the each and paid for at the per-each bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

This item shall also include the work, labor, equipment, .and materials for furnishing and placing pipeline markers at all new manholes, and locations shown in the plans. Markers shall be in accordance with the Detail in the plans. This work is subsidiary to the cost of replacing the manhole cover and frame.

Measurement for payment shall be per Each – complete in place.

Item 3B: Remove and Replace Manhole Cover and Frame (existing 32-inch) Paved, including related items – Complete in Place

Replacement of existing paved 32-inch manhole cover and frames with a 32-inch manhole cover and frame, including all materials, equipment, labor and related items, complete and in place, for, in accordance with specifications, drawings and plans, shall be measured by the each and paid for at the per-each bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

This item shall also include the work, labor, equipment, .and materials for furnishing and placing pipeline markers at all new manholes, and locations shown in the plans. Markers shall be in accordance with the Detail in the plans. This work is subsidiary to the cost of replacing the manhole cover and frame.

Measurement for payment shall be per Each – complete in place.

Item 4B: Remove and Replace Manhole Cover and Frame (existing 32-inch) Non-Paved, including related items – Complete in Place

Replacement of existing non-paved 32-inch manhole cover and frames with a 32-inch manhole cover and frame, including all materials, equipment, labor and related items, complete and in place, for, in accordance with specifications, drawings and plans, shall be measured by the each and paid for at the per-each bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

This item shall also include the work, labor, equipment, .and materials for furnishing and placing pipeline markers at all new manholes, and locations shown in the plans. Markers shall be in accordance with the Detail in the plans. This work is subsidiary to the cost of replacing the manhole cover and frame.

Measurement for payment shall be per Each – complete in place.

Item 5B: Manhole Grouting, including all related items – Complete in Place

Furnish and install all manhole grouting including all related items, in accordance with specifications, drawings and plans, complete and in place, shall be measured by the each and paid for at the per-each bid price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Each – complete in place.

Item 6B: For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes measuring 48” Diameter or less

Furnish and install Epoxy Coating, including cementitious coating, to manholes measuring 48-inches in diameter or less, including all related items, equipment, and labor, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per vertical foot price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Vertical Foot – complete in place.

Item 7B: For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes measuring 48” – 60” Diameter

Furnish and install Epoxy Coating, including cementitious coating, to manholes measuring 48-inches in diameter to 60-inches in diameter, including all related items, equipment, and labor, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per vertical foot price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Vertical Foot – complete in place.

Item 8B: For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes measuring 60” – 72” Diameter

Furnish and install Epoxy Coating, including cementitious coating, to manholes measuring 60-inches in diameter to 72-inches in diameter, including all related items, equipment, and labor, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per vertical foot price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Vertical Foot – complete in place.

Item 9B: For all materials (including cementious coating), equipment, and labor to apply new Epoxy Coating to all Manholes measuring 72" Diameter or greater

Furnish and install Epoxy Coating, including cementitious coating, to manholes measuring 72-inches in diameter or greater, including all related items, equipment, and labor, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per vertical foot price in the Proposal, which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Vertical Foot – complete in place.

Item 10B: Remove and Replace Manhole with Pre-cast Manhole (Includes Epoxy Coating) for 72" – 76" Manhole Diameter for 13' Manhole Depth – Complete in Place

Furnish and Install Precast Manhole, including all related items, equipment, material, labor, in accordance with specifications, drawings and plans, shall be measured by the each for one standard manhole of the diameter and type indicated.

Measurement for payment shall be per Each – complete in place.

Item 11B: Additional Manhole Depth

Furnish and Install Precast Manhole, including all related items, equipment, material, labor, in accordance with specifications, drawings and plans, shall be measured by the each for one standard manhole of the diameter and type indicated; Additional foot of vertical manhole depth in excess of 10 feet shall be measured to the nearest 0.1 foot and paid per vertical foot price in the Proposal. Where determined by the Engineer that a good connection cannot be made, additional footage outside of the five (5) linear feet covered by the complete manhole replacement bid item shall be paid at the unit price per linear foot for additional pipe.

Measurement for payment shall be per Vertical Foot – complete in place.

Item 12B: For all materials, equipment, and labor to install new Fiberglass Manhole Insert to all manholes measuring 72" – 76" Manhole Diameter for 13' Manhole Depth

Furnish and install Fiberglass manhole insert to manholes measuring 72-inches in diameter or greater, including all related items, equipment, and labor, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per each for 0 to 13 feet in the depth and paid for at the per-each bid price in the Proposal. Price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Each – complete in place.

Item 13B: Additional Fiberglass Manhole Insert to all manholes measuring 72" – 76" Manhole Diameter

Furnish and install Fiberglass manhole insert to manholes measuring 72-inches in diameter or greater, including all related items, equipment, and labor, in accordance with specifications, drawings and plans, complete and in place, shall be measured by per each for 0 to 13 feet in the depth and paid for at the per-each bid price in the Proposal. Additional foot of vertical manhole depth in excess of 13 feet shall be measured to the nearest 0.1 foot and paid per vertical foot price in the Proposal which price is the total compensation for furnishing design, materials, tools, labor, equipment, restoration, and incidentals necessary for construction complete and in place.

Measurement for payment shall be per Vertical Foot – complete in place.

Item 14B: Bypass Pumping Operations, including set ups, equipment rentals, labor, and other related items for bypass pumping operations – Compete in Place

Payment for the installation, maintenance and removal of the require overall project Bypass Pumping requirements, shall be made as listed in the Bid Proposal and as shown on the Drawings. Bypass pumping shall include furnishing all labor, materials, equipment, and incidentals to install and remove the bypass pumping operations. This item includes, but is not limited to, dewatering, shoring, diversion/bypass pumping, plugging of existing sanitary sewer main(s), compliance with OASHA regulations and installation of all piping and appurtenances to the bypass pumping at the location(s) indicated on the drawings in compliance with the specifications and details shown in the Drawings.

Measurement for payment shall be pro-rated based on the overall number of bypass operations proposed by the contractor for the existing trunk main manhole rehabilitation / restoration and the lump sum amount shown in the Bid Tab Form.

Item 15B: Manhole Location Assistance, including location and exposure of the structure and other related items for location manhole operations assistance to the North Texas Municipal Water District

Payment shall be made for manholes that North Texas Municipal Water District requests for help in locating. The process of locating requested manholes shall be up to the contractor. Should a manhole be located contractor will ensure that access into manhole is achieved. All measures taken to achieve this are inclusive to this pay item.

Measurement for payment shall be per Each – for efforts to locate MH and to make located MH accessible and all that entails. Payment will only be for manholes that have been requested to be located by North Texas Municipal Water District in writing.

E. Base Bid – Description of Base Bid Items – FRP Pipe

Item 4E through 9E: ASTM D3262 SN 72 Fiberglass Sewer Pipe (By Open Cut or By Other than Open Cut) with or without Steel Casing Pipe, respectfully – Complete in Place

See Items 4A through 9A for payment information. Items 4E through 9E shall be identical to items 4A through 9A respectively.

F. Alternate Bid – Description of Alternate Bid Items – PVC Pipe

Item 4F through 9F: ASTM F679 PS115 PVC Sewer Pipe (By Open Cut or By Other than Open Cut) with or without Steel Casing Pipe, respectfully – Complete in Place

This item shall consists of all the work, labor, equipment, and materials necessary for installing ASTM F679 PS115 PVC Sewer Pipe by Open Cut or by Other than Open Cut. This item shall include furnishing, hauling and laying of sewer line, trench excavation, backfilling and embedment material in accordance with Section 31 23 33, dewatering trench, removal and

disposal of unsuitable or excess excavated material, replacement of topsoil, protecting existing structures or utilities (where applicable), clean-up and maintenance, surveying and replacement of monuments, property restoration, testing of sewer line in accordance with Section 33 31 20, and any incidental work and materials not otherwise provided for in these specifications.

This item shall also include the work, labor, equipment, and materials for furnishing and placing pipeline markers at all new manholes, and locations shown in the plans. Markers shall be in accordance with the Detail in the plans. This item shall also include 10 extra markers to be given to the owner. This work is subsidiary to the cost of installing the pipe.

Payment will be made at the applicable unit price bid in Section 00 42 23.01 as it corresponds in size and depth to the constructed facility. Payment for sewer line shall include any and all extra precautions or construction requirements necessary to adequately protect and support existing utilities. Payment for sewer line shall include all costs required to have utility companies or other parties, repair any damage inflicted to their lines by the Contractor and any cleanup, property damages, fines, etc. resulting from damage inflicted to any utility line by the Contractor. The Contractor is responsible for any damage to existing property or fences.

Measurement for payment shall be on a horizontal linear foot basis.

END OF SECTION

01 31 00 PROJECT MANAGEMENT AND COORDINATION

1.00 GENERAL

1.01 WORK INCLUDED

A. Furnish equipment, manpower, products, and other items necessary to complete the Project with an acceptable standard of quality and within the Contract Time. Construct Project in accordance with current safety practices.

B. Manage Site to allow access to Site and control construction operations.

C. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

D. Utilize Internet Based Construction Management system for record keeping with NTMWD as specified in Section 01 31 24.

1.02 QUALITY ASSURANCE

A. Employ competent workmen, skilled in the occupation for which they are employed. Provide Work meeting quality requirements of the Contract Documents as determined by the Construction Manager.

B. Remove defective Work from the Site immediately unless provisions have been made and approved by the Construction Manager to allow repair of the product at the Site. Clearly mark the Work as "defective" until it is removed or allowable repairs have been completed.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00, SUBMITTALS:

1. Provide copies of Supplier’s printed storage instructions prior to furnishing materials or products and installation instructions prior to beginning the installation. Maintain one copy of these documents at the Site until the Project is complete. Incorporate this information into submittals. Place these documents into Projectmates.
2. Incorporate field notes, sketches, recordings, and computations made by the Contractor in to the Project Record Drawings. Place Project Record Drawings into Projectmates for permanent record keeping.

1.04 STANDARDS

A. Perform Work to comply with local, State and Federal ordinances and regulations.

1.05 PERMITS

Place all Permit documents, once attained into Projectmates for permanent document retention.

A. Obtain and pay for construction permits and licenses for highway and railroad crossings and other permits. .

B. Retain copies of permits and licenses at the Site and observe and comply with all regulations and conditions of the permit or license, including additional insurance requirements. Place all documents into Projectmates for permanent document retention.

C. Obtain and pay for all other necessary permits including any and all necessary highway, street and road permits for transporting pipe and/or heavy equipment necessary for construction of the Project.

D. Obtain and pay for other permits necessary to conduct any part of the Work.

E. Arrange for inspections and certification by agencies having jurisdiction over the Work.

F. Make arrangements with private utility companies and pay for fees associated with obtaining services, or for inspection fees.

1.06 COORDINATION

A. Coordinate the Work of various trades having interdependent responsibilities for installing, connecting to, and placing equipment in service.

B. Coordinate requests for substitutions to provide compatibility of space, operating elements, effect on the Work of other trades, and on the Work scheduled for early completion.

C. Coordinate the use of Project space and the sequence of installation of equipment, walks, mechanical, electrical, plumbing, or other Work that is indicated diagrammatically on the Drawings.

1. Follow routings shown for tubes, pipes, ducts, conduits, and other items as closely as practical, with due allowance for available physical space.
2. Utilize space efficiently to maximize accessibility for Owner's maintenance and repairs.
3. Schematics are diagrammatic in nature. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades. Document changes in the indicated routings on the Record Drawings.

D. Conceal ducts, pipes, wiring, and other non-finish items within construction in finished areas, except as otherwise shown. Coordinate locations of concealed items with finish elements.

E. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in sequence required to obtain best results.

F. Make adequate provisions to accommodate items scheduled for later installation, including:

1. Accepted alternates,
2. Installation of products purchased with allowances,
3. Work by others, and
4. Owner-supplied, Contractor-installed items.

G. Sequence, coordinate, and integrate the various elements of mechanical, electrical, and other systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical and electrical systems, equipment, and materials installation with other components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings during progress of construction.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components as they are constructed.
5. Install systems, materials, and equipment as permitted by codes to provide the maximum headroom possible where mounting heights are not detailed or dimensioned.
6. Coordinate the connection of systems with exterior underground and overhead utilities and services. Comply with the requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to the greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Adjust routing of piping, ductwork, utilities, and location of equipment as needed to resolve spatial conflicts between the various trades at no additional cost. Document changes in the indicated routings on the Record Drawings.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to structure’s surfaces.

9. Install systems, materials, and equipment to facilitate servicing, maintenance, and repair or replacement of components. As much as practical, connect for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to accessible locations.
10. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

1.07 SAFETY REQUIREMENTS

A. Assume sole responsibility for safety at the Site. Protect the safety and welfare of persons at the Site.

B. Provide safe access to move through the Site. Provide and maintain barricades, guard rails, covered walkways, and other protective devices to warn and protect from hazards at the Site.

C. Comply with latest provisions of the Occupational Health and Safety Administrations and other regulatory agencies in performing Work.

D. Cooperate with accident investigations related to the Site. Provide two copies of all reports prepared concerning accidents, injury, or death on the Site to the Engineer as Record Data per Section 01 33 00, SUBMITTALS.

1.08 CONTRACTOR'S USE OF SITE

A. Limit the use of Site for Work and storage to those areas designated on the Drawings or approved by the Construction Manager. Coordinate the use of the premises with the Construction Manager.

B. Repair or correct any damage to existing facilities, including contamination, caused by the Contractor's personnel, visitors, materials, or equipment.

C. Do not permit alcoholic beverages or illegal substances on the Site. Do not allow persons under the influence of alcoholic beverages or illegal substances to enter or remain on the Site at any time. Persons on Site under the influence of alcoholic beverages or illegal substances will be permanently prohibited from returning to the Site. Criminal or civil penalties may also apply.

D. Park construction equipment in designated areas only and provide spill control measures as discussed in paragraph 1.21 POLLUTION CONTROL.

E. Park employees' vehicles in designated areas only.

F. Obtain written permission of the Owner before entering privately-owned land outside of the Owner's property, rights-of-way, or easements.

G. Do not allow the use of loud radios, obnoxious, vulgar or abusive language, or sexual harassment in any form. These actions will cause immediate and permanent removal of the offender from the premises. Criminal or civil penalties may apply.

H. Require Workers to wear clothing that is inoffensive and meets safety requirements. Do not allow sleeveless shirts, shorts, exceedingly torn, ripped or soiled clothing to be worn on the project.

I. Do not allow firearms or weapons of any sort to be brought on to the Site under any conditions. No exception is to be made for persons with concealed handgun permits. Remove any firearms or weapons and the person possessing these firearms or weapons permanently and immediately from the Site.

1.09 POINTS OF ACCESS TO THE SITE

A. Restrict entry into Site to points where the easements cross state and county roads and highways or other publicly owned roads and streets. Keep operations within the easement.

B. Use State, County, or City roadways for construction traffic only with written approval of the appropriate representatives of each entity. State, County, or City roadways may not all be approved for construction traffic. Obtain written approval to use State, County, City or private roads to deliver pipe and/or heavy equipment to the Site. Copies of the written approvals must be furnished to the Owner as Record Data before Work begins. No additional compensation will be paid because the Contractor is unable to gain access to the easement from public roadways.

C. Maintain access to the facilities at all times. Do not obstruct roads, pedestrian walks, or access to the various buildings, structures, stairways, or entrances. Provide safe temporary walks or other structures to allow access for normal operations during construction.

D. Provide adequate and safe access for inspections. Leave ladders, bridges, scaffolding and protective equipment in place until inspections have been completed. Construct additional safe access if required for inspections.

E. Provide security at the construction Site as necessary to protect against vandalism and loss by theft.

F. Maintain security of the Site and access leading to it.

1. Close gates and keep locked.
2. Obtain permission of any landowners whose property must be crossed in gaining access to the Site.
3. Install a gate lock consisting of a chain with two locks. Give one lock and key to the landowner. Use one lock for the Contractor, Construction Manager and Owner. Provide keys to the Contractor's lock to Owner and Construction Manager.
4. At the end of the Project, remove the Contractor's lock from the assembly

1.10 PROPERTY PROVISIONS

A. Make adequate provisions to maintain the flow of storm sewers, drains and water courses encountered during the construction. Restore structures which may have been disturbed during construction to their original position as soon as construction in the area is completed.

B. Protect trees, fences, signs, poles, guy wires, and all other property unless their removal is authorized. Restore any property damaged to equal or better condition per Paragraph 1.11 of this Section.

C. Provide temporary fencing, with gates, to restrain livestock in areas where livestock are pastured unless the Contractor makes satisfactory arrangements with the property owner and/or tenant. Install temporary fence on the easement lines and removed after the trench has been backfilled. Pay damages for losses resulting from failure to maintain such barriers or failure of barriers to exclude livestock. Install temporary fencing on any tract in order to contain construction activities within easement limits if directed by the Owner.

1.11 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings show existing piping, valves, manholes, electrical conduits, utility poles, and other facilities based on information from available records. Examine the Site and review the available information concerning the Site.

1. Verify the type, size and location of all existing piping, valves, electrical conduit, telephone cable, and other utilities in the construction area prior to preparation of pipe shop drawings. Advise the Construction Manager of any utilities not shown or incorrectly shown.
2. Verify the type size and location of streets, driveways, fences, drainage structures, sidewalks, curbs, and gutters. Verify the elevations of the structures adjacent to excavations. Report discrepancies between these elevation and elevations shown on the Drawings to the Construction Manager before beginning construction.

B. Determine if existing structures, poles, piping, or other utilities at excavations will require relocation or replacement. Prepare a Plan of Action per Section 01 35 00, SPECIAL PROCEDURES. Coordinate Work with Construction Manager, local utility company and others. Include cost of demolition and replacement, restoration or relocation of these structures in the Contract Price.

C. Protect buildings, utilities, street surfaces, driveways, sidewalks, curb and gutter, fences, wells, drainage structures, piping, valves, manholes, electrical conduits, and other systems or structures unless they are shown to be replaced or relocated on the Drawings. Restore damage to items to be protected to the satisfaction of the Construction Manager utility owner or governing city without additional compensation from the Owner.

D. Carefully support and protect all structures and/or utilities so that there will be no failure or settlement where excavation or demolition endangers adjacent structures and utilities. Do not take existing utilities out of service unless show in the Contract Documents or approved by the Construction Manager. Notify and cooperate with the utility owner if it is necessary to move services, poles, guy wires, pipelines or other obstructions. Include the cost of relocation of existing utilities in the Contract Price.

E. Protect existing trees and landscaping at the Site.

1. Visit Site with Engineer to identify trees that may be removed during construction.
2. Mark trees to be removed with paint.
3. Protect trees to remain from damage by wrapping trunks with 2 x 4 timbers around the perimeter, securely wired in place, where machinery must operate around existing trees. Protect branches and limbs from damage by equipment.

1.12 DISRUPTION TO SERVICES / CONTINUED OPERATIONS

A. Existing facilities are to continue in service as usual during the construction unless noted otherwise. Owner or utilities must be able to operate and maintain the facilities. Disruptions to existing utilities, piping, process piping, or electrical services shall be kept to a minimum.

1. Do not restrict access to critical valves, operators, or electrical panels.
2. Do not store material or products inside structures.
3. Limit operations to the minimum amount of space needed to complete the specified Work.
4. Maintain storm sewers and sanitary sewers in service at all times. Provide temporary service around the construction or otherwise construct the structure in a manner that the flow is not restricted.

B. Provide a Plan of Action in accordance with Section 01 35 00, SPECIAL PROCEDURES if facilities must be taken out of operation.

1.13 CLEARING AND GRUBBING

A. Perform all clearing and grubbing necessary for the construction operations within the pipeline easements. Keep clearing of easements to within 2,000 feet of the pipe laying operation or as directed by Owner or indicated on the Drawings.

B. Avoid damage to existing trees outside the permanent easement that are larger than three inches in diameter (measured four feet above the ground). Protect trees per paragraph 1.11 of this section. Obtain approval from the Construction Manager before removing or trimming any tree larger than three inches in diameter located outside the permanent easement.

C. Remove and dispose of trees, branches, limbs, and roots leaving the right-of-way in a neat and presentable condition. Perform clearing and grubbing without injury or damage to adjacent property. Maintain the blade of equipment used for clearing and grubbing slightly above the ground surface to protect grass roots.

D. Remove all trees, stumps, slashing, brush or other debris removed from the Site before beginning construction. Select locations for dumping, acquire required permits and properly dispose of excess material. Do not allow burning without written approval of Construction Manager.

1.14 FIELD MEASUREMENTS

A. Perform complete field measurements for products required to fit existing conditions prior to purchasing products or beginning construction.

B. Verify property lines, control lines, grades, and levels indicated on the Drawings.

C. Verify pipe class, equipment capacities, existing electrical systems and power sources for existing conditions.

D. Check Shop Drawings and indicate the actual dimensions available where products are to be installed.

E. Include field measurements in record drawings as required in Section 01 31 13, PROJECT COORDINATION.

1.15 REFERENCE DATA AND CONTROL POINTS

A. The Construction Manager will provide the following control points:

1. Base line or grid reference points for horizontal control.
2. Benchmarks for vertical control.
3. Designated control points may be on an existing structure or monument.

B. Locate and protect control points prior to starting the Work and preserve permanent reference points during construction. Do not change or relocate points without prior approval of the Construction Manager. Notify Construction Manager when the reference point is lost, destroyed, or requires relocation. Replace Project control points on the basis of the original survey.

C. Provide complete engineering layout of the Work needed for construction.

1. Provide competent personnel. Provide equipment including accurate surveying instruments, stakes, platforms, tools, and materials.
2. Provide surveying with accuracy meeting the requirements established for Category 5 Construction Surveying as established in the Manual of Practice of Land Surveying in Texas published by the Texas Society of Professional Surveyors, latest revision.
3. Record data and measurements per standards.

1.16 CHANGE OF PIPELINE LOCATION

A. The alignment of the pipeline is shown on the Drawings, and no change is contemplated. It may be necessary to change the alignment due to utility conflicts, unanticipated variations in existing conditions, or for any other reason prior to the time pipe is actually installed.

B. No additional compensation will be paid to the Contractor except as provided by unit prices, unless excessive cost is incurred that is directly applicable to such changes and this cost is documented in accordance with the General / Supplemental Conditions. No compensation will be paid for specials, field cuts, field welds, or other incurred cost resulting from failure to locate existing utilities prior to manufacture of pipe.

1.17 DELIVERY AND STORAGE

A. Deliver products and materials to the Site in time to prevent delays in construction.

B. Deliver packaged products to Site in original undamaged containers with identifying labels attached. Open cartons as necessary to check for damage and to verify invoices. Reseal cartons and store until used. Leave products in packages or other containers until installed.

C. Deliver products that are too large to fit through openings to the Site in advance of the time enclosing walls and roofs are erected. Set in place, raised above floor on cribs.

D. Assume full responsibility for the protection and safekeeping of products stored at the Site.

E. Store products at locations acceptable to the Engineer and to allow Owner access to maintain and operate existing facilities.

F. Store products in accordance with the Supplier's storage instructions immediately upon delivery. Leave seals and labels intact, arrange storage to allow access for maintenance of stored items and for inspection. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

G. Obtain and pay for the use of any additional storage areas as needed for construction. Store products subject to damage by elements in substantial weather-tight enclosures or storage sheds. Provide and maintain storage sheds as required for the protection of products. Provide temperature, humidity control and ventilation within the ranges stated in the Supplier's instructions. Remove storage facilities at the completion of the Project.

H. Protect the pipe interior. Keep all foreign materials such as dirt, debris, animals, or other objects out of the pipe during the Work. Cap or plug ends of installed pipe in an approved manner when pipe is not being installed. Wash out pipe sections that become contaminated before continuing with installation. Take precautions to prevent the pipe from floating or moving out of the proper position during or after laying operations. Immediately correct any pipe that moves from its correct positions.

I. Provide adequate exterior storage for products that may be stored out-of-doors.

1. Provide substantial platforms, blocking, or skids to support materials and products above ground; slope to provide drainage. Protect products from soiling or staining.
2. Cover products subject to dislocation or deterioration from exposure to the elements, with impervious sheet materials. Provide ventilation to prevent condensation below covering.
3. Store loose, granular materials on clean, solid surfaces, or on rigid sheet materials, to prevent mixing with foreign matter.
4. Provide surface drainage to prevent erosion and ponding of water.
5. Prevent mixing of refuse or chemically injurious materials or liquids with stored materials.
6. Pipes and conduits stored outdoors are to have open ends sealed to prevent the entrance of dirt, moisture, and other injurious materials. Protect PVC pipe from ultraviolet light exposure.
7. Store light weight products to prevent wind damage.

J. Protect and maintain mechanical and electrical equipment in storage.

1. Provide Supplier's service instructions on the exterior of the package.
2. Service equipment on a regular basis as recommended by the Supplier. Maintain a log of maintenance services. Submit the log as Record Data at the completion of the Project.
3. Provide power to and energize space heaters for all equipment for which these devices are provided.
4. Provide temporary enclosures for all electrical equipment, including electrical systems on mechanical devices. Provide and maintain heat in the enclosures until equipment is energized.

K. Maintain storage facilities. Inspect stored products on a weekly basis and after periods of severe weather to verify that:

1. Storage facilities continue to meet specified requirements.
2. Supplier's required environmental conditions are continually maintained.

3. Surfaces of products exposed to the elements are not adversely affected.

L. Replace any stored item damaged by inadequate protection or environmental controls.

M. Payment may be withheld for any products not properly stored.

1.18 BLASTING

A. Blasting for excavations is not allowed.

1.19 ARCHAEOLOGICAL REQUIREMENTS

A. Cease operations immediately and contact the Owner for instructions if an historical or archaeological find is made during construction.

B. Conduct all construction activities to avoid adverse impact on the Sites where significant historical or archaeological Sites have been identified at the Site.

1. Obtain details for Working in these areas.
2. Maintain confidentiality regarding the Site.
3. Adhere to the requirements of the Texas Historical Commission.

C. Do not disturb Archaeological Sites.

1. Obtain the services of a qualified archaeological specialist to instruct construction personnel on how to identify and protect archaeological finds on an emergency basis.
2. Coordinate activities to permit Archaeological Work to take place within the area.
   a. Attempt to archaeologically clear areas needed for construction as soon as possible.
   b. Provide a determination of priority for such areas.

D. Assume responsibility for any unauthorized destruction that might result to such Sites by construction personnel, and pay all penalties assessed by the State or Federal agencies for non-compliance with these requirements.

E. Contract time will be modified to compensate for delays caused by such archaeological finds. No additional compensation shall be paid for delays.

1.20 STORM WATER POLLUTION CONTROL

A. Comply with the current requirements of TPDES General Permit No. TXR15000 (General Storm Water Permit) set forth by the Texas Commission on Environmental Quality for the duration of the Project:

1. Develop a Storm Water Pollution Prevention Plan meeting all requirements of the General Storm Water Permit.
2. Submit of a Notice of Intent to the Texas Commission on Environmental Quality.
3. Develop and implement appropriate Best Management Practices as established by local agencies of jurisdiction.
4. Provide all monitoring and/or sampling required for reporting to the Texas Commission on Environmental Quality
5. Submit reports to the Texas Commission on Environmental Quality as required as a condition of the permit
6. Submit copies of the reports to the Construction Manager as Record Data in accordance with Section 01 33 00 Submittals
7. Retain copies of these documents on site at all times for review and inspection by the Owner or regulatory agencies. Post a copy of the permit as required by regulations.
8. Pay all costs associated with complying with the provisions of the General Storm Water Permit. Assume solely responsible for implementing, updating, and modifying the General Storm Water Permit per regulatory requirements the Storm Water Pollution Prevention Plan and Best Management Practices.

B. Use forms required by the Texas Commission on Environmental Quality to file the Notice of Intent. Submit the Notice of Intent at least two days prior to the start of construction. Develop the Storm Water Pollution Prevention Plan prior to submitting the Notice of Intent. Provide draft copies of the Notice of Intent, Storm Water Pollution Prevention Plan, and any other pertinent Texas Commission on Environmental Quality submittal documents to Owner for review prior to submittal to the Texas Commission on Environmental Quality.

C. Return any property disturbed by construction activities to either specified conditions or pre-construction conditions as set forth in the Contract Documents. Provide an overall erosion and sedimentation control system that will protect all undisturbed areas and soil stockpiles/spoil areas. Implement appropriate Best Management Practices and techniques to control erosion and sedimentation and maintain these practices and techniques in effective operating condition during construction. Permanently stabilize exposed soil and fill as soon as practical during the Work.

D. Assume sole responsibility for the means, methods, techniques, sequences, and procedures for furnishing, installing, and maintaining erosion and sedimentation control structures and procedures and overall compliance with the General Storm Water Permit. Modify the system as required to effectively control erosion and sediment.

E. Retain copies of reports required by the General Storm Water Permit for three years from date of final completion.

1.21 POLLUTION CONTROL

A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.

B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.

1. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-Site locations in an acceptable manner.
2. Excavate contaminated soil and dispose at an off-Site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.
3. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal Site.
4. Comply with local, State and Federal regulations regarding the disposal of pollutants.

C. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.

1. Pump contaminated water to holding ponds constructed by the Contractor for this purpose, or discharge to areas on the interior of the Site, as designated by the Engineer.
2. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.
3. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.22 EARTH CONTROL

A. Remove excess soil, spoil materials and other earth not required for backfill at the time of generation. Control stock pile material to eliminate interference with Contractor and Owner's operations.

B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of the easements.

C. Place excess excavated material and neatly spread on tracts of land on which the pipeline is being constructed and where the property owner requests such material and the Construction Manager approves.

1.23 MANAGEMENT OF WATER

A. Manage water resulting from rains or ground water at the Site. Maintain trenches and excavations free of water at all times.

B. Lower the water table in the construction area by acceptable means if necessary to maintain a dry and workable condition at all times. Provide drains, sumps, casings, well points, and other water control devices as necessary to remove excess water.

C. Provide continuous operation of water management actions. Maintain standby equipment to provide proper and continuous operation for water management.

D. Ensure that water drainage does not damage adjacent property. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner. Assume responsibility for the discharge of water from the Site.

E. Remove the temporary construction and restore the Site in a manner acceptable to the Engineer and to match surrounding material at the conclusion of the Work.

1.24 CLEANING DURING CONSTRUCTION

A. Provide positive methods to minimize raising dust from construction operations and provide positive means to prevent air-borne dust from disbursing into the atmosphere. Control dust and dirt from demolition, cutting, and patching operations.

B. Clean the Project as Work progresses and dispose of waste materials, keeping the Site free from accumulations of waste or rubbish. Provide containers on Site for waste collection. Do not allow waste materials or debris to blow off of the Site. Control dust from waste materials. Transport waste materials with as few handlings as possible.

C. Comply with codes, ordinances, regulations, and anti-pollution laws. Do not burn or bury waste materials. Remove waste materials, rubbish and debris from the Site and legally dispose of these at public or private dumping areas.

1.25 MAINTENANCE OF ROADS, DRIVEWAYS, AND ACCESS

A. Maintain roads and streets in a manner that is suitable for safe operations of public vehicle during all phases of construction unless the Owner approves a street closing. Submit a written request for Owner's approval of a street closing. The request shall state:

1. The reason for closing the street.
2. How long the street will remain closed.
3. Procedures to be taken to maintain the flow of traffic.

Do not close public roads overnight.

B. Construct temporary detours, including by-pass roads around construction, with adequately clear width to maintain the free flow of traffic at all times. Maintain barricades, signs, and safety features around the detour and excavations.

C. Maintain road and driveway access to occupied buildings. Coordinate temporary closures or blockage with property owners, utilities, emergency service providers, Owner and Engineer. Property owners must be notified a minimum of two weeks or other time established by Owner prior to closure. Limit the time road out of service to eight (8) hours at Kings Road.

D. Maintain barricades, signs, and safety features around the Work in accordance with all provisions of the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD)

E. Assume responsibility for any damage resulting from construction along roads or drives.

1.26 CUTTING AND PATCHING

A. Perform cutting, fitting, and patching required to complete the Work or to:

1. Uncover Work to provide for installation of new Work or the correction of defective Work.
2. Provide routine penetrations of non-structural surfaces for installation of mechanical, electrical, and plumbing Work.
3. Uncover Work that has been covered prior to observation by the Engineer.

B. Submit written notification to the Engineer in advance of performing any cutting which affects:

1. Work of any other contractors or the Owner.
2. Structural integrity of any structure or system of the Project.
3. Integrity or effectiveness of weather exposed or moisture resistant structure or systems.
4. Efficiency, operational life, maintenance, or safety of any structure or system.
5. Appearance of any structure or surfaces exposed occasionally or constantly to view.

C. The notification shall include:

1. Identification of the Project.
2. Location and description of affected Work.
3. Reason for cutting, alteration, or excavation.
4. Effect on the Work of any separate contractor or Owner.
5. Effect on the structural or weatherproof integrity of the Project.
6. Description of proposed Work, including:
   a. Scope of cutting, patching, or alteration.
   b. Trades that will perform the Work.
   c. Products proposed for use.
   d. Extent of refinishing to be performed.
   e. Cost proposal, when applicable.
7. Alternatives to cutting and patching.
8. Written authorization from any separate contractor whose Work would be affected.
9. Date and time Work will be uncovered or altered.

D. Examine the existing conditions, including structures subject to damage or to movement during cutting or patching.

1. Inspect conditions affecting installation of products or performance of the Work after uncovering the Work.
2. Provide a written report of unacceptable or questionable conditions to the Engineer. The Contractor shall not proceed with Work until Engineer has provided further instructions. Beginning Work will constitute acceptance of existing conditions by the Contractor.

E. Protect the structure and other parts of the Work and provide adequate support to maintain the structural integrity of the affected portions of the Work. Provide devices and methods to protect adjacent Work and other portions of the Project from damage. Provide protection from the weather for portions of the Project that may be exposed by cutting and patching Work.

F. Execute cutting and demolition by methods which will prevent damage to other Work, and will provide proper surfaces to receive installation of repairs.

G. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

H. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to, the removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the modified Work.

I. Restore Work which has been cut or removed. Install new products to provide completed Work per the Contract Documents.

J. Fit Work air-tight to pipes, sleeves, ducts, conduit, and other penetrations through the surfaces. Where fire rated separations are penetrated, fill the space around the pipe or insert with materials with physical characteristics equivalent to fire resistance requirements of penetrated surface.

K. Patch finished surfaces and building components using new products specified for the original installation.

L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:

1. For continuous surfaces, refinish to the nearest intersection.
2. For an assembly, refinish the entire unit.

1.27 PRELIMINARY OCCUPANCY

A. Owner may deliver, install and connect equipment, furnishings, or other apparatus in buildings or other structures. These actions do not indicate acceptance of any part of the building or structure and does not affect the start of warranties or correction periods.

B. Protect the Owner's property after installation is complete.

C. Owner or Engineer may use any product for testing or determine that the product meets the requirements of the Contract Documents. This use does not constitute acceptance by either the Owner or Engineer. These actions do not indicate acceptance of any part of the product and does not affect the start of warranties or correction periods.

1.28 INITIAL MAINTENANCE

A. Maintain equipment until the Project is accepted by the Owner. Ensure that mechanical equipment is properly maintained as recommended by the Supplier.

B. Prior to acceptance of equipment, provide maintenance and start-up services per Section 01 75 00, STARTING AND ADJUSTING.

C. Remove and clean screens and strainers in piping systems.

D. Clean insects from intake louver screens.

2.00 PRODUCTS

2.01 MATERIALS

Provide materials in accordance with the requirements of the individual Sections.

3.00 EXECUTION

Perform the Work per the Supplier's published instructions. Do not omit any preparatory step or installation procedure unless specifically exempted or modified by Field Order.

END OF SECTION

1.00 GENERAL

1.01 WORK INCLUDED

A. Administer contract requirements to construct the project. Provide documentation per the requirements of this Section. Provide information as requested by the Construction Manager, Engineer, or Owner.

1.02 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00, SUBMITTALS.

1.03 COMMUNICATION DURING THE PROJECT

A. The Construction Manager is to be the first point of contact for all parties on matters concerning this project.

B. The Construction Manager will coordinate correspondence concerning:

1. Submittals, including Applications for Payment,
2. Clarification and interpretation of the Contract Documents,
3. Contract modifications,
4. Observation of work and testing, and
5. Claims.

C. The Construction Manager and Engineer will normally communicate only with the Contractor. Any required communication with Subcontractors or Suppliers will only be with the direct involvement of the Contractor.

D. Direct written communications to the Engineer at the address indicated at the Pre-construction Conference. Include the following with communications as a minimum:

1. Name of the Owner
2. Project name
3. Contract title
4. Project number
5. Date
6. A reference statement

E. Submit communications on the forms referenced in this Section or in Section 01 33 00, SUBMITTALS.

1.04 PROJECT MEETINGS

A. Pre-construction Conference

1. Attend a pre-construction meeting.
2. The location of the conference will be determined by the Construction Manager.
3. The time of the meeting will be determined by the Construction Manager but will be after the Notice of Award is issued and not later than fifteen (15) days after the Notice to Proceed is issued.
4. The Owner, Construction Manager, Engineer, representatives of utility companies, the Contractor's project manager and superintendent, and representatives from major Subcontractors and Suppliers may attend the meeting.
5. Provide and be prepared to discuss:
   a. Preliminary construction schedule per Section 01 32 16 CONSTRUCTION PROGRESS SCHEDULE.
   b. Preliminary submittal schedule per Section 01 33 00, SUBMITTALS.
   c. Schedule of values and anticipated schedule of payments per Section 01 29 00, PAYMENT PROCEDURES.
   d. List of Subcontractors and Suppliers.

e. Contractor's organizational chart as it relates to this project.
f. Letter indicating the agents of authority for the Contractor and the limit of that authority with respect to the execution of legal documents, contract modifications and payment requests.

B. Progress Meetings

1. Attend meetings with the Construction Manager, Engineer and Owner.
   a. Meet as requested by the Construction Manager to discuss the project.
   b. Meet at the project site or other location as designated by the Construction Manager.
   c. Contractor's superintendent and other key personnel are to attend the meeting. Other individuals may be requested to attend to discuss specific matters.
2. Provide information as requested by the Engineer or Owner concerning this project.
   a. Prepare to discuss:
      1) Status of overall project schedule.
      2) Contractor's detailed schedule for the next month.
      3) Anticipated delivery dates for equipment.
      4) Coordination with the Owner.
      5) Status of submittals.
      6) Information or clarification of the Contract Documents.
      7) Claims and proposed modifications to the contract.
      8) Field observations, problems, or conflicts.
      9) Maintenance of quality standards.
   b. Notify the Engineer of any specific items to be discussed a minimum of one week prior to the meeting.
3. Review minutes of meetings and notify the Construction Manager of any discrepancies within ten days of the date of the memorandum.
   a. Following that date, the minutes will stand as shown or as corrected.
   b. Corrections will be reflected in the minutes of the following meeting. Issues discussed will be documented and old issues will remain on minutes of subsequent meetings until the issue is resolved.

C. Pre-submittal and Pre-installation Meetings

1. Attend pre-submittal and pre-installation meetings as required in the individual technical specifications or as determined necessary by the Construction Manager (for example, instrumentation, roofing, concrete mix design, etc.).
2. The location of the meeting will be determined by the Construction Manager.
3. The time of the meeting will be determined by the Contractor when ready to proceed with the associated work, subject to submission of a Notification by Contractor (NBC) on the form shown in Section 01 31 13 13 FORMS and acceptance by the Construction Manager, Engineer and Owner of the proposed time.
4. The Owner, Construction Manager, Engineer, the Contractor's project manager and superintendent, and representatives from affected Subcontractors and Suppliers shall attend the meeting.

1.05 REQUESTS FOR INFORMATION

A. Submit Request for Information (RFI) to the Construction Manager to obtain additional information or clarification of the Contract Documents.

1. Submit a separate RFI for each item in the Contractor’s standard format.
2. Attach adequate information to permit a written response without further clarification. Construction Manager or Engineer will return requests that do not have adequate information to the Contractor for additional information. Contractor is responsible for all delays resulting from multiple submittals due to inadequate information.
3. A response will be made when adequate information is provided. Response will be made through Projectmates.

B. Response to an RFI is given to provide additional information, interpretation, or clarification of the requirements of the Contract Documents, and does not modify the Contract Documents.

C. Owner will initiate a Preliminary Contract Modification in Projectmates per Paragraph 1.07 if the RFI indicates that a contract modification is required.

1.06 NOTIFICATION BY CONTRACTOR

A. Notify the Construction Manager of:

1. Need for testing,
2. Intent to work outside regular working hours,
3. Request to shut down facilities or utilities,
4. Proposed utility connections,
5. Required observation by Engineer or inspection agencies prior to covering work and
6. Training.

B. Provide notification a minimum of two weeks in advance in order to allow Owner, Construction Manager, and / or Engineer time to respond appropriately to the notification.

1.07 REQUESTS FOR MODIFICATIONS

A. Submit a request to the Construction Manager for any change in the Contract Documents.

1. Assign a number to the Preliminary Contract Modification when issued.
2. Include with the Preliminary Contract Modification:
   a. A complete description of the proposed modification.
   b. The reason the modification is requested.
   c. A detailed breakdown of the cost of the change (necessary only if the modification requires a change in contract amount). The itemized breakdown is to include:
      1) list of materials and equipment to be installed,
      2) man hours for labor by classification,
      3) equipment used in construction,
      4) consumable supplies, fuels, and materials,
      5) royalties and patent fees,
      6) bonds and insurance,
      7) overhead and profit,
      8) field office costs, and
      9) home office cost,
      10) other items of cost.
   d. Provide the level of detail outline in the paragraph above for each Subcontractor or Supplier actually performing the Work if work is to be provided by a Subcontractor or Supplier. Indicate appropriate Contractor mark ups for Work provided through Subcontractors and Suppliers. Provide the level of detail outline in the paragraph above for self-performed Work.
   e. Provide a revised schedule indicating the effect on the critical path for the project and a statement of the number of days the project may be delayed by the modification.
3. A Preliminary Contract Modification is required for all substitutions or deviations from the Contract Documents that involve potential project cost impacts.
4. The Owner and the Engineer will evaluate the request for a preliminary contract modification.

B. Owner will initiate changes through the Engineer.

1. The Owner or Engineer will prepare a description of proposed modifications to the Contract Documents.
2. Owner will assign a number to the Preliminary Contract Modification when issued.

C. Engineer will issue a Field Order or a Change Order per the General Conditions if a contract modification is appropriate.

1. Modifications to the contract can only be made by a Change Order.
2. Changes in the project will be documented by a Field Order or by a Change Order.
3. Field Orders may be issued by the Engineer for contract modifications that do not change the Contract Price or Contract Time.
4. Any modifications that require a change in Contract Price or Contract Time can only be approved by Change Order.
    a. Proposals issued by the Contractor in response to a Preliminary Contract Modification will be evaluated by the Engineer.
    b. If the Preliminary Contract Modification is acceptable, the Contractor will be notified in writing. This will constitute the authorization to proceed with the work.
    c. Depending on the amounts involved, several Preliminary Contract Modifications may be collected into a contract Change Order.
    d. Change Orders can only be approved by the North Texas Municipal Water District Board of Directions. Upon approval, the Owner will prepare the Change Order for execution between the Contractor and the Owner.

D. The Contractor may be informed that the Preliminary Contract Modification is not approved and construction is to proceed in accordance with the Contract Documents.

1.08 RECORD DRAWINGS

A. Maintain at the Site one complete record copy of:

1. Drawings,
2. Specifications,
3. Addenda,
4. Contract modifications,
5. Approved Shop Drawings and record data,
6. Test records,
7. Clarifications and other information provided in Request for Information responses, and
8. Reference standards

B. Store documents and samples in the Contractor's field office.

1. Documents are to remain separate from documents used for construction. Do not use these documents for construction.
2. Provide files and racks for the storage of documents.
3. Provide a secure storage space for the storage of samples.
4. Maintain documents in clean, dry, legible conditions, and in good order.
5. Make documents and samples available at all times for inspection by the Construction Manager, Engineer and Owner.

C. Marking Drawings:

1. Label each document as "Project Record" in large printed letters.
2. Record information as construction is being performed.
    a. Do not conceal any Work until the required information is recorded.
    b. Mark drawings to record actual construction, including the following:
        1) Depths of various elements of the foundation in relation to finished first floor datum or the top of walls.
        2) Horizontal and vertical locations of underground utilities and appurtenances constructed and existing utilities encountered during construction.
        3) Location of internal utilities and appurtenances concealed in the construction. Refer measurements to permanent structure on the surface. Include the following equipment:
            a) Piping,
            b) Ductwork,
            c) Equipment and control devices requiring periodic maintenance or repair,
            d) Valves, unions, traps, and tanks,
            e) Services entrance,

f) Feeders, and
g) Outlets.

4) Changes of dimension and detail,
5) Changes made by Field Order and Change Order,
6) Details not on the original Drawings. Include field verified dimensions and clarifications, interpretations, and additional information issued in response to Requests for Information.

c. Mark Specifications and Addenda to identify products provided.
   1) Record product name, trade name, catalog number, and each Supplier (with address and phone number) of each product and item of equipment actually installed.
   2) Record changes made by Field Order and Change Order.

d. Mark additional work or information in erasable pencil.
   1) Use red for new or revised indication.
   2) Use purple for Work deleted or not installed (lines to be removed).
   3) Highlight items constructed per the Contract Documents in yellow.

e. Submit record documents to Engineer for review and acceptance 30 days prior to final completion of the project.
   1) Provide one set of marked up drawings.

D. Applications for Payment will not be recommended for payment if record documents are found to be incomplete or not in order. Final payment will not be recommended without complete record documents.

END OF SECTION

01 31 13.13 FORMS

1.00 GENERAL

1.01 WORK INCLUDED

A. Use the forms shown in ProjectMates or as provided in this section for contract administration, submittals and documentation of test results. Forms included are listed below:

1. Application for Payment forms
2. Equipment List Form
    a. Maintenance Summary Form
3. Testing forms
    a. Pressure Pipe Test Report
    b. Protective Coating Test Report
    c. Density Test Report
    d. TV Camera Inspection Report
4. Project closeout forms
    a. Consent of Surety Company to Final Payment
    b. Consent of Surety Company to Reduction of or Partial Release of Retainage.
    c. Contractor's Affidavit of Payment of Debts and Claims
    d. Contractor's Affidavit of Release of Liens

B. The following forms shall be provided, as needed, in the Contractor or Manufacture’s standard format, subject to approval:

1. Request for information
2. Notification by Contractor (NBC)
3. Preliminary Contract Modification
4. Submittal Transmittal

END OF SECTION

01 31 24 INTERNET BASED CONSTRUCTION MANAGEMENT SYSTEM

1.00 GENERAL

1.01 WORK INCLUDED

A. The Owner will utilize an Internet-based project delivery management system to manage this project.

B. The project website will provide server space and secured access to staff members representing the Owner, Engineer, and Contractor. Each user will have a separate log-in name and password to access the website.

1. Upon receipt of Notice of Award, Contractor to designate the lead person who will automatically receive notifications when responses are made to contractor postings. Contractor is allowed to request one additional user as support or back-up.
2. Instruction for login and use of system will be provided prior to pre-construction meeting.

C. Contract management related documents will be submitted, tracked, responded to, and made available to the Owner, Engineer and Contractor through the management system.

1.02 REQUIREMENTS

A. The Contractor will be required to make all submittals in electronic format by utilizing the designated construction management system. Process will be discussed at the pre-construction meeting.

B. The website includes a secured document management system for storing and making available to the project team the following:

1. Ability to store files and correspondence.
2. Latest drawings and specifications.
3. Project progress photos.

All electronic documents are considered record on file upon system receipt.

C. The website will include the following database driven applications. The system is designed to inform team members regarding new or updated documents and automatic task assignment and overdue notifications. The following items shall be entered, submitted, tracked, and responded to on-line:

1. Document Management
2. Construction Schedule
3. Meeting Minutes
4. RFIs (Requests for Information)
5. Submittals
6. CTRs (Certified Test Reports)
7. Owner Inspector Daily Field Report.
8. Contractor’s Site Visit Reports
9. PCOs (Proposed Change Order)
10. Change Orders
10. Applications for Payment with Schedule of Values
11. Warranty documents
12. Test Reports

1.03 ARCHIVES

A. Owner’s chosen web based project delivery management application is capable of archiving all files on the website.

B. All data from the website, such as RFIs, submittals, etc. will be available in the archive.

2.00 PRODUCTS

2.01 SOFTWARE

A. The actual software product to be used will be determined by the Owner.

3.00 EXECUTION

3.01 ORIENTATION

A. Contractor will receive system orientation by email. Orientation email will contain login instructions, video tutorials, user guide and access to system provided online training resources. Additional training can be done at the request of Contractor at no additional expense to the Contractor.

3.02 SUPPORT

A. Contractor shall contact Owner for initial system support. Owner will determine if Project Controls is to be contacted for further support. System support is provided at no additional expense to Contractor.

3.03 OPERATION

A. Contractor shall maintain high speed access to the internet for the Contractor and Owner to have access to and use of system at the jobsite trailers as well as on mobile devices.

3.04 DURATION

A. The website will be active for the duration of project delivery and a minimum of 3 months past final completion at which time the project file will be archived.

3.05 ARCHIVES

A. All files on the website will be archived at the end of the project. The archive file will be made available upon request by Contractor no sooner than 3 months past final completion.

END OF SECTION

1.00 GENERAL

1.01 REQUIREMENTS

A. Prepare and submit a progress schedule for the Work and update the schedule on a monthly basis for the duration of the Project.

B. Provide schedule in adequate detail to allow Owner to monitor the work progress, to anticipate the time and amount of Applications for Payment, and to relate submittal processing to sequential activities of the Work.

C. Incorporate and specifically designate the dates of anticipated submission of submittals and the dates when submittals must be returned to the Contractor into the schedule.

D. Assume complete responsibility for maintaining the progress of the Work per the submitted schedule.

E. Take all requirements of Section 01 35 00, SPECIAL PROCEDURES into consideration when preparing schedule.

1.02 SUBMITTALS

A. Submit progress schedules in accordance with Section 01 33 00, SUBMITTALS. Submit schedules within the following times:

1. Preliminary schedule within 10 days after the Notice of Award. The schedule is to be available at the pre-construction conference.
2. Detailed schedule at least 10 days prior to the first payment request.

B. Submit progress schedules with Applications for Payment. Schedules may be used to evaluate the Applications for Payment. Failure to submit the schedule may cause delay in the review and approval of Applications for Payment.

1.03 SCHEDULE REQUIREMENTS

A. Schedule is to be in adequate detail to:

1. Assure adequate planning, scheduling, and reporting during the execution of the Work.
2. Assure the coordination of the Work of the Contractor and the various Subcontractors and Suppliers.
3. Assist in monitoring the progress of the work.
4. Assist in evaluating proposed changes to Contract Time and project schedule.
5. Assist the Owner in review of Contractor's Application for Payment.

B. Provide personnel with five (5) years minimum experience in scheduling construction work comparable to this project.

C. Provide the schedule in the form of a time scaled horizontal bar chart which indicates graphically the Work scheduled at any time during the Project. The graph is to indicate:

1. Complete sequence of construction by activity.
2. Identification of the activity by structure, location, and type of Work.
3. Chronological order of the start of each item of work.
4. The activity start and stop dates.
5. The activity duration.
6. Successor and predecessor relationships for each activity. Group related activities or use lines to indicate relationships.
7. A clearly indicated critical path. Indicate only one critical path on the schedule. The subsystem with the longest time of completion is the critical path where several subsystems each have a critical path. Float time is to be assigned to other subsystems.
8. Projected percentage of completion, based on dollar value of the Work included in each activity as of the day Applications for Payment are due of each month.

D. Submit a separate submittal schedule indicating the dates when the submittals are to be sent to the Engineer.

1. List specific dates submittal is to be sent to the Engineer.
2. List specific dates submittal must be processed in order to meet the proposed schedule.
3. Allow a reasonable time to review submittals, taking into consideration the size and complexity of the submittal, the submission of other submittals, and other factors that may affect review time.
4. Allow time for re-submission of the submittals for each item. Contractor is responsible for delays associated with additional time required to review incomplete or erroneous submittals and for the time lost when submittals are submitted for products that do not meet specification requirements.

E. Update the schedule at the end of each monthly partial payment period to indicate the progress made on the project to that date.

1.04 SCHEDULE REVISIONS

A. Submit a written report if the schedule indicates that the Project is more than thirty (30) days behind schedule. The report is to include:

1. Number of days Project is behind schedule.
2. Narrative description of the steps to be taken to bring the Project back on schedule.
3. Anticipated time required to bring the Project back on schedule.

B. Submit a revised schedule indicating the action that the Contractor proposes to take to bring the Project back on schedule.

C. Revise the schedule to indicate any adjustments in Contract Time approved by Change Order.

1. Revised schedule is to be included with Contract Modification Request for which an extension of time is requested.
2. Failure to submit a revised schedule indicates that the modification shall have no impact on the ability of the Contractor to complete the project on time and that the cost associated with the change of additional plant or work force have been included in the cost proposed for the modification.

D. Updating the project schedule to reflect actual progress is not considered a revision to the project schedule.

E. Applications for Payment will not be recommended for payment without a revised schedule and if required, the report indicating the Contractor's plan for bringing the project back on schedule.

1.05 FLOAT TIME

A. Define float time as the amount of time between the earliest start date and the latest start date of a chain of activities on the construction schedule.

B. Float time is not for the exclusive use or benefit of either the Contractor or Owner.

C. Contract time cannot be changed by the submission of this schedule. Contract Time can only be modified by approved Change Order.

D. Schedule completion date must be the same as the contract completion date. Time between the end of construction and the contract completion date is to be indicated as float time.

END OF SECTION

01 32 33 PHOTOGRAPHIC DOCUMENTATION

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide a video recording with audio and narration of the Site prior to the beginning of construction. The narration shall describe what is being shown in the video, including building/process, manhole number, pipeline and station number, etc. as applicable.

1. Record the condition of all existing facilities in or abutting the construction area (right-of-way) including but not limited to streets, curb and gutter, utilities, driveways, fencing, landscaping, etc.
2. Record after construction staking is complete but prior to any clearing where possible.
3. Upload the recording, with label and date into the Internet based Construction Management System before the start of construction. Provide additional recording as directed by the Construction Manager if the recording provided is not considered suitable for the purpose of recording conditions prior to construction.

B. Furnish an adequate number of photographs of the Site to clearly depict the completed project.

1. Provide a minimum of ten different views.
2. Photograph a panoramic view of the entire project site.
3. Photograph all significant areas of completed construction.
4. Completion photographs are not to be taken until all construction trailers, excess materials, trash and debris have been removed.

C. All photographs, video recordings are to become the property of the Owner. Photographs or recordings may not be used for publication, or public or private display without the written consent of the Owner.

1.02 QUALITY ASSURANCE

A. Provide clear photographs and recordings taken with proper exposure. View photographs and recordings in the field and take new photographs or recordings immediately if photos of an adequate print quality cannot be produced or video quality is not adequate. Provide photographs with adequate quality and resolution to permit enlargements.

1.03 SUBMITTALS

A. Submit photographic documentation as record data in accordance with Section 01 33 00, SUBMITTALS.

2.00 PRODUCTS

2.01 PHOTOGRAPHS

A. Upload photographs in digital format with a minimum resolution of 1280 X 960, accomplished without a digital zoom.
B. Take photographs at locations acceptable to the Construction Manager.
D. Identify each digital file name with:
1. Date, time, location, and orientation of the exposure.
2. Description of the subject of photograph.

2.02 VIDEO RECORDING

A. Upload digital format to ProjectMates in format that allows playback within Windows Media player in common format in full screen.

B. Provide digital format on DVD that can be played on Windows Media Player in common format in full screen mode.

C. Identifying project on tape by audio or visual means.

END OF SECTION

1.00 GENERAL

1.01 WORK INCLUDED

A. Submit documentation as required by the Contract Documents and as reasonably requested by the Owner, Construction Manager and Engineer to:

1. Record the products incorporated into the Project for the Owner.
2. Provide information for operation and maintenance of the Project.
3. Provide information for the administration of the Contract.
4. Allow the Engineer to advise the Owner if products proposed for the project by the Contractor conform, in general, to the design concepts of the Contract Documents.

B. Contractor's responsibility for full compliance with the Contract Documents is not relieved by the Engineer's review of submittals. Contract modifications may only be approved by Change Order or Field Order.

C. Contractor shall utilize the Internet Based Construction Management System (Projectmates) as stated in Section 01 31 24 INTERNET BASED CONSTRUCTION MANAGEMENT SYSTEM.

1.02 CONTRACTOR'S RESPONSIBILITIES

A. Review all submittals prior to submission.

B. Determine and verify:

1. Field measurements.
2. Field construction requirements.
3. Location of all existing structures, utilities and equipment related to the submittals.
4. Submittals are complete for their intended purpose.
5. Conflicts between the submittals related to the various Subcontractors and Suppliers have been resolved.
6. Quantities and dimensions shown on the submittals.

C. Submit information per the procedures described in this section and the detailed specifications.

D. Furnish the following submittals:

1. As specified in the attached Submittal Schedule.
2. Schedules, data and other documentation as described in detail in this section or referenced in the General Conditions.
3. Documentation required for the administration of the Contract per Section 01 31 13, PROJECT COORDINATION.
4. Shop Drawings required for consideration of a contract modification per Paragraph 1.08.
5. Submittals as required in the Specifications.
6. Submittals not required will be returned without Engineer's review.

E. Submit a schedule indicating the date submittals will be sent to the Engineer and proposed dates that the product will be incorporated into the project. Make submittals promptly in accordance with the schedule so as to cause no delay in the Project.

1. Send submittals to ProjectMates allowing a reasonable time for review. Include time for review of a resubmission if necessary. Allow adequate time for the submittal review process, ordering, fabrication, and delivery of the product so as to not delay progress on the Project.
2. Schedule submittal to provide all information for interrelated work at one time. No review will be performed on submittals requiring coordination with other submittals. Engineer will return submittals for resubmission as a complete package.

F. Submit information for all of the components and related equipment required for a complete and operational system in the same submittal.

1. Include electrical, mechanical, and other information required to indicate how the various components of the system function.
2. Provide certifications, warranties, and written guarantees with the submittal package for review when they are required.

G. Fabrication or installation of any products prior to the approval of Shop Drawings is done at the Contractor's risk. Products not meeting the requirements of Contract Documents are defective and may be rejected at the Owner's option.

H. Payment will not be made for products for which submittals are required until the submittals have been received. Payment will not be made for products for which Shop Drawings or Samples are required until these are approved by the Engineer.

1.03 QUALITY ASSURANCE

A. Submit legible, accurate, complete documents presented in a clear, easily understood manner. Submittals not meeting these criteria will be returned without review.

B. Demonstrate that the proposed products are in full and complete compliance with the design criteria and requirements of the Contract Documents including Drawings and Specifications as modified by Addenda, Field Orders, and Change Orders.

C. Furnish and install products that fully comply with the information included in the submittal.

D. Review and approve submittals prior to submitting them to the Engineer for review. Submittals will not be accepted from anyone other than the Contractor.

1.04 SUBMITTAL PROCEDURES

A. Deliver submittals to ProjectMates system unless otherwise stated at the pre-construction conference. The complete contents of each submittal, including associated drawings product data, etc., shall be submitted in Adobe Acrobat PDF format, or other format approved by Engineer.

1. Assign the number consisting of a prefix, a sequence number, and a letter suffix. Prefixes shall be as follows:

Prefix	Description	Originator
CO	Change Order	Owner
PCO	Preliminary Change Order	Contractor
EIR	Equipment Installation Report	Contractor
FO	Field Order	Engineer
O&M	Operation & Maintenance Manuals	Contractor
RFI	Request for Information	Contractor
SD	Shop Drawing	Contractor

2. Issue sequence numbers in chronological order for each type of submittal.
3. Issue numbers for resubmittals that have the same number as the original submittal followed by an alphabetical suffix indicating the number of times the same submittal has been sent to the Engineer for processing. For example: SD-025-A represents a shop drawing that is the twenty-fifth submittal of this type and is the second time this submittal has been sent for review.
4. Clearly note the submittal number on each page or sheet of the submittal.
5. Correct assignment of numbers is essential since different submittal types are processed in different ways.

B. Submit attachments with uniform markings and page sizes.

1. Paper size shall allow for ease of reproduction.
   a. Submit documents on 8-1/2" X 11" paper where practical.
   b. Use 11" X 17" paper for larger drawings and schematics.
   c. Use full size sheets for fabrications and layout drawings. Reproducible drawings may be submitted in lieu of prints.
2. Mark submittals to:
   a. Indicate Contractor's corrections in green.
   b. Highlight items pertinent to the products being furnished in yellow and strike items that are not pertinent when the Supplier's standard drawings or information sheets are provided.
   c. Cloud items and highlight in yellow where selections by the Engineer or Owner are required.
   d. Mark dimensions with the prefix FD to indicate field verified dimensions on the drawings.
   e. Provide a blank space 8" x 3" for Contractor's and Engineer's stamp.
3. Define abbreviations and symbols used in Shop Drawings.
   a. Use terms and symbols in Shop Drawings consistent with the Contract Drawings.
   b. Provide a list of abbreviations and their meaning as used in the Shop Drawings.
   c. Provide a legend for symbols used on Shop Drawings.

C. Mark submittals to reference the Drawing number and/or section of the Specifications, detail designation, schedule or location that corresponds with the data submitted. Other identification may also be required, such as layout drawings or schedules to allow the reviewer to determine where a particular product is to be used.

D. Deliver samples required by the Specifications to the project site. Provide a minimum of two (2) samples.

E. Construct mock-ups from the actual products to be used in construction per Specifications.

F. Submit color charts and Samples for every product requiring color, texture or finish selection.

1. Submit all color charts and Samples at one time.
2. Do not submit color charts and Samples until all record data have been submitted or Shop Drawings for the products have been approved.
3. Submit color charts and Samples not less than thirty (30) days prior to when these products are to be ordered or released for fabrication to comply with the schedule for construction of the Project.

G. Submit Preliminary Change Order per Section 01 31 13, PROJECT COORDINATION to request modifications to the Contract Documents.

1.05 REVIEW PROCEDURES

A. Shop drawings are reviewed in the order received, unless Contractor request that a different priority be assigned.

B. Mark a submittal as "Priority" to place the review for this submittal ahead of submittals previously delivered. Priority submittals will be reviewed before other submittals for this Project which have been received but not reviewed. Use discretion in the use of "Priority" submittals as this may delay the review of submittals previously submitted. Revise the Schedule of Contractor's Submittals for substantial deviations from the previous schedule.

C. Review procedures vary with the type of submittal as described in Paragraph 1.06.

1.06 SUBMITTAL REQUIREMENTS

A. Shop Drawings are required for those products that cannot adequately be described in the Contract Documents to allow fabrication, erection or installation of the product without additional detailed information from the Supplier.

1. Shop drawings are requested so that the Engineer can:
   a. Assist the Owner in selecting colors, textures or other aesthetic features.

b. Compare the proposed features of the product with the specified features so as to advise the Owner that the product does, in general, conform to the Contract Documents.
c. Compare the performance features of the proposed product with those specified so as to advise the Owner that it appears that the product will meet the designed performance criteria.
d. Review required certifications, guarantees, warranties, and service agreements for compliance with the Contract Documents.

2. Certify that Contractor has reviewed the Shop Drawings and made all necessary corrections such that the products, when installed, will be in full compliance with the Contract Documents per Section 00 73 00, Supplementary Conditions. Shop Drawings submitted without this certification will be returned without review.
3. Submit Shop Drawings for:
   a. Products indicated in the submittal schedule following this section.
   b. When a substitution or equal product is proposed in accordance with Paragraph 1.08 of this Section.
4. Include a complete description of the material or equipment to be furnished. Information is to include:
   a. Type, dimensions, size, arrangement, model number, and operational parameters of the components.
   b. Weights, gauges, materials of construction, external connections, anchors, and supports required.
   c. Performance characteristics, capacities, engineering data, motor curves, and other information necessary to allow a complete evaluation of mechanical components.
   d. All applicable standards such as ASTM or Federal specification numbers.
   e. Fabrication and installation drawings, setting diagrams, manufacturing instructions, templates, patterns, and coordination drawings.
   f. Wiring and piping diagrams and related controls.
   g. Mix designs for concrete, asphalt, or other materials proportioned for the Project.
   h. Complete and accurate field measurements for products which must fit existing conditions. Indicate on the submittal that the measurements represent actual dimensions obtained at the site.
5. Provide all required statements of certification, guarantees, extended service agreements, and other related documents with the Shop Drawing. The effective date of these documents shall be the date of acceptance of the work by the Owner.
6. Comments will be made on items called to the attention of the Engineer for review and comment. Any marks made by the Engineer do not constitute a blanket review of the submittal or relieve the Contractor from responsibility for errors or deviations from the Contract requirements.
   a. Submittals that are reviewed will be returned with one or more of the following designations:
      1) Approved - Submittal is found to be acceptable as submitted.
      2) Approved as Noted - Submittal is acceptable with corrections or notations made by Engineer and may be used as corrected.
      3) Revise and Resubmit - Submittal has deviations from the Contract Documents, significant errors, or is inadequate and must be revised and resubmitted for subsequent review.
      4) Not Approved - Products are not acceptable.
   b. Drawings with a significant or substantial number of markings by the Contractor may be marked "Approved as Noted" and "Revise and Resubmit". These drawings are to be revised to provide a clean record of the submittal.
   c. Dimensions or other data that do not appear to conform to the Contract Documents will be marked as "At Variance With" (AVW) the Contract Documents or other information provided. The Contractor is to make revisions as appropriate to comply with Contract Documents.

B. Certifications, Warranties and Service Agreements include documents as specified in the detailed specifications, as shown in the submittal schedule or as follows:

1. Certified Test Reports (CTR) - A report prepared by an approved testing agency giving results of tests performed on products to indicate their compliance with the specifications. (Refer to Section 01 40 00, QUALITY REQUIREMENTS.)
2. Certification of Local Field Service (CLS) - A certified letter stating that field service is available from a factory or supplier approved service organization located within a 50 mile radius of the project site. List names, addresses, and telephone numbers of approved service organizations on or attach to the certificate.
3. Extended Warranty (EW) - A guarantee of performance for the product or system beyond the normal one year correction period described in the General Conditions. **[5]** Issue the warranty certificate in the name of the Owner.
4. Extended Service Agreement (ESA) - A contract to provide maintenance beyond that required to fulfill requirements for warranty repairs, or to perform routine maintenance for a definite period of time beyond the warranty period. Issue the service agreement in the name of the Owner.
5. Certification of Adequacy of Design (CAD) - A certified letter from the manufacturer of the equipment stating that they have designed the equipment to be structurally stable and to withstand all imposed loads without deformation, failure, or adverse effects to the performance and operational requirements of the unit. The letter shall state that mechanical and electrical equipment is adequately sized to be fully operational for the conditions specified or normally encountered by the product's intended use.
6. Certification of Applicator/Subcontractor (CSQ) - A certified letter stating that the Subcontractor or Supplier proposed to perform a specified function is duly designated as factory authorized and trained for the application of the specified product.

C. Submit record data to provide information to allow the Owner to adequately identify the products incorporated into the project and allow replacement or repair at some future date.

1. Provide record data for all products. Record data is not required for items for which Shop Drawings and/or operations and maintenance manuals are required.
2. Provide information only on the specified products. Submit a Preliminary Change Order for approval of deviations or substitutions and obtain approval by Field Order or Change Order prior to submitting record data.
3. Provide the same information required for Shop Drawings.
4. Record data will be received by the Engineer, logged, and provided to Owner for the Project record.
   a. Record data may be reviewed to see that the information provided is adequate for the purpose intended. Inadequate drawings will be returned as unacceptable.
   b. Record data is not reviewed for compliance with the Contract Documents. Comments may be returned if deviations from the Contract Documents are noted during the cursory review performed to see that the information is adequate.

D. Provide Samples for comparison with products delivered to the Site for use on the Project.

1. Samples shall be of sufficient size and quantity to clearly illustrate the functional characteristics of the product, with integrally related parts and attachment devices.
2. Indicate the full range of color, texture, and patterns.
3. Dispose of Samples when related Work has been completed and approved, and disposal is requested by the Engineer. At Owner's option Samples will become the property of the Owner.

E. Construct mock-ups for comparison with the work being performed.

1. Construct mock-ups of the size or area indicated in the detailed Specifications.
2. Construct mock-ups complete with texture and finish to represent the finished product.
3. Protect mock-ups until Work has been completed and accepted by the Owner.
4. Dispose of mock-ups when related Work has been completed and disposal is approved by the Engineer.

F. Submit Operation and Maintenance manuals (O&M) for all equipment, mechanical devices, or components described in the Contract Documents per Section 01 78 23, OPERATION AND MAINTENANCE DATA. Include copies of approved Shop Drawings in the manual.

G. Submit Request for Information (RFI) in accordance with Section 01 31 13, PROJECT COORDINATION.

H. Submit a Schedule of Values and Application for Payment (AP) in accordance with Section 01 29 00, PAYMENT PROCEDURES.

I. Submit Progress Schedules (SCH) in accordance with Section 01 32 16 CONSTRUCTION PROGRESS SCHEDULES.

J. Submit Certified Test Reports (CTR) from independent testing laboratories in accordance with Section 01 40 00, QUALITY REQUIREMENTS.

1. Submit test reports for material fabricated for this project with Shop Drawings for that product.
2. Submit test reports produced at the point of production for standard production products with the record data for that product.

K. Submit a list of Suppliers and Subcontractors as record data in accordance with Section 01 31 13, PROJECT COORDINATION.

L. Submit Equipment Installation Reports (EIR) in accordance with Section 01 75 00, STARTING AND ADJUSTING.

M. Submit Notifications by Contractor (NBC) in accordance with Section 01 31 13, PROJECT COORDINATION.

1.07 REQUESTS FOR DEVIATION

A. Submit requests for deviations from the Contract Documents for any product that does not fully comply with the Contract Documents.

B. Submit request for deviations by Preliminary Change Order in the Contractor’s standard format per Section 01 31 13, PROJECT COORDINATION. Identify the deviations and the reason the change is requested.

C. Include the amount if cost savings to the Owner for deviations that result in a reduction in cost.

D. A Change Order or Field Order will be issued by the Engineer for deviations, if approved. Deviations from the Contract Documents require specific approval by the Owner and the Engineer.

1.08 SUBMITTALS FOR EQUAL NON-SPECIFIED PRODUCTS

A. The products of the listed suppliers are to be furnished where detailed specifications list several manufacturers but do not specifically list "or equal" or "or approved equal" products. Use of any products other than those specifically listed is a substitution and must be approved per Paragraph 1.09.

B. Contractor may submit other manufacturers' products that are in full compliance with the specification where detailed specifications list one or more manufacturers followed by the phase "or equal" or "or approved equal".

1. Submit Shop Drawings of adequate detail to document that the proposed product is equal or superior to the specified product.
2. Prove that the product is equal. It is not the Engineer's responsibility to prove the product is not equal.
   a. Indicate on a point by point basis for each specified feature that the product is equal to the Contract Document requirements.
   b. Make a direct comparison with the specified manufacturer's published data sheets and available information. Provide this printed material with the submittal.
   c. The decision of the Engineer regarding the acceptability of the proposed product is final.

3. Provide a typewritten certification that, in furnishing the proposed product as an equal, the Contractor:
   a. Has thoroughly examined the proposed product and has determined that it is equal or superior in all respects to the product specified.
   b. Has determined that the product will perform in the same manner as the specified product.
   c. Will provide the same warranties and/or bonds as for the product specified.
   d. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the product into the Work and will waive all claims for additional materials or effort which may be necessary to incorporate the product into the Project.
   e. Will maintain or improve the delivery and installation schedule as for the specified product.
4. A modification request is not required for any product that is in complete compliance with the Contract Documents.

1.09 SUBMITTALS FOR SUBSTITUTIONS

A. Substitutions are defined as any product that the Contractor proposes to provide for the Project in lieu of the specified product.

B. Submit the following for consideration of approval of a Supplier or product which is not specified:

1. Submit request for deviation from the Contract Documents per Paragraph 1.07.
2. Prove that the product is acceptable as a substitute. It is not the Engineer's responsibility to prove the product is not acceptable as a substitute.
   a. Indicate on a point by point basis for each specified feature that the product is acceptable to meet Contract Documents requirements.
   b. Make a direct comparison with the specified Supplier's published data sheets and available information. Provide this printed material with the submittal.
   c. The decision of the Engineer regarding the acceptability of the proposed substitute product is final.
3. Provide a typewritten certification that, in making the substitution request, the Contractor:
   a. Has determined that the substituted product will perform in substantially the same manner and result in the same ability to meet the specified performance as the specified product.
   b. Will provide the same warranties and/or bonds for the substituted product as specified or as would be provided by the Manufacturer of the specified product.
   c. Will assume all responsibility to coordinate any modifications that may be necessary to incorporate the substituted product into the project and will waive all claims for additional Work which may be necessary to incorporate the substituted product into the Project which may subsequently become apparent.
   d. Will maintain the same time schedule as for the specified product.

C. Pay engineering cost for review of substitutions.

1. Cost for additional review time may be billed to the Owner by the Engineer for the actual hours required for the review and marking of Shop Drawings by Engineer and in accordance with the rates listed in Paragraph SC-14.02, Section 00 73 00, SUPPLEMENTARY CONDITIONS.
2. Any incurred cost for the additional review shall be paid to the Owner by the Contractor on a monthly basis.

1.10 WARRANTIES AND GUARANTEES

A. Submit warranties and guarantees required by the Contract Documents with the Shop Drawings or record data.

B. Provide a separate tabbed section (manual) for warranties and guarantees.

1. Provide a log of all products for which warranties or guarantees are provided, and for all equipment. Index the log by Specification section number on forms provided by the Engineer.
2. Indicate the start date, warranty or guarantee period and the date upon which the Warranty or guarantee expires for product or equipment which a warranty or guarantee is required.
3. Indicate the date for the start of the correction period specified in the General Conditions for each piece of equipment and the date on which the specified correction period expires.
4. Provide a copy of the warrantee or guarantee under a tab indexed to the log.

1.11 RESUBMISSION REQUIREMENTS

A. Make all corrections or changes in the submittals required by the Engineer and resubmit until approved.

B. For shop drawings:

1. Revise initial drawings or data and resubmit as specified for the original submittal.
2. Highlight in yellow those revisions which have been made in response to the first review by the Engineer.
3. Highlight in blue any new revisions which have been made or additional details of information that has been added since the previous review by the Engineer.

C. For samples:

1. Submit new samples as required for the initial sample.
2. Remove samples which have been rejected.

D. For mock-ups:

1. Construct a new mock-up as initially required.
2. Dispose of mock-ups which have been rejected.

E. Engineering incurred cost for excessive review of shop drawings will be paid by the Contractor.

1. Excessive review of shop drawings is defined as any review required after the original review has been made and the first resubmittal has been checked to see that corrections have been made.
2. Cost for additional review time may be billed to the Owner by the Engineer for the actual hours required for the review and marking of shop drawings by Engineer.
3. Pay any cost incurred for the additional review to the Owner on a monthly basis as billed by the Owner.
4. Need for more than one resubmission or any other delay of obtaining Engineer's review of submittals, will not entitle the Contractor to an extension of Contract Time. All costs associated with such delays shall be at the Contractor's expense.

1.12 ENGINEER'S DUTIES

A. Review the submittals and return with reasonable promptness.

B. Indicate approval, rejection, and the need for resubmittal.

C. Distribute documents

END OF SECTION

1.00 GENERAL

This specification outlines the general steps and responsibilities of NTWMD and its Contractors on a project that requires shutdown of the NTWMD water transmission, water treatment, or wastewater systems.

1.01 GENERAL

A. The following are special provisions and general project information related to the construction of the Project. The Contractor is required to comply with these provisions, in addition to other project contract documents.

B. All Construction/rehabilitation activities should be limited between the hours of 7:00 a.m. and 6:00 p.m., Monday through Friday. Any Saturdays and holidays work need to be approved by NTMWD with at least 48 hours' notification.

C. Contractor may remove fences and gates at crossings, as needed with approvals and as directed by NTMWD; and replace per construction documents with fence of equal or better quality. The costs are incidental to the Project.

D. Contractor shall maintain visible easement stakes throughout the project duration.

E. If, during the time of construction, the NTMWD service area is under a Stage 3 or 4 water restriction (as per the NTWMD Water Conservation and Drought Contingency and Water Emergency Response Plan) then seeding and sodding surface restoration will not be included in the Work.

F. NTMWD may issue multiple Notice To Proceed for the Project.

1.02 CONSTRUCTION SEQUENCE

A. Owner expects contractor to mobilize and use multiple main-line crews to complete the work within the contract requirements.

B. Work shall be completed within the specified time for these items:

MILESTONE	STATION TO STATION			COMPLETE
1	319+42.92 (FM 740)	To	476+99.43 (south of Kings Rd)	9/30/2021
2	476+99.43 (south of Kings Rd)	To	631+09.58 (south side of FM 549)	3/31/2022
3 (Golf Course)	684+00	To	714+00	2/28/2022

C. Manhole rehabilitation – cementitious coating needs to be fully cured for 28 days prior to epoxy coating being applied. Minimizes epoxy coating failure due to off gassing.

D. Consider the sequences, duration limitations, and governing factors outlined in this Section to prepare the schedule for the Work.

E. Perform the Work not specifically described in this Section as required to complete the entire Project within the Contract Time.

1.03 USACE SECTION 404 NWP12 PERMIT

A. SWF-2019-00031 Permit was issued by the USACE in August, 2019, a copy of the

permit is attached in the Appendix. NTMWD has paid for the mitigation bank transaction to the Bunker Sands Mitigation Bank.

1.04 CLEARING AND GRUBBING WITHIN CONSTRUCTION EASEMENTS

A. Clearing, grubbing and tree/shrub removals are permitted within the proposed permanent and temporary easements. Contractor is to stockpile top 6-inch top soil; and upon completion of pipe installation, the 6-inch top soil is to be placed/restored, graded to avoid ponding, and area is to be hydromulched or sodded, except within the golf course.

1.05 CULTURAL RESOURCES SURVEY

A. A Cultural Resources Survey was conducted by Terracon Consultants, Inc. for the Buffalo Creek Parallel Interceptor, Phase 1, (Terracon Project No. 96197129, Antiquities Permit No. 8789). Based on the intensive pedestrian survey performed by Terracon, it's their opinion that there are no historic properties in the Area of Potential Effect eligible for listing on the National Register of Historic Place or designation as a State Antiquities Landmark. In the unlikely event that human remains or intact cultural resources are discovered during construction, those activities should cease, and Terracon should be contacted. (Caitlin Gulihur, 512-442-1122).

1.06 WORK WITHIN BUFFALO CREEK GOLF COURSE

A. Contact Chris Rahter, Buffalo Creek Golf Course Superintendent at (214) 929-1243 to coordinate scheduled construction activities within the golf course.

B. Construction within the Golf Course is limited to between November 1, 2021 and February 28, 2022.

C. Construction limits within the golf course is approximately STA 684+00 to STA 714+00.

1. Contractor to stake permanent and temporary construction easements within the golf course. Coordinate with golf course on location of existing irrigation lines. Others (golf course) is to cut/plug irrigation lines at easement limits. Contractor can then remove the irrigation lines during construction of the wastewater interceptor line.

2. Contractor to perform a topographic survey of the golf course project limits on a 50 foot grid (minimum). Contractor to provide copy of topographic survey to Engineer, Golf Course, NTMWD and Construction Manager.

3. After wastewater interceptor line and retaining wall are installed, contractor shall use the pre-construction topographic survey to restore the grades to their preconstruction elevation with the stockpiled topsoil placed on the top 6 inches of the restored grade. Others (golf course) will restore the vegetation within the easement limits.

D. Contractor is responsible for protecting irrigation system and utilities in the golf course that are outside of the easement limits, and is responsible for all damages.

E. Contractor shall replace damaged irrigation system and utilities with similar or better kind at no additional cost to the owner.

F. Compensatory excavation of the Golf Course Pond is required by the contractor to provide the Golf Course the same amount of water storage as they had prior to construction / installation and backfilling of the sheet piling retaining wall. The removal and disposal of the required volume of material is by the Contractor's means and methods and could include dewatering, installation and removal of coffer dam, extra long boom on excavator or other methods.

G. Contractor is to coordinate with Golf Course and is responsible to provide golf cart access path(s) during construction within the golf course; maintained and available for golf cart use at all times through the construction work areas. A temporary golf path shall be installed and approved by the golf club personnel prior to the existing access path being removed. If the path is damaged or not passable by a golf cart due to construction traffic crossing the path, the Contractor shall immediately make the necessary repairs to the path. Contractor shall coordinate location / relocation of golf cart access path with golf club officials. Flexbase is an acceptable path material within the work area. A potential temporary golf path exhibit is included in the construction plans, only as a guide. (See Sheet 60 and 61 or plan set)

H. Allowance in the Bid Form is for electrical power line installation. Allowance is to be used by the Contractor to pay others (ONCOR) to install the wires and make the connections at the existing switchgear and transformer pad, adjacent to the golf course pump house. Contractor has a pay item to install via direct bury the schedule 80 PVC conduit. Prior to construction of pond retaining wall, coordinate inspection of installation of the conduit with ONCOR and obtain written acceptance of the installation. Submit copies of accepted inspection to Engineer, Golf Course, NTWMD and Construction Manager.

1.07 CITY OF HEATH SEWER ABANDONMENT

B. Approximately 1,545 feet of a 10-inch City of Heath sanitary sewer line and associated manholes are to be abandoned and removed between stations 656+19 and 671+59. Two sewer connections shall be made to the new interceptor; contractor shall provide appropriate bypass pumping to facilitate the construction.

1.08 WATER FOR CONSTRUCTION

C. Contractor is responsible for providing its own water for construction purposes and this is incidental to the Project.

1.09 WORK IN BUFFALO CREEK AND TRIBUTARIES TO BUFFALO CREEK

D. Contractor must maintain normal flows in all creeks and tributaries of Buffalo Creek during construction.

1.10 GEOTECHNICAL INFORMATION

E. A geotechnical investigation was conducted by Terracon Consultants, Inc. and the geotechnical engineering reports dated August 21, 2018 and October 30, 2019 are included in Appendices.

1.11 SURVEY INFORMATION

F. Design survey for this project included locating existing manholes and providing associated rim and invert elevations, and topographic survey for the proposed sewers. Subsurface Utility Engineering was completed to locate the two DWU pipelines and Atmos gas. Any

utility information shown on plan sheets is approximate and based on available record drawings and survey. Survey Controls are provided in the plans for Contractor's use. Contractor is responsible for locating utilities, appurtenances and structures within the project area prior to construction.

1.12 SHUT DOWNS AND PLANS OF ACTION

A. Shut downs of operations or equipment must be planned and scheduled.
   1. Submit a written plan of action for approval for shutting down essential services. The contractor shall use the **Shut Down and Tie in Form** and follow **NTMWD 01 33 00 Submittals.** These operations include:
      a. NTMWD Pipelines.
      b. Electrical power.
      c. Control power.
      d. Process piping.
      e. Treatment equipment.
      f. Communications equipment.
      g. Other designated functions.
   2. Describe the following in the Plan of Action:
      a. Construction necessary.
      b. Utilities, piping, or services affected.
      c. Length of time the service or utility will be disturbed.
      d. Procedures to be used to carry out the Work.
      e. Plan of Action to handle emergencies.
      f. Contingency plan that will be used if the original schedule cannot be met.
   3. Plan must be received by the Owner **3 weeks** prior to beginning the Work.

1.13 CRITICAL OPERATIONS

A. The Owner has identified "Critical Operations" that must not be out of service longer than the designated maximum out of service time and/or must be performed only during the designated times. These have been identified in the table below:

Item	Critical Operation	Maximum Time Out of Operation	Hours Available to Contractor[1]	Hours Operation Can be Shut Down (0:00 AM-PM)	Liquidated Damages (Dollars per Hour)

1. Other Hours of the shutdown are for NTMWD to perform its tasks in the shutdown

B. Submit a written plan of action for approval for Critical Operation.

   1. Describe the following in the Plan of Action:
      a. Construction necessary.

b. Utilities, piping, or services affected.
c. Length of time the service or utility will be disturbed.
d. Procedures to be used to carry out the Work.
e. Plan of Action to handle emergencies.
f. Contingency plan that will be used if the original schedule cannot be met.
g. List of manpower, equipment, and ancillary supplies. Identify backups for key pieces of equipment such as excavators and pumps and key personnel such as welders.

2. Plan must be received by the Owner **3 weeks** prior to beginning the Work.

C. Work affecting "Critical Operations" is to be performed on a 24-hour a day basis until Owner's normal operations have been restored. Leaving a project site without authorization of the owner will result in the assessment of liquidated damages as listed in (A) above.

D. Provide additional work force and equipment as required to complete the Work affecting "Critical Operations" within the allotted time.

E. Include the cost for Work affecting "Critical Operations" in the Contract Proposal.

F. Shutdown meeting required prior to submittal of “Critical Operations” shutdown request. All shutdown approvals are dependent of weather and/or system emergencies.

G. Liquidated damages will be assessed if Work on "Critical Operations" is not completed within the time indicated.

1. These items are critical to for operation of the existing system.
2. Loss of operation of the existing system can subject the Owner to loss of revenue, additional operations cost, and fines from regulatory agencies.
3. Liquidated damages have been established for each critical operation.

1.14 OWNER REQUIREMENTS

A. The Owner will coordinate with the Contractor and internal staff before and during the shutdown.

B. The Owner will coordinate with other Cities or Agencies as required.

C. The Contractor must have all required labor, equipment and materials on site preceding the beginning of the work. Failure to meet this requirement will result in the Owners Representative, in concurrence with the Project Manager, delaying the shutdown for up to two weeks.

D. The Owner can require the Contractor to perform a walkthrough of the shutdown process prior to the day of the activity.

E. The Contractor is encouraged to set up a meeting with the Owner one week prior to the shutdown to review the steps of the shutdown and go over and potential risks.

F. The Owner reserves the right to cancel a shutdown if there is the potential that service will be lost due to conditions unrelated to the project. (weather, system failures, etc)

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION (NOT USED)

END OF SECTION

1.00 GENERAL

This specification outlines how NTMWD will verify the viability of the contractors intended methods to achieve a reliable and repeatable pipe compaction in accordance with the project specifications throughout the pipeline alignment.

1.01 INTENT

The intent of the Prove-out Demonstration is that the Contractor, Owner, and design Engineer will agree on the standard field approach and level of care to be taken by the installation crews to promote compliance with the specifications, details, manufacturers' recommendations, and accepted industry standards throughout the project. Acceptable embedment density test results shall be based on this trench test performed by the Contractor at the beginning of pipe laying operations.

1.02 SAMPLE SIZE

The Prove-out should be demonstrated on a minimum of two joints of applicable pipe material and size specified for the project. It shall be placed in the project limits and observed during installation by the Inspector.

1.03 REQUIRED ATTENDEES

The Contractor will schedule for the inspector, senior inspector materials testing company representative, NTWMD project manager, and engineer to be onsite to review the findings of the pipe prove out. The Manufacturers representation must be on site during the first part of the Trench Test Procedure (1.05) to go over holiday testing, patching coatings and canusa installation. Failure for one of these individuals to participate may result in the need to reschedule the prove-out or to re-demonstrate the installation.

1.04 TRENCH TEST REQUIREMENTS

1. The demonstration shall be performed prior to any open-cut pipe installation.
2. All submittals for pipe and backfill/embedment material shall be complete and approved based on NTMWD 01 33 00 Submittals prior to the demonstration.
3. The Contractor shall schedule the demonstration with the Owner at least 14 days in advance.
4. This process will establish a relationship between the density achieved at the spring line and the density achieved at the haunch area by the Contractor's proposed placement and compaction method.
5. The density at the spring line may have to be higher than the minimum specified density in order to achieve the minimum specified density in the haunch area.
6. The density at the spring line required to achieve the minimum specified density in the haunch area shall be the target density at the spring line, but shall be no less than the minimum specified density.
7. Additional test sections shall be performed for all different embedment materials, or if the Contractor proposes to change methods of placement and compaction.
8. The means, methods, and techniques of placement and compaction shall be the sole responsibility of the Contractor, and the trench test will be considered only as a

means to verify that the Contractor's methods are capable of achieving the specified compaction throughout the embedment zone.

9. The actual quality of the embedment and backfill, as compacted, shall be the responsibility of the Contractor and the satisfactory results from the trench test(s) and field density tests shall not be considered as a guarantee of the quality of the Contractor's embedment and backfill operations.
10. Changes in the embedment material after completion of the Prove-out Demonstration shall require a new Prove-out Demonstration, unless specifically waived by the Owner. Such changes after the Prove-out Demonstration will require specific, written approval from the Owner.

1.05 TRENCH TEST PROCEDURE

This process will establish a relationship between the density achieved at the spring line and the density achieved at the haunch area by the Contractor's proposed placement and compaction method. The Contractor shall demonstrate the pipe embedment placement and compaction approach in the following manner:

1. Employ all NTMWD safety procedures that apply to the permanent work.
2. Utilize the same equipment and crews that will be used for the permanent work, to the extent practical.
3. Excavate the trench to the width and minimum depth shown on the drawings.
4. Prepare the trench subgrade and bedding to the requirements of the specification and trench details
5. Install and embed one complete section of pipe, extending compacted fill up to the spring line of the pipe using the materials and density requirements specified. Lifting straps shall be left in place.
6. Use bulkheads as needed to allow the specified compaction to extend to within two feet of each end of the pipe section.
7. Testing lab shall perform density tests in the embedment material near the spring line of the pipe at two locations to be designated by the Owner.
8. Carefully remove the pipe from the trench, preserving the embedment to the extent possible.
9. Check deflection of within the pipe after the backfill is complete to ensure it is within manufacturer's acceptable range. (Pipe will sometimes float due to over compaction on the sides) Upon request of owner the contractor may be asked to recheck deflection on the prove-out pipe at 30 days to confirm original findings.
10. Testing lab shall perform a second set of in-place density tests on the compacted embedment to verify the Contractor's method has achieved the specified density and uniformity of embedment. Failure of the compacted embedment to hold the shape or achieve the specified density will be a failure of the pipe embedment demonstration.
11. In the event of a failure, the Contractor shall clean the trench to subgrade, adjust his methods and retest, all as needed, to demonstrate acceptable results.

1.06 OWNER ACCEPTANCE

The NTWMD Senior Inspector and Inspector will notify the Project Manager and Engineer of the success or failure (with specific concerns) that occurred during the Trench Test. The Project Manager will notify the Contractor approval/rejection of the embedment and the potential need for new trench test.

1.07 MEASUREMENT AND PAYMENT

The trench test, including all labor, equipment, and testing, shall be incidental to the pipe laying operations and shall be included in the overall bid price for the installed pipe.

END OF SECTION

1.00 GENERAL

1.01 CONTRACTOR'S QUALITY CONTROL RESPONSIBILITIES

A. Control the quality of the Work and verify that the Work meets the standards of quality established in the Contract Documents.

1. Inspect the Work of the Contractor, Subcontractors and Suppliers. Correct defective Work.
2. Inspect products and materials to be incorporated into the Project. Ensure that Suppliers of raw materials, parts, components, assemblies, and other products have adequate quality control system to ensure that quality products are produced. Provide only products that comply with the Contract Documents.
3. Provide and pay for the services of an approved professional materials testing laboratory acceptable to the Owner to insure that products proposed for use fully comply with the Contract Documents.
4. Provide all facilities and calibrated equipment required for quality control tests.
5. Provide consumable construction materials of adequate quality to provide a finished product that complies with the Contract Documents.
6. Perform tests as indicated in this and other sections of the specifications. All quality control testing is to be observed by the Owner’s designated representative.
7. Maintain complete inspection and testing records at the site and make them available to Owner or Engineer.

B. Provide and pay for the services of an approved professional materials testing laboratory acceptable to the Owner to insure that Work fully complies with the Contract Documents. Provide services of a testing laboratory capable of performing a full range of testing procedures complying with the standards for testing procedures specified. Provide personnel certified to perform the test required. Obtain Owners' approval for the testing laboratory before testing is performed. All certified test results shall be delivered directly to the Owner and the Engineer.

C. Should requirements of this Section of the specification conflict with the requirements of the technical specifications, the technical specifications shall govern.

1.02 QUALITY ASSURANCE ACTIVITIES BY THE OWNER

A. Owner may perform its own quality assurance test independent of the Contractor’s Quality Control Program or as otherwise described in the Contract Documents. Provide labor, materials, tools, equipment, and related items for testing by the Owner including, but not limited to temporary construction required for testing and operation of new and existing utilities. Assist the Owner or Engineer, and testing organizations in performing quality assurance activities.

1. Provide access to the Work and to the Supplier's operations at all times Work is in progress.
2. Cooperate fully in the performance of sampling, inspection, and testing.
3. Furnish labor and facilities to:
   a. Provide access to the work to be tested.
   b. Obtain and handle samples for testing at the project site or at the source of the product to be tested.
   c. Provide calibrate scales and measuring devices for the Owner's use.
   d. Facilitate inspections and tests.
   e. Provide adequate lighting to allow Owner observations.
   f. Store and cure test samples.
4. Furnish copies of the tests performed on materials and products.

5. Provide adequate quantities of representative product to be tested to the laboratory at the designated location.
6. Give the Owner's Designated Representative adequate notice before proceeding with work that would interfere with testing.
7. Notify the Owner's Designated Representative and the testing laboratory prior to the time that testing is required. Lead time is to be adequate to allow arrangements to be made for testing.
8. Do not proceed with any work until testing services have been performed and results of tests indicate that the work is acceptable.
9. Provide complete access to the Site and make Contract Documents available.
10. Provide personnel and equipment needed to perform sampling or to assist in making the field tests.
11. Quality Assurance testing performed by the Owner will be paid for by the Owner, except for verification testing performed by the Owner, which shall be paid for by the Contractor as described in Paragraph 1.06.

B. Quality Assurance activities of the Owner or Engineer through their own forces or through contracts with materials testing laboratories and survey crews are for the purpose of monitoring the results of the Contractor's work to see that it is in compliance with the requirements of the Contract Documents.

C. Quality assurance activities of the Owner and Engineer or non-performance of quality assurance activities:

1. Do not relieve the Contractor of its responsibility to perform Work and furnish materials and products and constructed Work conforming to the requirements of the Contract Documents.
2. Do not relieve the Contractor of its responsibility for providing adequate quality control measures.
3. Do not relieve the Contractor of responsibility for damage to or loss of the material, product or Work before Owner's acceptance.
4. Do not constitute or imply Owner's acceptance.
5. Do not affect the continuing rights of the Owner after Owner's acceptance of the completed Work.

D. The presence or absence of the Owner's Resident Representative or Engineer does not relieve the Contractor from any contract requirement, nor is the Owner's Resident Representative or Engineer authorized to change any term or condition of the Contract Documents without the Owner's written authorization in a Field Order or Change Order.

E. Failure on the part of the Owner or Engineer to perform or test products or constructed works in no way relieves the Contractor of the obligation to perform work and furnish materials conforming to the Contract Documents.

F. All materials and products are subject to Owner's quality assurance observations or testing at any time during preparation or use. Material or products which have been tested or observed or approved by Owner at a supply source or staging area may be re-observed or re-tested by Owner before or during or after incorporation into the Work, and rejected if they do not comply with the Contract Documents.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00, SUBMITTALS, and shall include:

1. A written Quality Management Plan that establishes the methods of assuring compliance with the Contract Documents. Submit this program as Record Data
2. A Statement of Qualification for the proposed testing laboratory. The statement of qualifications is to include a list of the engineers and technical staff that will provide testing services on the Project, descriptions of the qualifications of these individuals, list

of tests that can be performed, equipment used with date of last certification and a list of recent projects for which testing has been performed with references for those projects.

3. Test reports per Paragraph 1.07, TEST REPORTS of this specification. Reports are to certify that products or constructed Works are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.
4. Provide Certified Test Reports on materials or products to be incorporated into the Project. Reports are to indicate that material or products are in full compliance with the Contract Documents or indicate that they are not in compliance and describe how they are not in compliance.

1.04 STANDARDS

A. Provide a testing laboratory that complies with the ACIL (American Council of Independent Laboratories) "Recommended Requirements for Independent Laboratory Qualifications".

B. Perform testing per recognized test procedures as listed in the various sections of the specifications, standards of the State Department of Highways and Public Transportation, American Society of Testing Materials (ASTM), or other testing associations. Perform tests in accordance with published procedures for testing issued by these organizations.

1.05 DELIVERY AND STORAGE

Handle and protect test specimens of products and construction materials at the Site in accordance with recognized test procedures.

1.06 VERIFICATION TESTING

A. Provide verification testing when tests indicate that materials or the results of construction activities are not in conformance with Contract Documents.

B. Verification testing is to be provided at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.

C. Tests must comply with recognized methods or with methods recommended by the testing laboratory and approved by the Engineer.

1.07 TEST REPORTS

A. Test reports are to be prepared for all tests.

1. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:
   a. Name of the Owner, project title and number, equipment installer and general contractor.
   b. Name of the laboratory, address, and telephone number.
   c. Name and signature of the laboratory personnel performing the test.
   d. Description of the product being sampled or tested.
   e. Date and time of sampling, inspection, and testing.
   f. Date the report was issued.
   g. Description of the test performed.
   h. Weather conditions and temperature at time of test or sampling.
   i. Location at the site or structure where the test was taken.
   j. Standard or test procedure used in making the test.
   k. A description of the results of the test.
   l. Statement of compliance or non-compliance with the Contract Documents.
   m. Interpretations of test results, if appropriate.
2. Submit reports on tests performed by Contractor or his suppliers or vendors in the Contractor’s standard format, as approved by Owner.

3. Engineer will prepare test reports on test performed by the Engineer.

B. Distribute copies of the test reports to the Owner's Designated Representative within 24 hours of completing the test. Flag tests reports with results that do not comply with Contract Documents for immediate attention. Payment for Work subject to testing may be withheld until the Contractor's quality control test reports of the Work are submitted to the Owner's Resident Representative.

1.08 NON-CONFORMING WORK

A. Immediately correct any Work that is not in compliance with the Contract Documents or submit a written explanation of why the Work is not to be corrected immediately and when corrective to the Work will be performed.

B. Payment for non-conforming Work shall be withheld until Work is brought into compliance with the Contract Documents.

1.09 LIMITATION OF AUTHORITY OF THE TESTING LABORATORY

A. The testing laboratory representatives are limited to providing consultation on the test performed and in an advisory capacity.

B. The testing laboratory is not authorized to:

1. Alter the requirements of the Contract Documents.
2. Accept or reject any portion of the Work.
3. Perform any of the duties of the Contractor.
4. Stop the work.

1.10 QUALITY CONTROL PLAN

A. Submit Contractor's Quality Control Plan that identifies personnel, procedures, control, instructions, tests, records, and forms to be used. Construction will be permitted to begin only after acceptance of the Quality Control Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a Quality Control Plan or another interim plan containing the additional features of work to be started.

B. Content of the Quality Control Plan. The Quality Control Plan shall include, as a minimum, the following to address all construction operations, both onsite and offsite, including work by Subcontractors and Suppliers:

1. A description of the quality control organization, including a chart showing lines of authority and acknowledgement that the quality control staff shall implement the quality control program for all aspects of the Work specified.
2. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a quality control function.
3. A copy of the letter to the Quality Control Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the Quality Control Manager, including authority to stop work which does not comply with the Contract Documents or will result in Work that does not comply with the Contract Documents. The Quality Control Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Owner's Designated Representative.
4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of Subcontractors and Suppliers.
5. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test

frequency, person responsible for each test, applicable industry testing standards and laboratory facilities to be used for the test.
6. Procedures for tracking phases of quality control, verification, and acceptance tests including documentation.
7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Indicate how verification that identified deficiencies have been corrected is to be documented.
8. Reporting procedures, including proposed reporting formats
9. The name of the proposed testing laboratory along with documentation of qualifications, a list of tests that can be performed, and a list of recent projects for which testing has been performed with references from those projects.

C. Notification of Changes. After submittal of the Quality Control Plan, the Contractor shall notify the Owner in writing of any proposed changes.

D. Coordination Meeting. After the Pre-construction Meeting and before start of construction, the Contractor shall meet with the Owner or Engineer to discuss the Contractor's Quality Control Plan. The Quality Control Plan shall be submitted a minimum of fourteen (14) calendar days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the Quality Control operations, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance. Revise the Quality Management Plan to reflect comments and recommended changes resulting from this meeting.

1.11 QUALITY CONTROL ORGANIZATION [NOT USED]

2.00 PRODUCTS

2.12 TESTING APPARATUS

A. Furnish testing apparatus and related accessories necessary to perform the tests.

3.00 EXECUTION

3.01 QUALITY CONTROL PROGRAM

A. Perform quality control observations and testing as required in each section of the specifications and where indicated on the drawings.

Provide a quality control program that includes the following phases for each definable Work task. A definable Work task one which is separate and distinct from other tasks, has separate control requirements, may be provided by different trades or disciplines, or may be work by the same trade in a different environment.

1. Planning Phase. Perform the following before beginning each definable Work task:
   a. Review the contract drawings.
   b. Review submittals and determine that they are complete in accordance with the Contract Documents.
   c. Check to assure that all materials and/or equipment have been tested, submitted, and approved.
   d. Examine the work area to assure that all required preliminary work has been completed and is in compliance with the Contract Documents.
   e. Examine required materials, equipment, and sample work to assure that they are on hand, conform to submittals, and are properly stored.
   f. Review requirements for quality control inspection and testing.
   g. Discuss procedures for controlling quality of the work. Document construction tolerances and workmanship standards for the Work task.

h. Check that the portion of the plan for the Work to be performed incorporates submittal comments.
i. Discuss results of planning with the Owner's Designated Representative. Conduct a meeting attended by the quality control manager, the Owner's Designated Representative, superintendent, other quality control personnel as applicable, and the foreman responsible for the Work task. Instruct applicable workers as to the acceptable level of workmanship required in order to meet the requirements of the Contract Documents. Document the results of the preparatory phase actions by separate meeting minutes prepared by the quality control manager and attached to the quality control report.
j. Do not move to the next phase unless results of investigations required for the planning phase indicate that requirements have been met.

2. Work Phase. Complete this phase after the Planning Phase:
   a. Notify the Owner's Designated Representative at least 24 hours in advance of beginning the Work and discuss the review of the planning effort to indicate that requirements have been met.
   b. Check the Work to ensure that it is in full compliance with the Contract Documents.
   c. Verify adequacy of controls to ensure full compliance with Contract Documents. Verify required control inspection and testing is performed.
   d. Verify that established levels of workmanship meet acceptable workmanship standards. Compare with required sample panels as appropriate.
   e. Repeat the initial phase for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
3. Follow-up Phase. Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements:
   a. Make checks daily and record observations in the quality control documentation.
   b. Conduct follow-up checks to correct all deficiencies prior to the start of additional Work tasks that may be affected by the defective Work. Do not build upon nor conceal non-conforming work.
   c. Conduct a review of the Work one month prior to the expiration of the correction period prescribed in the General Conditions with the Owner. Correct defects noted during the review.

B. Conduct additional planning and review if:

1. The quality of on-going work is unacceptable
2. Changes are made in applicable quality control staff, onsite production supervision or work crew
3. Work on a task is resumed after a substantial period of inactivity
4. Other quality problems develop.

3.02 CAST-IN-PLACE CONCRETE TESTING

A. Test cast-in-place concrete in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.03 PROTECTIVE COATINGS

A. Test protective coatings per Section 09 96-00, PROTECTIVE COATINGS and Section 09 91 00, PAINTING.

3.04 LEAKAGE TESTS FOR STRUCTURES [NOT USED]

3.05 PIPING SYSTEMS

A. TEST REQUIREMENTS

1. Perform test on piping systems including piping installed between or connected to existing pipe.
2. Conduct tests on buried pipe to be hydrostatically tested after the trench is completely backfilled. If field conditions permit and if approved by the Engineer, partially backfill the trench and leave the joints open for inspection and conducting of the initial service leak test. Do not conduct the acceptance test until backfilling is complete.
3. Pneumatically test the buried piping and expose joints of the buried piping for the acceptance test.
4. Conduct the test on exposed piping after the piping is completely installed, including supports, hangers, and anchors, but prior to insulation and coating application.
5. Do not perform testing on pipe with concrete thrust blocking until the concrete has cured at least five (5) days.
6. Determine and remedy the cause of the excessive leakage for any pipe failing to meet the specified requirements for water or air tightness.
7. Tests must be successfully completed and reports filed before piping is accepted.
8. Submit a comprehensive plan and schedule for testing to the Engineer for review at least 10 days prior to starting each type of testing.
9. Remove and dispose of temporary blocking material and equipment after completion and acceptance of the piping test.
10. Repair any damage to the pipe coating.
11. Clean pipelines so they are totally free flowing prior to final acceptance.
12. Test piping independently from tests on structures.
13. Test method and test pressure depend upon the application of the piping.
    a. Pressure pipe is defined as piping that is part of a pumped or pressurized system. Perform test for pressure pipe per the procedures indicated in Paragraph B of this section.
    b. Gravity pipe is defined as piping that depends upon the force of gravity for flow through the pipe, with the exception of process piping described in paragraph d. Perform test for gravity pipe per the procedures indicated in Paragraph C, D, or E of this section.
    c. Chemical processing lines are to be tested as pressure pipe regardless of the operating conditions. The test pressure is to be 1.5 times the pressure rating of the pipe.
    d. Process piping between hydraulic structures is to be considered as pressure pipe. Perform the test for this pipe per Paragraph B of this section. The test pressure is to be the maximum hydrostatic head plus 10'. The maximum hydrostatic head is the difference in elevation of the pipe at it lowest point and the maximum top of the wall

B. HYDROSTATIC LEAK TEST-GRAVITY FLOW SEWER LINES

1. Perform hydrostatic leak tests after backfilling.
2. The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2' or 2' above the ground water level whichever is higher and the head over the downstream crown is not more than 6'.
3. Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
4. Continue the test for one hour and make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
5. Remove the jointing material, and remake the joint if any joint shows any visible leakage or infiltration.
6. Remove and replace any defective or broken pipes.
7. Determine the maximum allowable leakage or infiltration by the following formula:

$$L = \frac{C\ D\ S}{26{,}720}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
C	Infiltration / exfiltration rate	
	Use 50 for C outside of 25 year floodplain.	
	Use 10 for C within 25 year floodplain.	

8. Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's approval.
9. Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.

C. LOW PRESSURE AIR TEST- GRAVITY FLOW SEWER LINES

1. Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.
2. Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F-1417 except for testing times. The following test times are required:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Long Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

   a. Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.
   b. Pass air through a single control panel.
   c. Provide pneumatic plugs that have a sealing length equal to or greater than the circumference of the pipe to be tested.
   d. Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
   e. Provide an air compressor of adequate capacity for charging the system.
3. Perform air test only on lines less than 36" diameter. Air tests for pipes larger than 36" may be air tested at each joint.
4. Check connections for leakage with a soap solution. Release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test if leaks are found,.
5. Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch by the following formula:

T = 0.0850 DK/Q

Equation Term	Represents	Measure
T	Time for the pressure to drop 1.0 pound per square inch gauge	seconds
K	Factor equal to 0.000419DL, but not less than 1.0	
D	Average inside diameter of the pipe	inches
L	Length of line of the same pipe size	feet
Q	Rate of loss. Use 0.0015 cubic feet per minute per square foot of internal surface	

D. AIR TEST FOR INDIVIDUAL JOINTS

1. Lines 36" and larger may be tested at individual joints.
2. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.

E. DEFLECTION TESTING FOR PIPE

1. Perform deflection tests on flexible and semi-rigid pipe in accordance with ASTM 3034.
   a. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is given in the following table:

Nominal Pipe Size Inches	Percent Deflection Allowed
12 and smaller	5.0
15 through 30	4.0
Greater than 30	3.0

   b. Conduct test after the final backfill has been in place a minimum of 30 days.
   c. Thoroughly clear the lines before testing.
2. Perform deflection test by pulling a properly sized mandrel through lines that are 27 inch diameter or smaller. For pipes greater than 27 inches diameter - measure deflection from the inside of the pipe.
3. Excavate and repair pipe with deflections in excess of the maximum allowable deflection.

F. MANHOLE TESTING

Test manholes for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing or other approved methods acceptable to TCEQ. Test manholes after installation with all connections (existing and/or proposed) in place. Plug lift holes with an approved non-shrink grout prior to testing. Install drop-connections and gas sealing connections prior to testing.

1. Hydrostatic Test - Make manhole watertight and re-test if the manhole fails the leakage test. The maximum leakage for hydrostatic testing is 0.025 gallons per foot diameter per foot of manhole depth per hour. Prepare for hydrostatic exfiltration testing by sealing all wastewater lines coming into the manhole with an internal pipe plug, then fill the manhole with water and maintain full for at least one hour. With concrete manholes a period of 24 hours prior to testing may be used in order to allow saturation of the concrete.
2. Vacuum Test – Temporarily plug lines entering the manhole with the plugs braced to prevent them from being drawn into the manhole. Install plugs in the lines beyond drop-connections, gas sealing connections, etc. Place the test head inside the frame at the top of the manhole and inflate in accordance with the manufacturer’s recommendations.

Draw a vacuum of 10 inches of mercury, then turn off the vacuum pump. Read the level of vacuum after the required test time with the valve closed. The manhole will pass the test if the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury). The required test time for 48", 60", and 72" manholes with depths up to 30 feet is one minute-thirty seconds. Test times for manholes of greater size and depths will be determined by the Engineer.

3. Manhole Repairs – Manholes will be accepted in accordance with the criteria above. Repair any manhole which fails the initial test with non-shrink grout or other suitable material as determine for the material from which the manhole is constructed. Retest the manhole as described above until a successful test is achieved. Remove all temporary plugs and grout after a successful test.

G. TESTS FOR PLUMBING DRAINAGE AND VENT SYSTEMS [NOT USED}

3.06 ELECTRICAL TESTING [NOT USED]

END OF SECTION

01 45 16.16 Hydrostatic Testing of Wastewater Pipelines

1.00 GENERAL

1.01 WORK INCLUDED

A. Perform a hydrostatic pressure test on each valved or plugged section of newly laid pipe after the pipe has been backfilled. Perform hydrostatic pressure test by raising the pressure in the pipe section to the required test pressure for the duration defined in Paragraph 3.02.

B. Obtain water from the Owner for filling the pipeline for the hydrostatic test. Provide the necessary piping, connection, pressure reducing and backflow prevention equipment required to conduct the test. Fill the new pipeline through a backflow prevention device. Leave the pipeline full of water upon completion of the hydrostatic test, unless internal test plugs must be removed to allow construction to continue or where pipe will gravity drain.

C. Purchase water required for re-testing of the pipeline from the Owner. Water will be sold to the contractor at the published rates in effect at the time of the re-testing.

1.02 SUBMTTALS

A. Submit Hydrostatic Pipe Test Reports per Section 01 33 00 SUBMITTALS.

1.03 STANDARDS

A. American Water Works Association

AWWA M23	PVC Pipe Design and and Installation
AWWA C605	Standard for Underground Installation of PVC Pressure Pipe and Fittings.
AWWA C900	Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches to 12 Inches.
AWWA C905	Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In.

2.00 PRODUCTS (NOT USED)

3.00 EXECUTION

3.01 GENERAL

A. Perform hydrostatic pressure and leakage tests using methods, and per performance requirements of AWWA C605, in accordance with these specifications, and the pipe Supplier's recommendations.

3.02 TEST CONDITIONS

A. Test pipe at the test pressure for the duration as indicated below for the various pipe materials:

Pipe Type	Duration (hours)	Test Pressure (psi)
Polyvinyl Chloride Pressure Pipe	[2 hour minimum]	50

3.03 PROCEDURE

A. Polyvinyl Chloride Pressure Pipe

1. Provide temporary plugs and blocking necessary to maintain the required test pressure. Where piping is cast in the walls for a structure, brace the walls prior to testing as required to prevent load of test pressure from being imposed upon the structure.

2. Provide corporation cocks at least 3/4" in diameter, pipe riser, and angle globe valves at each pipe dead-end in order to bleed air from the line.

3. Repair any visible leaks regardless of the total leakage shown by the test.

4. Repair pipelines which fail to meet the test and retest as necessary until the results conform to the test requirements.

5. Remove and replace defective materials, pipes, valves, and accessories.

6. Test the pipelines in sections by shutting valves or installing temporary plugs as necessary.

7. Fill the pipeline with water and remove the air.

8. Maintain the test pressure in the pipe for the entire test period by means of a force pump.

9. Accurately measure the water required to maintain the pressure. The amount of water required is a measure of the leakage.

10. The maximum allowable leakage is determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{F}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
P	Test pressure	pounds per square inch gauge
F	Pipe factor	
	Use 148,000 Ductile Iron Pipe and PVC Pipe.	
	Use 133,200 for all other pipe types.	

Leakage is defined as the volume of water provided to maintain the test pressure after the pipe has been filled with water, the air expelled and the pipe brought to test pressure.

B. Pipe with visible leaks or leakage exceeding the maximum allowable leakage is considered defective and must be corrected.

3.04 EXAMINATION UNDER PRESSURE

A. Inspect the pipe during the test to locate any leaks or breaks, defective joints, cracked or defective pipe, fittings, or valves. Correct defective Work identified during the pressure test.

B. Correct all identified leaks even if leakage is within the parameters for permissible make up water per Paragraph 3.05.

C. Test the pipe again after defective Work has been corrected. Repeat the test and correction of defective Work until satisfactory test results are obtained.

3.05 PERMISSIBLE MAKEUP WATER

A. Measure make up water required for the section of pipe being tested. Makeup water is the volume of water pumped into the test section of pipe necessary to maintain the specified test pressure after the pipe has been filled with water and the air expelled.

B. The maximum acceptable volume of makeup water for steel or bar-wrapped pipe installations is 10 gallons per inch of pipe diameter per mile of pipe tested per 24 hours. Calculate the maximum acceptable volume of makeup water using the following equation:

$V_m = 10\ D\ L / 5280$ where

V_m is the maximum acceptable volume of makeup water in gallons for 24 hours

D is the nominal pipe diameter in inches

L is the length of the pipe test section in feet

As an example the allowable amount of makeup water for a test section of 2,500 feet of 60 inch diameter pipe would be:

10 x 60 x 2500 / 5280= 284 gallons

END OF SECTION

PART 1 - GENERAL

1.01 PAYMENT

A. The Contractor shall employ and pay for services of an independent testing laboratory to perform specified testing.

B. The Contractor shall allow access by the Owner for any additional testing requested by and paid for by the Owner.

1.02 WORK INCLUDED

Testing is required for the following items of work:

A. Soils compaction control.

B. Pile load tests.

C. Concrete paving.

D. Concrete reinforcement.

E. Cast-in-place concrete.

F. Precast, pre-stressed concrete.

G. Mortar.

H. Pipe Steel Welding.

I. Protective Coating Testing

1.03 TESTING LABORATORY QUALIFICATIONS

A. Standards.

1. Meet “Recommended Requirements for Independent Laboratory Qualification,” latest edition, published by American Council of Independent Laboratories.
2. Meet basic requirements of ASTM E 329, “Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction.”
3. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection; with memorandum of remedies of any deficiencies reported by inspection.

B. Testing Equipment.

1. Either calibrate at maximum 12-month intervals by devices of accuracy traceable to the National Bureau of Standards or accepted values of physical constants.
2. Submit copy of certificate of calibration, made by accredited calibration agency.

1.02 CONTRACTOR’S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to the work or to manufacturer’s operations.

B. Provide to laboratory, preliminary representative samples of materials to be tested, in required quantities.

C. Furnish copies of mill test reports.

D. Furnish labor and equipment:

1. To provide access to the work to be tested.
2. To obtain and handle samples at the site.
3. To facilitate inspections and tests.
4. For laboratory's exclusive use for storage and curing of test samples.

E. Notify the Engineer and laboratory at least 48 hours in advance of operations to allow for his assignment of personnel and scheduling of tests.

F. Arrange with the laboratory and pay for additional samples and tests required for the Contractor’s convenience.

PART 2 - PRODUCTS

2.01 EARTHWORK

A. Soil Analysis Tests (Site and Select Fill). One analysis required for each type of soil under paving for:

1. Liquid limit.
2. Plastic limit.
3. Plasticity index.
4. Maximum laboratory density (Proctor) tests.

B. Field density tests under paving for subgrade and each lift of fill: one for each 5000 square feet.

C. Additional Testing as Identified in the Geotechnical Report.

2.02 PAVING - BASE COURSE

Test density (ASTM D 1557) and installed thickness in locations as directed by Engineer.

2.03 CONCRETE

Conform to ACI 301, as modified below.

A. Mix Designs. One for each class of concrete required, Method 1, Section 3.8.2, ACI 301.

B. Concrete Pours. Random sampling as directed by Engineer or Field representative to verify general compliance with contract documents. Each sampling: three cylinders and slump test (ASTM C 143). Test one at 7 days; two at 28 days.

2.04 STEEL

Observation and testing of shop welds and bolted work and nondestructive tests of completed welds when directed by Engineer/Field Representative.

2.05 MECHANICAL PIPING

Observation and testing of field welds and nondestructive testing of completed welds when directed by the Engineer/Field Representative.

2.06 PROTECTIVE COATING PIPING

Holiday Testing of protective coating on the steel piping.

PART 3 - EXECUTION

3.01 Cooperate with the Engineer and Contractor; provide qualified personnel promptly on notice.

3.02 Perform specified inspections, sampling and testing of materials and methods of construction:

A. Comply with specified standards; ASTM or other recognized authorities, and as specified.

B. Ascertain compliance with requirements of the contract documents.

3.03 Promptly notify the Engineer and Contractor of irregularities or deficiencies of work, which are observed during performance of services.

3.04 Prepare and distribute reports of inspections and tests within 3 days of test completion or weekly on continuous work as follows:

A. Engineer: two copies.

B. Contractor: two copies.

C. Owner: one copy.

3.05 Include the following information for each test as well as additional data specified in the applicable section.

A. Date of test.

B. Location of test.

C. Specified standards.

D. Test results.

E. Remarks.

3.06 The laboratory is not authorized to stop the work or:

A. Release, revoke, alter, or enlarge on requirements of the contract documents.

B. Approve or accept any portion of the work.

C. Perform any duties of the Contractor.

END OF SECTION

01 50 00 TEMPORARY FACILITIES AND CONTROLS

1.00 GENERAL

1.01 WORK INCLUDED

A. Contractor may elect to furnish temporary facilities, including Owner and Engineer's field office and the Contractor's field offices, storage sheds, and temporary utilities needed to complete the work.

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

1.02 QUALITY ASSURANCE

A. DESIGN CRITERIA

1. Furnish a total electrical heating and cooling system for the Owner and Engineer's field office capable of maintaining the following minimum design criteria:
   a. Heating: Minimum 75 degrees ID temp @ 10 ambient.
   b. Cooling: Minimum 75 degrees ID temp @ 105 ambient.
   c. Relative humidity: 48 to 54%

B. TESTING

1. Inspect and test each service before placing temporary utilities in use. Arrange for all required inspections and tests by regulatory agencies, and obtain required certifications and permits for use.

1.03 DELIVERY AND STORAGE

A. Arrange transportation, loading, and handling of temporary buildings and sheds.

1.04 JOB CONDITIONS

A. Locate buildings and sheds at the job site as indicated or as approved by the Owner.

B. Prepare the site by removing trees, brush, or debris and performing demolition or grubbing needed to clear a space adequate for the structures.

C. Pay for the utilities used by temporary facilities during construction.

D. Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in the performance of the Work. Provide Owner and Engineer's field office completely installed and ready for occupancy and use within seven (7) days of the Notice to Proceed.

E. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the Work.

F. Do not remove services and facilities until they are no longer needed.

G. Operate temporary facilities in a safe and efficient manner.

1. Do not overload temporary services or facilities.
2. Do not let temporary services or facilities interfere with the progress of the work.
3. Do not allow unsanitary conditions, public nuisance, or hazardous conditions to develop or exist at the site.
4. Do not permit freezing of pipes, flooding, or the contamination of water.
5. Maintain site security and protection of the facilities.

1.05 OPTIONS

A. Construction offices may be prefabricated buildings on skids or mobile trailers.

B. Storage sheds may be prefabricated buildings on skids or truck trailers.

2.00 PRODUCTS

2.01 SIGN MATERIALS

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

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

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

D. Provide exterior quality coatings.

2.02 TEMPORARY OFFICES

A. A field office is NOT REQUIRED for this project, but if the Contractor elects to erect a field office, it shall be furnished and continuously maintained throughout the project duration. The field office for the Owner and the Engineer's use needs to meet the following requirements:

1. Minimum size of 12’ x 60’
   a. The building is to be divided into three separate spaces (two offices and conference) by full height walls with a single 3’-0” x 6’-8” door for passage in each wall. The office spaces are to be located at each end of the building and are to be 12’ x 12’.
   b. Each space is to have an exterior 3’-0” x 6’-8” weathertight door located on one side of building.
   c. Each office space is to have a minimum of one (1) 4’-0” x 5’-0” window.
   d. Flooring may be plywood, vinyl, or VCT tile. Do not use carpet.
2. Separate from Contractor’s office.
3. Structurally sound, weather-tight, and have floor raised above the ground.
4. Adequately braced and anchored to prevent movement.
5. Heated and air-conditioned.
6. Provide a fully plumbed indoor restroom located in one corner of the center section of the building. The restroom shall contain a flush toilet, sink, medicine cabinet with mirror, and storage shelving. Connect fixtures to complete potable water, sanitary, and vent systems.
7. Make connections to electrical power source and provide electrical service to building for duration of project.
8. Provide a skirt around perimeter of building of same material as building siding.
9. Construct a porch with steps and covered overhang at each entrance. Construct a handicap accessible ramp to main entrance. Provide railing around porch, steps, and ramp.
10. Provide burglar bars on all windows and hinged burglar bars on outside doors with padlocks or door locks.
11. Provide operable, screened windows with locks.
12. Provide Venetian type blinds for all windows.
13. Provide electric water cooler with bottled water supply for the duration of the project.
14. Provide furnishings manufactured by HON, or approved equal as follows:
    a. Three (3) 2’-6” x 5’-0” office desks with credenza
    b. Three (3) fabric covered, cushioned adjustable arm chairs with swivel/tilt/roll capabilities and three (3) protective floor mats.
    c. One (1) 3’-0” x 8’-0” folding table
    d. Two (2) 2’-6” x 5’-0” folding tables
    e. Ten (10) padded folding chairs
    f. Two (2) cushioned drafting stool with back
    g. Two (2) drafting table or layout table similar to Mayline Model 7737-B
    h. Plan holding rack similar to Planhold Model 43CRI-30 with 10 holders
    i. Ten (10) legal size, four-drawer filing cabinets

j. Three (3) 4-shelf metal book shelves
k. Three (3) wastepaper baskets similar to Lawson Model H9-334-09

15. Provide telephone services.
    a. Provide three (3) separate outside telephone lines. One line will be used for the fax machine. One line will be used for Internet service. One line will be the main office phone number.
    b. Provide rollover capability with the main phone line and fax line such that any incoming calls from the main phone line will rollover to the fax line whenever the main line is in use.
    c. Provide voicemail, call waiting, and caller ID for the main phone line.
    d. Provide three (3) telephones equal to Southwestern Bell TeleMatrix Two Line Caller ID Business Speakerphone. Furnish a minimum of four (4) telephone jacks for each line at locations designated by the Owner/Engineer.
16. Provide Internet service for the duration of the project. The service is to include provisions for at least one (1) e-mail address that is accessible to the Owner and Engineer's off-site e-mail systems.
17. Provide long distance calling service for Owner and Engineer's field office for the duration of the project. The Contractor shall be responsible for Engineer/Owner's monthly long distance charges of up to $100 per month.
18. Provide two (2) Dell OptiPlex desktop computers with the following criteria:
    a. Minimum of 2.40 GHz Pentium 4 processor
    b. 256MB RAM
    c. 24X DVD-CDRW Combo Drive, Slimline, with software decoder GX260 Small Form Factor
    d. Integrated Intel Gigabit NIC, 10/100/1000
    e. V.92, PCI, Data/Fax Modem
    f. Integrated Sound Blaster Compatible AC97 Sound
    g. Internal Chassis Speaker Option
    h. Small Form Factor Case
    i. Stand w/Bottom Assembly
    j. Dell 16.0 Inch Viewable Image Size, Flat CRT
    k. 32MB Video Card
    l. 20GB Hard Drive
    m. 3.5 inch, 1.44MB, Slimline Floppy Drive
    n. Dell PS/2 Keyboard
    o. Logitech USB, Optical, Wheel 2-button Mouse
    p. Windows XP Professional (or latest version)
    q. MS Office Pro XP (or latest version)
    r. Adobe Acrobat 5.0 Retail Package (or latest version)
19. Provide a Hewlett Packard Laserjet 3200se Printer/Fax/Copier/Scanner, or approved equal.
20. Provide a new or leased copier.
    a. Konica 3135 copier with auto feed/sort/collate features and 11x17 copying capabilities, or approved equal
    b. Provide service and maintenance agreement throughout duration of project.
21. Provide a Sony MVC-CD1000 digital camera or approved equal. Provide camera accessories including battery charger and leather carrying case.
22. Furnish and maintain office supply stock, including but not limited to, pens, pencils, markers, staples, notepads, paper, posted notes, floppy disks, CD-WR computer disks, file folders, paper clips, binder clips, etc., for duration of project. The Contractor shall be responsible for Engineer/Owner's office supply purchases of up to $50 per month.
23. Furnish a microwave unit with a minimum cooking volume of 1.5 cubic feet.
24. Furnish a refrigerator with minimum storage capacity of 3.5 cubic feet. Refrigerator shall include a freezer section.
25. Provide sufficient lighting for office environment using fluorescent light fixtures with lenses energized by wall switches. Provide switches adjacent to doorway into each space.

26. Provide three (3) duplex receptacles in each office space and four (4) duplex receptacles for the remainder of the building.
27. Provide a fire extinguisher and first aid kit.
28. Provide an electronic alarm system that monitors all entry points into the building and will automatically notify a local security system of any unauthorized entry.
29. Contract with a local security service to monitor and respond to any intrusion alarms throughout duration of project.
30. Office and/or materials of construction may be new or used but must be in good condition acceptable to the Owner/Engineer, serviceable, adequate for the intended purpose, and must not violate codes or regulations.
31. Field office and furniture will remain the property of the Contractor. Computer equipment, printer/fax machine, and digital camera shall be turned over to the Owner at the end of the project.

B. Prior to installation of Owner/Engineer field office, submit the following information for approval:

1. Office Trailer/Building – floor plan including square footage of floor area
2. Telephone equipment – catalog cut sheets
3. Computer equipment – catalog cut sheets
4. Security/Alarm System – catalog cut sheets
5. Office Furniture– catalog cut sheets

C. Furnish a field office for Contractor's use of adequate size to allow meetings of about fifteen (15) people.

D. Provide access to and reserved parking spaces for ten (10) vehicles adjacent to the Owner and Owner and Engineer's field office. The parking area surface shall be covered by a durable surface to prevent erosion, mud, dust, or rutting caused by vehicles. The surface shall be a flexible crushed limestone base material, with a 2" HMAC overlay meeting the requirements of TxDOT Standard Specification, Item 340.

E. Other trades may provide their own offices only when space is available on the site, and both the Owner and the Contractor agree.

2.03 TEMPORARY STORAGE BUILDINGS

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

2.04 TEMPORARY SANITARY FACILITIES

A. Provide sanitary facilities at the job site from the Notice to Proceed until project conclusion. Maintain these facilities in a clean and sanitary condition at all times, and comply with the requirements of the local health authority. On large sites, provide portable toilets at such locations that no point in the work-site shall be more than 600' from a toilet.

B. Use these sanitary facilities. Do not use rest rooms within existing or Owner - occupied buildings.

2.05 TEMPORARY HEAT

A. Provide heating devices needed to protect the building during construction.

1. Provide fuel needed to service the heating devices.
2. Attend heating devices at all times.
3. Do not allow heaters to operate overnight without someone in attendance.

2.06 TEMPORARY UTILITIES

A. Provide all temporary utilities needed during construction, testing, disinfection, and start-up of the Work, including electrical power, water, and telephone. Include costs associated with furnishing temporary utilities in the Contract Price.

1. Provide a source of temporary electrical power of adequate size for the construction procedures.
   a. Provide electrical pole and service that complies with OSHA and other safety requirements and the requirements of the power company
   b. Make the electrical power available to the trades as needed.
   c. Provide extensions to the various parts of the buildings as needed.
   d. Provide junction boxes in such an arrangement that distribution boxes are available within 75' of any part of the structure.
2. Provide for temporary water. Extend water to the construction site and maintain source until such time that the permanent water supply can be extended to the site. Include the cost of water, costs for construction, testing, disinfection, and start-up of the Work in the Contract Price.
3. Provide telephone service to the site and install telephones inside the Contractor's and the Engineer’s office.

B. Make arrangements with the local utility company, comply with utility company's requirements and pay for the utility costs during construction, testing, disinfection, and start-up of the Work.

C. Make utilities available to the trades during construction, testing, disinfection, and start-up.

3.00 EXECUTION

3.01 LOCATION OF TEMPORARY FACILITIES

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

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

3.02 PROJECT IDENTIFICATION AND SIGNS

A. Provide project identification signs of the size, lettering, and construction indicated by the Owner and in accordance with specified requirements.

3.03 TEMPORARY LIGHTING

A. Once a building is "shelled-in", provide temporary lighting inside the building.

1. Lighting shall be adequate to perform work within any space.
2. Lights shall be left in position in such a manner that every space has temporary light at all times.
3. Temporary lights may be removed once the permanent lighting is in service.

B. Provide portable flood lights at any time that work will be performed outside the structure at night. Provide adequate lighting to provide sufficient light at any location work is being performed.

3.04 DRINKING WATER

A. Provide field offices with potable water for Owner's and Engineer's office. Bottled drinking water is to be provided with a dispenser and cooling apparatus.

B. Pay for services and maintain daily.

3.05 CONSTRUCTION FENCE

A. Install and maintain a construction fence around the construction site and/or around the storage yard as indicated. Fence may be wood picket or chain link construction. Provide gates with padlocks.

3.06 REMOVAL OF TEMPORARY FACILITIES

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

B. Remove informational signs upon completion of construction.

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

3.07 MAINTENANCE AND JANITORIAL SERVICE

A. Provide janitorial service (sweeping/mopping) for the Owner's and Engineer's office on a weekly basis or as requested. Trash receptacles are to be emptied daily.

B. Maintain signs and supports in a neat, clean condition. Repair damage to structures, framings, or signs.

C. Repair any damage to permanent structures or finishes caused by placement or removal of temporary signage.

END OF SECTION

1.00 GENERAL

1.01 WORK INCLUDED

A. Provide labor, materials, equipment and incidentals necessary to construct temporary facilities to provide and maintain control over environmental conditions at the Site. Remove temporary facilities when no longer needed.

B. Construct temporary impounding works, channels, diversions, furnishing and operation of pumps, installing piping and fittings, and other construction for control of conditions at the Site. Remove temporary controls at the end of the Project.

C. Provide a Storm Water Pollution Prevention Plan in accordance with TCEQ General Permit TXR150000, file required legal notices and obtain required permits prior to beginning any construction activity.

D. Provide labor, materials, equipment, and incidentals necessary to prevent storm water pollution for the duration of the Project. Provide and maintain erosion and sediment control structures as required to preventive sediment and other pollutants from the Site from entering any storm water system, including open channels. Remove pollution control structures when no longer required to prevent storm water pollution.

1.02 QUALITY ASSURANCE

A. Construct storm water pollution prevention measures prior to the beginning of construction and maintain these during construction until final stabilization has been achieved for the area protected.

B. Plan and conduct all land-disturbing activities to minimize the area to be exposed at any one time. Minimize the time of exposure, off-site erosion, sedimentation, and adverse water quality impacts.

C. Manage surface water runoff originating upgrade of an exposed area to minimize erosion and sediment loss during the period of exposure.

D. Install measures to control both the velocity and rate of release so as to minimize erosion and sedimentation of the receiving water body (i.e., ditch, channel, stream) in accordance with regulatory requirements and as directed by the Owner, Construction Manager or the Engineer.

E. Periodically clean out and dispose of all sediment and other pollutants as necessary to maintain the treatment capacity of each pollution control feature. Clean out and properly dispose of all sediment and other storm water pollutants at the time of completion of the Work.

1.03 SUBMITTALS

A. Provide copies of notices, records and reports required by Paragraph 1.05 as Record Data in accordance with Section 01 33 00, SUBMITTALS.

1.04 STANDARDS

A. Provide a storm water pollution prevention plan that complies with Local, State, and Federal requirements. Comply with all requirements of the Texas Commission on Environmental Quality General Permit (TXR150000) for storm water discharges from construction activities under the Texas Pollutant Discharge Elimination System (TPDES) program.

B. Perform Work to comply with “Best Practice” as established by the North Central Texas Council Of Governments (NCTCOG) integrated Storm Water Management (iSWM) Design Manual for Construction or the local agency of jurisdiction.

1.05 PERMITS

A. Submit the following to the TCEQ and the Operator of any Municipal Separate Storm Sewer System (MS4) receiving construction site discharge from the Site:

   a. Notice of Intent (NOI) at least 48 hours prior to beginning construction activity. Construction activity may commence 24 hours after the submittal of an electronic NOI.
   b. Notice of Change (NOC) letter when relevant facts or incorrect information was submitted in the NOI, or if relevant information in the NOI changes during the course of construction activity.
   c. Notice of Termination (NOT) when the construction project has been completed and stabilized.

B. Post a copy of the NOI at the construction site in a location where it is readily available for viewing by the general public and Local, State, and Federal authorities prior to starting construction activities and maintain the posting until completion of the construction activities.

C. Maintain copies of a schedule of major construction activities, inspection reports, and revision documentation with the storm water pollution prevention plan (SWPPP) required under the TPDES General Permit (TXR150000) for Storm Water Discharges from Construction Activities for all projects.

1.06 POLLUTION CONTROL

A. Prevent the contamination of soil, water or atmosphere by the discharge of noxious substances from construction operations. Provide adequate measures to prevent the creation of noxious air-borne pollutants. Prevent dispersal of pollutants into the atmosphere. Do not dump or otherwise discharge noxious or harmful fluids into drains or sewers, nor allow noxious liquids to contaminate public waterways in any manner.

B. Provide equipment and personnel and perform emergency measures necessary to contain any spillage.

C. Contain chemicals in protective areas and do not dump on soil. Dispose of such materials at off-Site locations in an acceptable manner.

D. Excavate contaminated soil and dispose at an off-Site location if contamination of the soil does occur. Fill resulting excavations with suitable backfill and compact to the density of the surrounding undisturbed soil.

E. Provide documentation to the Owner which states the nature and strength of the contaminant, method of disposal, and the location of the disposal Site.

F. Comply with local, State and Federal regulations regarding the disposal of pollutants.

G. Groundwater or run-off water which has come into contact with noxious chemicals, sludge, or sludge-contaminated soil is considered contaminated. Contaminated water must not be allowed to enter streams or water courses, leave the Site in a non-contained form or enter non-contaminated areas of the Site.

H. Pump contaminated water to holding ponds constructed by the Contractor for this purpose, or discharge to areas on the interior of the Site, as designated by the Engineer.

I. Construct temporary earthen dikes or take other precautions and measures as required to contain the contaminated water and pump to a designated storage area.

J. Wash any equipment used for handling contaminated water or soil within contaminated areas three times with uncontaminated water prior to using such equipment in an uncontaminated area. Dispose of wash water used to wash such equipment as contaminated water.

1.07 EARTH CONTROL

A. Remove excess soil, spoil materials and other earth not required for backfill within two weeks of completing excavation Work. Control stock pile material to eliminate interference with Contractor and Owner's operations.

B. Dispose of excess earth off the Site. Pay cost for disposal unless otherwise noted. Provide written approval by the property owner for all disposal on private property, and approval by the Owner if such disposal affects the use of Site or other easements.

C. Place excess excavated material and neatly spread on tracts of land on which the pipeline is being constructed and where the property owner requests such material and the Construction Manager approves.

1.08 MAINTENANCE OF WATER

A. Manage water resulting from rains or ground water at the site. Maintain trenches and excavations free of water at all times. Provide and maintain pumps as necessary to remove excess water. Direct water away from the site to prevent damage to surrounding property.

B. Maintain standby equipment to provide proper and continuous operation for water management. Monitor the operation on a 24-hour basis to provide continuous operation.

C. Ensure that water drainage does not damage adjacent property. The Contractor shall be responsible for the discharge of water from the site.

1.09 WATER MAINTENANCE AT BORROW AREAS [NOT USED]

1.10 FLOOD CONTROL

A. Build, erect, maintain, and operate cofferdams, drainage channels, flumes, sumps, or other temporary construction necessary to contain or otherwise divert storm water, streams, or flood water around the construction site so that flood waters are controlled during construction.

1. At the conclusion of the work, remove the temporary construction and restore the site in a manner acceptable to the Engineer and to match surrounding material.

2. Divert water into the same natural watercourse in which its headwaters are located, or other natural stream or waterway as approved by the Owner.

3. Construct permanent work in an area that has been made free of water. The Contractor shall provide dewatering equipment as necessary to maintain the area free of water during construction.

2.00 PRODUCTS

2.01 MATERIALS

A. Provide materials meeting regulatory requirements.

3.00 EXECUTION

3.01 CONSTRUCTING, MAINTAINING AND REMOVING TEMPORARY CONTROLS

A. Construct temporary controls in accordance with regulatory requirements.

B. Maintain controls in accordance with regulatory requirements were applicable, or in accordance with the requirements of the Contract Documents.

C. Remove temporary control when no longer required, but before the Project is complete. Correct any damage or pollution that occurs as the result of removing controls before the point where they are no longer required.

END OF SECTION

01 70 00 EXECUTION AND CLOSEOUT REQUIREMENTS

1.00 GENERAL

1.01 WORK INCLUDED

Comply with requirements of the General Conditions and specified administrative procedures in closing out the Construction Contract.

1.02 SUBMITTALS

Submit affidavits and releases on forms shown in Section 01 31 13.13, FORMS.

1.03 SUBSTANTIAL COMPLETION

A. Submit written notification that the work or designated portion of the work is substantially complete to the Construction Manager when the work is considered to be substantially complete per the General Conditions. Include a list of the items remaining to be completed or corrected before the project will be considered to be complete.

B. Construction Manager and Engineer shall visit the project site to observe the work within a reasonable time after notification is received to determine the status of completion.

C. Construction Manager shall issue notification to the Contractor that the work is either substantially complete or that additional work must be performed before the project may be considered substantially complete.

1. Construction Manager shall notify the Contractor in writing of items that must be completed before the project can be considered substantially complete.
   a. Correct the noted deficiencies in the work.
   b. Issue a second written notice with a revised list of deficiencies when work has been completed.
   c. Construction Manager and Engineer shall revisit the site and the procedure shall begin again.

2. Construction Manager shall issue a tentative Certificate of Substantial Completion to the Owner when the project is considered to be substantially complete. Certificate shall include a tentative list of items to be corrected before final payment.
   a. Owner will review and revise the list of items and notify the Construction Manager of any objections or other items that are to be included in the list.
   b. Construction Manager shall prepare and send to the Contractor a definite Certificate of Substantial Completion with a revised tentative list of items to be corrected or completed.
   c. Review the list and notify the Construction Manager in writing of any objections within 10 days of receipt of Certificate of Substantial Completion.

1.04 FINAL INSPECTION

A. Submit written request for final inspection when the project is complete and:

1. Contract Documents have been reviewed.
2. Work has been completed in compliance with the Contract Documents.
3. Equipment and systems have been tested per Contract Documents and are fully operational.
4. Final Operations and Maintenance Manuals have been provided to the Owner and all operators training has been completed.
5. Specified spare parts and special tools have been provided.
6. Work is complete and ready for final inspection.

B. Construction Manager and Engineer shall make an inspection with the Owner and appropriate regulatory agencies to determine the status of completeness within a reasonable time after the receipt of the Certificate.

C. Construction Manager shall issue notice that the project is complete or notify the Contractor that work is not complete or is defective.

1. Submit the request for final payment with Closeout submittals described in Paragraph 1.07 if notified that the project is complete and the work is acceptable.
2. Upon receipt of notification from the Construction Manager that work is incomplete or defective, take immediate steps to remedy the stated deficiencies. Send a second certification to the Construction Manager when work has been completed or corrected.
3. Construction Manager and Engineer shall re-visit the site and the procedure will begin again.

1.05 RE-INSPECTION FEES

A. Pay fees to the Owner to compensate the Construction Manager and Engineer for re-inspection of the work required by the failure of the work to comply with the claims of status of completion made by the Contractor.

B. Owner may withhold the amount of these fees from the Contractor's final payment.

C. Cost for additional inspections will be billed to the Owner by the Construction Manager and Engineer for the actual hours required for the inspection and preparation of related reports in accordance with the rates in the Supplemental Conditions.

1.06 CLOSEOUT SUBMITTALS TO THE ENGINEER

A. Record Drawings per Section 01 31 13, PROJECT COORDINATION.

B. Keys and keying schedule.

C. Warranties and bonds.

D. Evidence of payment or release of liens on the form indicated in Section 01 31 13.13, FORMS and as required by the General Conditions.

E. Releases from property owners of land outside the easement which were used by the Contractor.

F. Consent from Surety to Final Payment.

G. Equipment installation reports on equipment.

H. Shop drawings, record data, Operations and Maintenance Manuals, and other submittals as required by the Contract Documents.

I. Specified spare parts and special tools.

J. Certificates of Occupancy, operating certificates, or other similar releases required to allow the Owner unrestricted use of the work and access to services and utilities.

K. Evidence of final, continuing insurance, and bond coverage as required by the Contract Documents.

L. Compile Equipment List on compact disc or Flash Drive in Microsoft Excel format containing information indicated in Section 01 78 23.2.01.E Operations And Maintenance Data for all equipment included in the Contract Documents. Equipment List shall be developed using Equipment List Form provided in Section 01 31 13.13 Forms.

1.07 FINAL PAYMENT REQUEST

A. Submit a preliminary final payment request. This request is to include adjustments to the Contract Amount for:

1. Approved Change Orders
2. Allowances not previously adjusted by Change Order
3. Unit prices
4. Deductions for defective work that has been accepted by the Owner
5. Penalties and bonuses
6. Deductions for liquidated damages
7. Deductions for re-inspection payments per Paragraph 1.05
8. Other adjustments

B. Engineer shall prepare a final Change Order, reflecting the approved adjustments to the contract amount which have not been covered by previously approved Change Orders.

C. Submit the final Application for Payment per the General Conditions, including the final Change Order.

1.08 TRANSFER OF UTILITIES

A. Transfer utilities to the Owner when the Substantial Completion has been issued, final cleaning has been completed and the work has been accepted by the Owner.

B. Submit final meter readings for utilities and similar data as of the date the Owner occupied the work.

1.09 WARRANTIES, BONDS, AND SERVICES AGREEMENTS

A. Provide warranties, bonds, and service agreements required by Section 01 33 00, SUBMITTALS or by the individual sections of the specifications.

B. The date for the start of warranties, bonds, and service agreements is established per the General Conditions.

C. Compile warranties, bonds, and service agreements and review these documents for compliance with the Contract Documents.

1. Each document is to be signed by the respective manufacturer, supplier, and subcontractor.
2. Each document is to include:
   a. The product or work item description
   b. The firm, with the name of the principal, address, and telephone number
   c. Scope of warranty, bond or services agreement
   d. Date, duration, and expiration date for each warranty bond and service agreement
   e. Procedures to be followed in the event of a failure
   f. Specific instances that might invalidate the warranty or bond

D. Submit two copies of each document to the Engineer for review and transmittal to the Owner.

1. Submit duplicate sets.
2. Documents are to be submitted on 8-1/2" x 11" paper, punched for a standard three-ring binder.
3. Submit each set in a commercial quality three-ring binder with a durable and cleanable plastic cover. The title "Warranties, Bonds, and Services Agreements", the project name and the name of the Contractor are to be typed and affixed to the cover.

E. Submit warranties, bonds and services agreements:

1. At the time of final completion and before final payment.
2. Within 10 days after inspection and acceptance for equipment or components placed in service during the progress of construction.

1.10 CLAIMS AND DISPUTES

Claims and disputes must be resolved prior to recommendations of final payment. Acceptance and final payment by the Contractor will indicate that any outstanding claims or disputed issues have been resolved to the full satisfaction of the Contractor.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor is responsible for all detailed staking and layout necessary for construction of the Project.

1.02 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Owner's Representative if required by the Contract.

1.03 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. No separate payment will be made for field surveying. Include cost in unit price for related items.

1.04 SUBMITTALS

A. Conform to requirements of Section 01 33 00 - Submittal Procedures.

B. Submit name, address, and telephone number of Surveyor to Owner's Representative 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 the Work are in conformance with the Contract.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of major site improvements.

C. Submit record documents under provisions of Section 01 31 13 - Project Coordination.

1.06 EXAMINATION

A. Verify locations of survey control points prior to starting the Work.

B. Notify Owner's Representative immediately if any discrepancies are discovered.

1.07 SURVEY REFERENCE POINTS

A. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

1.08 SURVEY REQUIREMENTS

A. Utilize recognized engineering survey practices.

B. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.

C. Establish elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:

1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs

D. Periodically verify layouts.

1.09 NOTIFICATIONS

A. In the event that it appears there is an error or contradiction between plan grades, construction stakes, and/or actual conditions, the Contractor shall notify the Engineer immediately.

B. Within 15 days after the Notice to Proceed, Contractor shall field verify and provide written notice

that all primary survey controls furnished by the Owner has not been disturbed and is acceptable. If the primary control has been disturbed or damaged, the Owner will re-establish at no cost to the Contractor. However, once the Contractor has verified and accepted the primary controls, the Contractor will be responsible for all costs to re-establish disturbed primary controls caused by his work.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 REQUIREMENTS

A. The Contractor is responsible to provide such layout and control work as may be required for construction of the proposed improvements. The permanent and temporary construction easements shall be marked every 100 linear feet with hubs and lathes and shall include the elevation of the ground and the proposed pipeline. Layout and staking shall be provided as many times as necessary to accommodate the Contractor's work plan and schedule. Re-staking because of damage by construction activities, vandalism, or other losses shall be provided at the Contractor's expense.

B. The Contractor shall provide workers competent in the layout and control work necessary. The Contractor shall provide the equipment and materials necessary for establishing the necessary control and layout.

C. The Contractor shall be responsible for protecting and preserving all property corners and survey control points (i.e. benchmarks and horizontal control points). If existing property corners or survey control points are disturbed, the Contractor shall be responsible for the costs of re-establishing the information. All survey work will be performed by a professional land surveyor.

D. The centerline of the pipe shall be marked (staked) before construction. This centerline staking shall be maintained throughout the project.

3.02 PLAN GRADES AND ALIGNMENT

A. The horizontal alignment of pipelines, manholes, and structures will be from pipe centerlines, center of castings, or corners of structures, respectively, unless otherwise noted.

B. Discrepancies between final casting elevation for drainage structures and manholes shown on the plans versus actual field conditions shall be determined by the Engineer, after final grading is completed.

END OF SECTION

SECTION 01 74 19 WASTE MATERIAL DISPOSAL

PART 1 - GENERAL

1.01 RELATED WORK

A. Erosion and Sediment Controls. Section 31 25 00.

B. Trench Excavation and Backfill. Section 31 23 33.

C. Top Soil. Section 32 91 16.13.

D. Hydromulch Seeding. Section 32 92 16.

1.02 SUBMITTALS

Submit record data in accordance with Section 01 33 00, Submittals.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

Specific products are not required. Use equipment and materials necessary to properly complete disposal of waste materials.

PART 3 - EXECUTION

3.01 DISPOSAL AREA

A. All waste material becomes property of the Contractor and must be removed from the work site and disposed of in a legal manner not to damage the Owner or other persons. Provide copies of all disposal manifests to the Owner.

B. Spoils shall either be disposed of by Contractor and/or placed in a location as directed by the Plans and /or Owner.

C. Strip the disposal area of vegetation, humus or other debris. Strippings become property of Contractor to be legally disposed of with other waste materials.

D. Protect trees designated for preservation. Take special care not to damage trees designated for preservation that are outside limits of waste disposal areas.

3.02 BURNING

Burning of waste materials will not be permitted on Owner’s controlled property.

3.03 COMPACTION AND GRADING

Compact waste materials to the density of the surrounding area. Shape the area for proper drainage. Place excess topsoil on waste material in an even layer not greater than 3 inches thick and grade smooth.

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes

1. Requirements for maintaining the work and site in a standard of cleanliness throughout the construction period.

B. Related Specification Sections include but are not necessarily limited to

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.

1.02 PRICE AND PAYMENT PROCEDURES

Payment for final cleaning shall be incidental to the work and shall be included in the overall bid price. There will be no separate payment for final cleaning.

1.03 REFERENCES

A. Definitions

1. "Clean", for the purpose of this Section, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

1.04 QUALITY ASSURANCE

A. Conduct daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

B. In addition to the standards described in this Section, comply with pertinent requirements of governmental agencies having jurisdiction.

2.00 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Description

1. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.
2. Use only the cleaning materials and equipment that are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

3.00 EXECUTION

3.01 APPLICATION

A. Progress Cleaning

1. General

a. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.

b. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

c. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.

d. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

2. Site

   a. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.

   b. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of subparagraph 3.01.A.1 above.

   c. Maintain the site in a neat and orderly condition at all times.

B. Final Cleaning

1. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described above.

2. Site

   a. Unless otherwise specifically directed by the Construction Manager, broom clean paved areas on the site and public paved areas adjacent to the site.

   b. Completely remove resultant debris.

3. Schedule final cleaning as approved by the Construction Manager to enable the Owner to accept a completely clean Work.

3.02 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Engineer in accordance with the General Conditions of the Contract.

END OF SECTION

1.00 GENERAL

1.01 WORK INCLUDED

A. Prepare a complete and detailed Operation and Maintenance Manual for each type and model of equipment or product furnished and installed under this contract.

B. Prepare the manuals in the form of an instruction manual for the Owner. The manual is to be suitable for use in providing operation and maintenance instruction as required by Section 01 75 00, STARTING AND ADJUSTING.

C. Provide complete and detailed information specifically for the products or systems provided for this project. Include the information required to operate and maintain the product or system. Provide Maintenance Summary Form to include information on any routine operations required to ensure satisfactory performance and longevity of equipment. D. Manuals are to be in addition to any information packed with or attached to the product when delivered. This information is to be taken from the product and provided as an attachment to the manual.

1.02 SUBMITTALS

A. Submit manuals in accordance with Section 01 33 00, SUBMITTALS. Attach to each manual a copy of the Operation and Maintenance Manual Review Form as shown in Section 01 31 13 13 FORMS with pertinent information completed.

B. Preliminary Manuals: Submit prior to shipment date for equipment, system, subsystem, or component. Include copy of warranties, bonds, and services agreements if specified.

1.03 GUARANTEES

A. Provide copies of the Manufacturer's warranties, guarantees, or service agreements in accordance with Section 01 70 00, EXECUTION AND CLOSEOUT REQUIREMENTS.

2.00 PRODUCTS

2.01 MATERIALS

A. Print manuals on heavy, first quality paper.

1. Paper shall be 8-1/2" X 11" paper.
   a. Reduce drawings and diagrams to 8-1/2" X 11" paper size.
   b. When reduction is not practical, fold drawings and place each separately in a clear, super heavy weight, top loading polypropylene sheet protector designed for ring binder use. Provide a typed identification label on each sheet protector.
2. Punch paper for standard three-ring binders.

B. Place manuals in Wilson Jones 385 Line D-Ring Dubllock Presentation Binders.

1. Binders are to have clear front, back, and spine covers.
2. Sheet lifters are to be provided.
3. Minimum size is 2" capacity. Maximum size is 3" capacity.

C. Provide tab indexes for each section of the manual.

1. Indexes are to be constructed of heavy-duty paper with a reinforced binding edge and punched with 9/32" holes to fit the binders.
2. Index is to have clear insertable tabs for a typed insert.

D. Provide indexed PDF version of manual on a CD or Flash Drive.

E. Provide an Equipment List using Equipment List Form, Section 01 31 13.13 Forms, on compact disc or Flash Drive in Microsoft Excel format which includes all information required by Paragraph 3.03

3.00 EXECUTION

3.01 MANUAL ORGANIZATION AND CONTENTS

A. Provide a Table of Contents listing each section of the manual for each product or system.

1. Identify each product or system using the nomenclature shown in the Contract Documents.
2. Assign a number and letter to each section in the manual.
   a. Assign a number to each product or system. The number is to correspond to the Owner's equipment numbering system or other system designated by the Engineer.
   b. A cross reference is to be provided for the Owner's numbering system and designations for equipment indicated in the Contract Documents.
   c. The letter assigned will represent the part of the manual, consistent with the manual contents as required by Paragraphs 3.02, 3.03, and 3.04.
3. Provide index tabs for each section in the manual.
4. The designation on each index tab is to correspond to the number and letter assigned in the Table of Contents.

B. Include only the information that pertains to the product described. Annotate each sheet to:

1. Clearly identify the specific product or component installed.
2. Clearly identify the data applicable to the installation.
3. Delete reference to inapplicable information.

C. Supplement manual information with drawings as necessary to clearly illustrate relations of component parts of equipment and systems, and control and flow diagrams.

D. Identify each manual by placing a printed cover sheet in the front cover of the binder and as the first page in the manual. The first page is to be placed in a clear polypropylene sheet protector. The information on first page and the cover page are to include:

1. Name of Owner
2. Project Name
3. Volume number
4. The Table of Contents for that volume

E. Insert the Table of Contents into the spine of each manual.

F. Manuals for several products or systems may be provided in the same binder.

1. Sections for each product or system must be included in the same binder.
2. Sections must be in numerical order from volume to volume.

G. Correlate the data into related groups when multiple binders are used.

H. Fill binders to only 3/4 of its indicated capacity to allow for addition of materials to each binder by the Owner.

3.02 EQUIPMENT AND SYSTEMS MANUAL CONTENT

A. Manual shall provide the following information:
1. A description of the unit and component parts.
2. Schedule of routine maintenance requirement on the Maintenance Summary form
3. Operating instructions for startup, normal operations, regulation, control, shutdown, emergency conditions, and limiting operating conditions.
4. Maintenance instructions including assembly, installation, alignment, adjustment, and checking instructions.
5. Lubrication schedule and lubrication procedures. Include a cross reference for recommended lubrication products.
6. Troubleshooting guide.
7. Description of sequence of operation by the Control Manufacturer.
8. Warnings for detrimental maintenance practices.
9. Parts lists including:

a. Outline, cross section and assembly drawings, engineering data, test data, and performance curves.
b. Control schematics and point to point wiring diagrams prepared for field installation, including circuit directories of panel boards and terminal strips.
c. Other information as may be required by the individual sections of the specifications.

3.03 EQUIPMENT LIST

A. Provide Equipment List Form, Section 01 31 13.13 Forms, on compact disc or Flash Drive in Microsoft Excel format containing the following information for all equipment included in the Contract Documents.
   1. Asset Type
   2. Equipment Number complying with Owner's Tagging Standard. Contact NTMWD Project Manager for copy of standard.
   3. Description of Equipment including type, location, model number and serial number.
   4. Location detail
   5. Manufacturer
   6. Model number
   7. Serial number
   8. Acceptance date
   9. List Price
   10. Warranty Expiration date
   11. Warranty coverage information

3.04 LIST OF SERVICE ORGANIZATIONS

A. Provide a directory of authorized service organizations with company name, address, telephone number, and the contact person for warranty repair.

3.05 SUPPLEMENTS

A. The supplement listed below, following "End of Section", is part of this specification.
   1. Form: Maintenance Summary Form

END OF SECTION

MAINTENANCE SUMMARY FORM

PROJECT NUMBER& NAME: # 507-0484-17, Buffalo Creek Parallel Interceptor, Phase I

1. **EQUIPMENT ITEM _____**
2. **MANUFACTURER_____**
3. **EQUIPMENT LOCATION _____**
3. **EQUIPMENT/TAG NUMBER(S)_____**
4. **RECOMMENDED MAINTENANCE REQUIREMENTS**

Maintenance Operation Comments	Frequency	Materials Required
List briefly each maintenance operation require and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable)	List require frequency of each maintenance operation (weekly, monthly, quarterly, annually, etc)	Lubricant, chemicals, paint, air filters, etc with specific size, recommended model name, type, etc.
Example: Replace Air Filter on air vent	Every 90 days	20" X 30" air filter

5. **LUBRICANT LIST**

Reference Symbol	Lubricant 1	Lubricant 2	Lubricant 3	Lubricant 4
List symbols used in (4) above	List lubricants as distributed by each manufacturer for the specific use intended.			

6. **RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY**

Part No	Description	Unit	Quantity	Unit Cost
Note: Identify Parts provided by this contract with two asterisks				

1.00 GENERAL

A. The Contractor shall provide the management and labor required to develop, implement, enforce, and report on a job specific Environmental Health and Safety Plan (EH&S) for this project.
B. The Contractor is responsible for addressing the safety issues associated with construction activities, including potential hazards. **CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR CONSTRUCTION JOB SITE SAFETY INCLUDING LAYDOWN AREAS AND TRANSPORT OF EQUIPMENT MATERIALS AND SUPPLIES TO AND FROM THE PROJECT SITE.**

1.01 WORK INCLUDED

A. Prepare a job specific EH&S Plan.
B. Maintain the EH&S Plan, including all required staff, equipment, and materials, through the project duration.
C. Submit the EH&S plan as a project submittal prior to the Preconstruction Meeting and be prepared to discuss major points of the submitted plan at the meeting. (See 1.04-Submittals below)
D. Host safety training for staff and subcontract staff on site as conditions require.
E. Designate a safety officer to oversee enforcement and to serve as point-of-contact to NTMWD and contractor's employees.
F. Inspect equipment as needed to ensure safe operation.
G. Provide necessary training to employees as merited by equipment, materials, or working conditions prior to risk activities.
H. Maintain an OSHA 300 log and provide monthly update (with pay application) of recordable incidents.

1.02 QUALITY ASSURANCE

A. Plan and conduct all construction activities to minimize risk and ensure safety to staff, surroundings, and subcontractors.

1.03 STANDARDS

A. The Contractor shall provide a job specific EH&S Plan that incorporates the following considerations, as a minimum:
    i. Applicable Local, State, and Federal Requirements for all project specific hazards.
    ii. All requirements of OSHA Title 29 CFR Part 1926
    iii. NTMWD Lock Out Program Control #382-018
    iv. Any site or task specific risk management guidance that has been implemented by the District that pertains to the Work under this project.

1.04 SUBMITTALS

A. Contractor shall submit the EH&S plan in accordance with Section 01 33 00 "Submittal Procedures" prior to the Preconstruction Meeting. The document shall be updated in the Construction Management Software on a regular basis and a current, updated copy shall be available at the project site at all times.

2.00 EXECUTION

2.01 JOB SPECIFIC EH&S CONTENTS

The EH&S Plan shall include at the minimum the following information:

A. Background information including but not limited to
    a. Contractor Name
    b. NTMWD Project Number
    c. Project Name
    d. Project Location(s)/Site(s)
    e. Project Description
    f. List of conditions of site/location that may or shall pose a hazard to contractor, owner, or citizens.
B. Objective of the EH&S Plan
C. Administration and Enforcement of the Plan
    a. Assignment of Safety Officer(s)
    b. Injury reporting procedure
D. Emergency Notification procedures based on hazard type
    a. Who to notify in which situations
    b. Name, address, contact number, and map showing location of nearest urgent care facility and nearest emergency care facility.
E. Site Access Control Requirements
    a. Contractor shall control access to the work site by unauthorized persons during the performance of this Contract. Contractor shall be responsible for ensuring that applicable OSHA requirements and standards are met before any person is allowed to enter the project area.
F. Contractor Safety Guidelines may include, but not limited to, the following based on the project specific issues.
    a. Fire Prevention and Protection
    b. Means of Egress
    c. Hazardous Materials
    d. Hazardous waste operations
    e. Bloodborne Pathogen Exposure
    f. Solid wastes
    g. Health Hazards
    h. Confined Space plan
    i. Electrical safety
    j. Excavations
    k. Fall Protection Plan
    l. Equipment safety (scaffolding, vehicles, etc.)
    m. Site safety housekeeping
    n. Flammable/Combustible Liquids
    o. Hot work activities (welding, torch cutting, grinding, etc.)
    p. Hazard communication
    q. Trench safety requirements
    r. Reference trench safety plan
    s. Ladders and Stairways

t. Machine and equipment guarding
u. Personal protective equipment

G. Contractor's training program
H. Job Hazard analysis
    a. Job site safety inspections and audit schedule/plan
    b. Job safety checklist specific to the project (and phase)
I. Contractor and subcontractor acknowledgement of the safety plan
J. Appendix
    a. Accident Reporting documentation
    b. Safety equipment checklists
    c. Equipment Checklists
    d. Safety Meeting sign in
    e. List of Trained Individuals

2.02 EH&S PLAN ORGANIZATION

A. Provide a Table of Contents listing each section of the manual for each product or system.
B. Assign a number and letter to each section in the manual.
C. Provide Index tabs for each section of the manual
D. The designation on each index tab is to correspond to the number and letter assigned in the "Table of Contents"

END OF SECTION

02 16 10 EXCAVATION SAFETY

PART 1 GENERAL

1.01 SUMMARY

A. Description

This section covers the trench and excavation safety system required for constructing improvements that necessitate open excavations on the project. All work under this item shall be in accordance with the current edition of the OSHA Standard for Excavation and Trench Safety Systems, 29 CFR 1926 Subpart P.

B. Related Sections
SECTION 01 33 00 - Submittals
SECTION 33 05 10 – Utility Trench Excavation, Embedment, and Backfill

1.02 SUBMITTALS

A. Trench Safety System shall be designed by a Professional Engineer licensed in the state of Texas.

1.03 REFERENCE STANDARDS

A. 29 CFR 1296 Subpart P -Occupational Safety and Health Standards – Excavations

B. 29 CFR 1296 Subpart U -Occupational Safety and Health Standards – Blasting and Use of Explosives

1.04 NOTIFICATION REQUIRED

A. The Contractor, before beginning any excavation, shall notify the State Department of Labor (Safety Division) that work is commencing on a project which has excavations five feet deep or deeper. The Contractor shall provide written documentation of the notification to the District.

B. The Contractor shall notify all utility companies and owners in accordance with the OSHA requirements given in 29 CFR 1926.651(b)(2) for the purpose of locating utilities and underground installations.

1.05 EXISTING STRUCTURES AND UTILITIES

A. Where the trench or excavation endangers the stability of a building, wall, street, highway, utilities, or other installation the Contractor shall provide support systems such as shoring, bracing, or underpinning to ensure the stability of such structure or utility.

B. The Contractor may elect to remove and replace or relocate such structures or utilities with the written approval of the Utility and the District.

PART 4 – MEASUREMENT AND PAYMENT

Will be in accordance with Section 01 29 00.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. The Work covered by this Section includes furnishing all labor, materials, power, equipment, supplies, supervision, tools, system design and performing all operations necessary and incidental to the control of water during construction in accordance with the Drawings and Specifications.

B. Groundwater control may be necessary for trenching and excavating. Groundwater control installations involve either dewatering systems for removal of groundwater from the excavation or pumped relief well systems for control of piezometric pressures or a combination of dewatering and relief wells, as necessary to achieve stable excavation and bottom conditions.

C. Under the requirements of this Section, major items of work include the design, installation, operation and maintenance of various temporary dewatering or relief well systems, and stormwater drainage facilities required to drain and maintain excavations and foundation beds in dry and stable conditions without adverse effect on adjacent facilities or property, and to protect construction activities from water from any source which would impede the scheduled construction or endanger the structural integrity of the work. Included are designing, installing, maintaining, operating and removing vacuum or educator well points, or deep well systems and other installations or devices for lowering the water table within excavations; control of seepage and piezometric pressures; excavation drainage by placement of crushed stone wrapped in geotextile; and construction of sumps, drains, levees, ditches, pipes and culverts for removal of standing water, surface drainage and protecting work against rising waters and floods and repair of any resulting damage. The CONTRACTOR shall also protect adjoining properties from surface drainage damage due to construction activities.

D. Related Requirements

1. Section 01 31 00: PROJECT MANAGEMENT AND COORDINATION
2. Section 01 33 00: SUBMITTALS
3. Section 31 20 00: EARTH MOVING
4. Section 31 23 33: TRENCH EXCAVATION AND BACKFILLING

1.02 REFERENCES

A. The publications and standards listed below form a part of the Specification for the extent referenced. The publications are referred to in the text by designation only. Where reference is made to one of the below standards, the revision in effect at the time of the bid opening shall apply, unless otherwise noted.

1. Texas Commission on Environmental Quality (TCEQ)
   a. TCEQ: Rules and Regulations
2. Texas Department of Licensing and Regulation (TDLR)
   a. WWD/PI Water Well Drillers/Pump Installers Rules and Well Construction and Plugging Specifications

1.03 SUBMITTALS

A. All submittals shall be made in accordance with Section 01 33 00 – SUBMITTALS.

B. The CONTRACTOR shall submit complete descriptions, drawings, details and layouts showing the CONTRACTOR's proposed plans for control of groundwater and surface water prior to commencement of work.

1. The groundwater control plan shall show the dewatering and pressure relief systems in clear detail, including well types, locations, installation depths and layouts, pump capacities, or other proposed methods for controlling the groundwater conditions within

the construction areas. The plan shall also define the means for monitoring the effectiveness of the groundwater control system. The groundwater control plan shall demonstrate how the piezometric levels will be maintained to provide stability and prevent settlement/heave, in conjunction with other means for ground stabilization, from start of excavation to completion of backfill. The plan shall also show, in the event that wells will be used for tunnel sections, how these wells are intended to function in conjunction with the selected tunneling method.

2. The surface water control plan shall show the proposed methods of handling storm-water runoff, including the use of sumps, drains, levees, ditches, pipes and culverts, to prevent flow of runoff into trenches, excavations and tunnels. The plan shall also detail how creek flows will be diverted and/or controlled where creeks are crossed by open trench pipe installation methods.

C. The CONTRACTOR shall not start the operation of any dewatering pressure relief or other excavation drainage until the groundwater control plan and other data required herein have been reviewed by the ENGINEER.

D. Submittals shall include names of equipment suppliers and installation subcontractors, installation reports for educators, deep wells and well points, water level readings from piezometers and method of maintenance, and other information in sufficient detail to allow the ENGINEER to evaluate the proposed dewatering systems.

E. The CONTRACTOR shall submit the design criteria used for the surface water control plan and for the groundwater control systems plan with the plans and a certification signed, dated and sealed by a licensed Professional Engineer, registered in the State of Texas, that the plans were designed according to that criteria. This professional engineer shall also review the actual groundwater control installations to verify that the as-installed systems will satisfy the required functions for the encountered conditions. Any changes in the groundwater control plans contemplated by the CONTRACTOR during the course of the work shall also be sealed by the same licensed professional engineer and re-submitted to the ENGINEER.

F. The adequacy and implementation of the water control plans submitted is solely the responsibility of the CONTRACTOR. The plans will be reviewed by the ENGINEER and then maintained in the ENGINEER's files for reference purposes only. No responsibility for the plans is assumed by the OWNER or the ENGINEER.

1.04 QUALITY ASSURANCE

A. Equipment used for groundwater control and surface water drainage shall be suitable equipment normally used for this type of work.

B. Groundwater control equipment shall be furnished, installed and operated by a reputable contractor regularly engaged in dewatering and groundwater control.

C. If subgrade soils are disturbed or become unstable due to dewatering operation or an inadequate dewatering system, notify the OWNER's Representative, stabilize the subgrade, and modify system to perform as specified at no additional cost to the OWNER.

D. Notify the OWNER's Representative immediately if any settlement or movement is detected on structures. If the settlement or movement is deemed by the OWNER's Representative to be related to the dewatering, take actions to protect the adjacent structures and submit a modified dewatering plan to the OWNER's Representative within 24 hours. Implement the modified plan and repair any damage incurred to the adjacent structures at no additional cost to the OWNER.

E. If oil and/or other hazardous materials are encountered after dewatering begins, immediately notify the OWNER's Representative.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Section 01 31 00 PROJECT MANAGEMENT AND COORDINATION and as Specified herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide observation wells where necessary or planned.

B. Provide settlement markers, piezometers and/or any other geotechnical instruments in accordance with the submitted dewatering plan or as specified.

C. Provide casings, well screens, piping, fittings, pumps, power and other items required for dewatering system as needed.

D. Provide sand and gravel filter around the well screen. Wrapping geotextile fabric directly around the well screen shall not be allowed.

E. When deep wells, well points, or vacuum well points are used, provide pumping units capable of maintaining high vacuum and handling large volumes of air and water at the same time.

F. Provide and store auxiliary dewatering equipment, consisting of pumps and hoses on the site in the event of breakdown, at least one (1) pump for every five (5) used.

G. Provide and maintain erosion/sedimentation control devices as indicated or specified and in accordance with the dewatering plan.

H. Provide temporary pipes, hoses, flumes, or channels for the transport of discharge water to the discharge location.

I. Provide cement grout as required having a water cement ratio of 1 to 1 by volume.

J. Provide two (2) pumps (minimum discharge size of 6-inches) for assistance in dewatering the pipelines (within the pump station only) during installation of meters, valves and any other piping configuration changes. Contractor shall provide larger pumps if required for dewatering. If pumps smaller than 6-inch are sufficient, a formal RFI must be submitted for the Engineer's approval.

PART 3 – EXECUTION

3.01 APPLICATION, INSTALLATION AND/OR CONSTRUCTION

A. It shall be solely the responsibility of the CONTRACTOR to identify groundwater conditions and to provide the necessary installations to control and handle the groundwater as required for his construction method and to monitor the effectiveness of the installed system(s) and its effect on adjacent facilities.

B. The CONTRACTOR shall obtain all necessary permits from agencies with control over the use of groundwater and matters affecting well installations, water discharge and use of existing storm drains and natural watercourses as applicable. The development, drilling and abandonment of all wells used in the dewatering system shall comply with TCEQ regulations and WWD/PI rules and specifications.

C. The CONTRACTOR shall assume sole responsibility for groundwater and surface water control systems and for all loss or damage resulting from partial or complete failure of protective measures. The CONTRACTOR shall monitor the effect of groundwater control operations on the construction and installed facilities including the possible effect of heave settlement on shored excavations, and adjoining pipes. The CONTRACTOR shall also monitor the possible influence on adjacent structures and other facilities due to groundwater control and other construction activities.

D. The CONTRACTOR shall obtain all required construction permits issued by any government agency having jurisdiction, as related to operations for the control and discharge of water during construction.

E. The CONTRACTOR shall determine the depths and locations of water bearing strata along the open cut pipeline sections and at all excavations required for structures by borings or soundings. The borings or soundings shall be performed to sufficient depth to ensure that all strata of potential

significance to groundwater control and stability have been located and to allow determination of proper depth for well penetration and screen settings. These investigation results shall be used to develop the groundwater control plan. The CONTRACTOR shall obtain samples from the borings that are necessary to provide information for design and operation of the groundwater control and pressure relief installations and design of construction shafts, and other applicable structures or systems addressed under other parts of this specification. The CONTRACTOR may use the borings for installation of piezometers to be incorporated in the groundwater control program.

F. The CONTRACTOR shall discharge all water from dewatering operations and cause all surface drainage from construction activities to drain away from construction and into existing drainage courses capable of safely accepting the drainage volume. The CONTRACTOR shall obtain the approval of the responsible government agencies and owners of adjoining properties to discharge water from dewatering and surface runoff from construction activities on or across their properties. All drainage into existing drainage courses shall be performed in such a manner as to prevent scouring, eroding or any other damages, and shall be accomplished in the manner approved by the government agency authorizing applicable permits.

G. The CONTRACTOR shall maintain the free groundwater level at least 2 feet below the lowest excavation bottom elevation during excavation and backfilling of the pipe trench or where concrete is placed. Bedding, backfill or concrete shall not be placed in excavations in the presence of water. Seepage into excavation which cannot be controlled by pumped installation outside the excavation shall be drained by installation of crushed stone wrapped in geotextile and sump pumps. The CONTRACTOR shall control the piezometric level in water bearing strata below the excavation to sufficient depth to maintain stability and prevent heave of the excavation bottom. Excavation required for crushed stone wrapped in geotextile shall not be considered as authorized over excavation or authorized additional backfill.

H. Sump pumping shall be used as necessary to remove residual free water and rain water, after groundwater seepage and hydrostatic pressure have been brought under control by well points or deep wells. Sumps shall be adequately supported and provided with crushed stone and filter fabric to prevent loss of fines from the surrounding soils. Any sump supports, such as wooden frames, shall be removed and disturbed soil shall be compacted to the density of the adjacent soil material.

I. The CONTRACTOR shall provide necessary groundwater control, or other means of ground stabilization, to ensure that any access shaft excavations required and/or constructed remain stable and that the shafts will not be subjected to hydrostatic pressures causing uplift or bottom heave at any time. The piezometric pressure at the access shafts shall be reduced to at least 3 feet below the base elevation of the shaft excavation.

J. The hydrostatic pressure must be reduced and under control before proceeding with the excavations. Dewatering and pressure relief systems shall remain in operation until the backfill of the trench, construction shafts, bored or tunneled sections or the subgrade portions of structures have been completed and sufficiently backfilled to safely prevent uplift or other dislocation or disturbance of the installed work. The dewatering and pressure relief systems shall provide for continuous operation including nights, weekends and holidays. Appropriate mechanical or electrical backup as applicable shall be provided.

K. In the event any damage occurs to adjacent structures or property due to the lowering of the water table and subsequent ground settlement, the CONTRACTOR shall be responsible for correction of damage and/or settlement of any claims arising from such damage at the CONTRACTOR's expense.

L. The CONTRACTOR shall be responsible for modifying his groundwater control operations, or changing the means and methods or schedule of work in the event that a potential or actual environmental impact condition is encountered in the field, in order to minimize the adverse effects. The CONTRACTOR shall be responsible for any adverse environmental effects caused by the excessive, unnecessary or otherwise imprudent groundwater pumpage.

M. The CONTRACTOR shall construct temporary drainage ditches and dikes and install such temporary culverts and sump pumps with discharge lines as required protecting the work from

any source of surface water. The CONTRACTOR shall install such temporary protective works required to protect adjoining properties from surface drainage damage from the project site.

3.02 FIELD QUALITY CONTROL

A. Before installations and operations begin, the CONTRACTOR shall have available sufficient pumping equipment and other machinery on site to assure that the operation of the groundwater control systems can be maintained at all times.

B. If well points or deep wells are used, they shall be adequately spaced to provide the necessary groundwater control, and shall be properly developed to achieve the necessary pumping capacity. The well points or deep wells shall be sand packed and/or protected by other means to prevent the pumping of fine sands or silts from the subsurface in order to minimize ground subsidence. A continual check by the CONTRACTOR shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

C. The CONTRACTOR shall install survey monuments and benchmarks to detect any movements in construction shafts and adjacent structures and property due to groundwater control operations. Areas to be monitored shall include tunnels and other structures either within or adjacent to the work areas as applicable, where heave/settlement may cause adverse effects. Reference monuments shall be installed by the CONTRACTOR outside the area of influence from the construction work.

D. The CONTRACTOR shall furnish weekly information in the form of monitoring reports to the ENGINEER regarding the performance of the groundwater control systems and data from monitoring of piezometers, monitoring wells and survey points. Monitoring reports shall include field notes as well as tabulated measurements and plots of pumpage rates, piezometric levels and survey point movements.

3.03 CLEANING

A. Upon completion of the work and approval of the ENGINEER, the CONTRACTOR shall remove all temporary facilities and systems related to the control of water. All equipment and materials used in the temporary systems shall be removed from the project site. The CONTRACTOR shall perform all required earthwork to restore temporary surface drainage and temporary protective works to the original grades and to a condition equal to or better than that existing prior to start of construction and to the satisfaction of the ENGINEER.

B. All borehole, well point, deep well, piezometer, monitoring well and sump locations shall be backfilled in accordance with all applicable regulations.

3.04 DE CHLORINATION

A. When dewatering the existing pipelines and/or tanks, if the chlorine residual exceeds 0.1 mg/L (ppm), the water shall remain in the pipeline and/or tank until the chlorine residual is less than 0.1 mg/L (ppm).

1. If time is a restriction and the Contractor cannot wait, they may choose to empty the water into trucks, or discharge into an existing sanitary sewer system, or an approved storage facility until the chlorine residual is 0.1 mg/L (ppm) or less, or treat the water with Sodium Bisulfite or another de chlorination chemical (Sulfur Dioxide, Sodium Sulfite, Sodium Thiosulfate, or Ascorbic Acid) or method appropriate for potable water and approved by the ENGINEER until the chlorine residual is reduced to 0.1 mg/L (ppm) or less.

2. Heavily chlorinated water will not be allowed to be disposed of into the existing storm sewer system. After the specified chlorine residual is obtained, the water may then be discharged into the storm sewer system or utilized by the Contractor. The Contractor shall be responsible for the monitoring of the discharge to ensure the residual remains below 0.1 mg/L for the entire duration of dewatering.

B. The regulations for discharge of heavily chlorinated water are found in the TPDES General Permit to Authorize the Discharge of Storm Water and Certain Non-Storm Water Discharges from Regulated Construction Activities within the State of Texas.

C. Prior to any draining of potable water from waterlines for repairs or tie-ins, dewatering of potable waterlines, or discharge of chlorinated water used for testing of waterlines, the Contractor shall complete a letter including the language of the below “SAMPLE DISCHARGE LETTER” and submit the letter to NTMWD for their review and submission to the Texas Commission on Environmental Quality. This letter must be submitted to the TCEQ via certified mail at least 72 hours prior to the discharge of potable water.

D. SAMPLE DISCHARGE LETTER

[Insert Date]

Attn: Tony Walker *(Confirm Current Director)*
Region 4, Regional Director
Texas Commission on Environmental Quality
2309 Gravel Drive
Fort Worth, Texas 76118-6951

Re: Potable Water Line Repair and Associated Discharge

Dear Mr. Walker:

On or about_____date, [CONTRACTOR] is {scheduled to conduct repairs} OR {Conducted repairs} to a potable water line belonging to North Texas Municipal Water District. During the repair activities, the [Contractor] will be discharging potable water. In accordance with the TCEQ's Enforcement Initiation Criteria (EIC, Revision 14, effective Dec. 1, 2012), "a violation may not be addressed via NOV or NOE, or Order against a regulated entity for the discharge of potable water, if proper and complete notice (as required by rule/statute/permit) is provided to the appropriate TCEQ regional office and other requirements are met." Please consider this letter proper and complete notice as required by the EIC. The following information is provided for your information:

- The repair {will be} or {was} conducted at [insert location]
- The following steps {will be} or {were} taken to minimize the environmental impact of the discharge
    - [List any steps taken]
- This discharge is unavoidable due to proper maintenance and/or servicing of the water system and all practicable measures {will be} taken to address discharge activities.

Please contact me if you have any questions regarding this matter.

Sincerely,

[Contractor]

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to provide all dismantling, modifications, and salvage work required, as shown on the Drawings and specified herein.

B. The Contractor shall comply with applicable laws, codes, ordinances and regulations, and shall obtain and pay for necessary permits.

C. The Contractor shall remove from site and legally dispose of dismantled materials, trash, debris, etc. except any items specifically indicated to be reused and any items designated to be salvaged for Owner's own purposes. Such items shall be carefully removed under the Contract and moved to an area designated by the Owner on the project site. All disposal shall be at a legal waste facility or at a TCEQ permitted waste disposal facility.

D. All other materials removed under the modification work and not called for to be reused or turned over to the Owner on the project shall be disposed of legally, off the site, by Contractor, who shall, upon removal from site, have the rights of salvage of materials.

E. The Contractor shall visit the site of the work and examine the premises so as to fully understand all of the existing conditions relative to the work. No increase in cost or extension of performance time will be considered for failure to know the conditions of the site and structures.

F. The Contractor shall be responsible for removing and modifying piping and structures in such a sequence that there will be no disruption of operations. The Contractor's construction schedule, to be provided per Section 01 32 16 shall include demolition work at times that meet the construction sequencing issues presented in Contract Documents.

1.02 CARE, PROTECTION AND REPAIR

The Contractor is cautioned to exercise great care in protecting existing structures and property of the Owner while proceeding with work of this Section and the entire Contract. All damage shall be repaired at once to the satisfaction of the Engineer. All such repairs shall be at the expense of the Contractor and no claims for additional payment will be accepted.

1.03 CONDITIONS OF STRUCTURES

A. The Owner and the Engineer assume no responsibility for the actual condition of the piping and equipment to be demolished or modified.

B. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, slight variations may occur prior to the start of demolition work.

C. The Engineer may, upon inspection, direct the Contractor to repair or replace deteriorated or damaged structures, piping or mechanical equipment as extra work. Extra work, if any, will be performed and paid for in accordance with other portions of this Project Manual.

1.04 TRAFFIC AND ACCESS

Special attention of the Contractor is directed towards maintaining safe and convenient access at all times to and through the existing facilities, properties and public access for manufacturing, commercial and private operations, other personnel and associated vehicles.

1.05 TO BE REMOVED BY CONTRACTOR

A. The following shall be removed during the course of this construction project,

1. Excess soil, Bedding and Rubble

B. Contractor shall be responsible for removing materials off-site to a legal TCEQ permitted facility. A waste manifest shall be given to the OWNER for disposed of materials

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 MANNER OF CONDUCTING WORK

A. Execute work in careful, orderly manner. Provide and maintain barriers, dust screens, warning lights as may be necessary to protect persons and property. Perform work with utmost care, using tools and methods that will not transfer any heavy shocks to adjacent structures to remain in service and in place. Take all possible care to avoid vibration and other disturbance. Conduct work in a manner giving prime consideration to, but not necessarily limited by:

1. Protection of public and Owner's personnel.
2. Protection from weather.
3. Control of noise, shocks, vibration.
4. Control of dirt and dust.
5. Maintenance of orderly access.
6. Protection of existing structures or portions thereof to remain.
7. Coordination and cooperation with Owner.

B. Debris shall not be allowed to accumulate.

C. No fires will be permitted on site.

D. The use of explosives will not be permitted on the project.

E. Provide temporary support and shoring as required for existing materials until new work is installed.

F. Pollution Controls. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection. -

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by Owner or governing authorities. Return adjacent areas to condition existing prior to start of work.

3. Prior to demolition inside existing structures, provide covers consisting of plastic sheeting and framing over existing pumps, motors, switchgear and control panels. Maintain covers during demolition operations.

3.02 MODIFICATIONS

Modification consists of demolition as required, removing, replacing, or altering existing concrete. Also included is such work as plugging pipe and wall openings, the removal of portions of an existing structure, and construction of additions to existing structures.

3.03 CONSTRUCTION METHODS

A. Explosives. The use of explosives will not be permitted for any purposes.

B. Fires. Fires are not permitted on this project

C. Modifications of Existing Structures.

1. Where only a portion of the existing structure is to be removed, special care shall be taken

to prevent damage to that portion that will remain in place. Portions of concrete structures to be removed shall be saw-cut or cored in order to minimize impact loads on the remaining structure. No "headache" balls or other swinging weights may be used. Where not connecting to new structures, the existing concrete shall be removed to neat lines as shown on the Plans or as established by the Engineer, and reinforcing steel shall be saw-cut and removed to a depth of 2 inches from the finished surface and coated, or as noted on the Drawings. The new opening shall be patched and finished with nonshrink nonmetallic grout or other treatment as required to function as intended.

2. Execute cutting and demolition by methods which will prevent damage to other work, and will provide proper surfaces to receive installation of repairs. Torch cutting will not be permitted.

3. Where physical cutting is required, cut work with sawing and grinding tools, not with hammering and chopping tools. Unless otherwise specified, core drill or saw cut openings through all concrete work. Core drilling shall be done utilizing diamond bits. Corners shall not be over-cut without prior written approval from the Engineer.

4. Where a portion of the existing concrete is to be removed and new concrete is to be added, a minimum of 1-inch saw-cut is required to provide a straight, neat edge at the surface. Care shall be taken to maintain existing reinforcement where indicated on the plans.

5. Patch with seams which are durable and as invisible as possible. Restore exposed finishes of patched areas and, where necessary, extend finish restoration onto retained work, adjoining, in a manner which will eliminate evidence of patching.

6. Take care in the removal of equipment and materials to be salvaged to prevent damage to such.

D. Piping Demolition. Piping shall be disconnected, dismantled, and removed as required and in such a manner as to minimize distributing or damaging adjacent facilities. Where indicated on the Contract Drawings piping shall be properly restrained as specified.

E. Disposal. All removed material, debris, and rubbish resulting from the demolition operations shall be removed from the site and disposed by and at the expense of the Contractor. Metallic items removed from the site shall be recycled or delivered to a steel mill, ferrous foundry, or similar facility, where material will be scrapped. Under no circumstances shall any other use be made of the removed material, nor shall they be reused in another installation. Contractor shall submit a Construction Waste Management Plan. Contractor shall also maintain Waste Management Reports and CWM Closeout Documentation.

F. Structural Members. Carefully remove and lower structural steel, cast-iron framing and heavy timbers.

G. Pavement Repair. Repair existing access paving and/or sidewalks that is disturbed as a result of demolition procedures, including haul-off. Replacement shall include repair of the existing subgrade and surface course. The new materials shall be of the same type and thickness as the existing materials.

END OF SECTION

1.00 GENERAL

1.01 SCOPE

The work included in this section consists of the design, furnishing and construction of all necessary concrete formwork and false work to produce cast-in-place concrete in the finished structure(s).

The design, furnishing and construction of the concrete formwork and false work shall comply with industry standards including but not limited to the latest edition of ACI 301 and 347 and as indicated on the Drawings and specified in this section.

1.02 FORMWORK DESIGN

Provide the design by an engineer registered in the Project's state of all formwork, including shoring and reshoring, for this work. Formwork shall comply with ANSI A10.9 and OSHA Construction Standards, Part 1926, Subpart Q, Concrete, Concrete Forms, and Shoring. In addition, the formwork design shall meet the requirements of the latest edition of ACI 347.

1.03 SUBMITTALS

Shall conform to Section 01 33 00 of the Specifications.

1.04 RESPONSIBILITIES

The Contractor is fully responsible for the design and construction of all forms, false work and shoring to be in compliance with all applicable OSHA requirements, ACI requirements and the requirements of all agencies having jurisdiction on the Project. The submission of any design details for false work, forms and shoring is for information only.

1.05 STORAGE AND PROTECTION

All form materials and accessories shall be stored above ground on framework or blocking, shall be protected from precipitation and shall have adequate air circulation and ventilation.

2.00 PRODUCTS

2.01 FORM MATERIAL

A. Smooth Form Finish: Forms for this finish shall be applied to surfaces specified in Section 03 30 00 of these Specifications.

1. Form facing material shall produce a smooth, dense, uniform texture on the concrete. Form facing shall be one of the following:

a. Plywood, meeting the requirements of U.S. Department of Commerce Product Standard (PS). PS 1 - Construction and Industrial Plywood, B-B Concrete Form Panels. The arrangement of the facing material shall be orderly with the number of seams kept to a practical minimum.

b. Patented forms may be used, subject to acceptance by the Engineer, provided they produce a smooth, even surface. This acceptance is for the finish these forms will leave on the contact surfaces and will not relieve the Contractor of the responsibility for the design and structural soundness of the forms. Patented forms shall be lined with the specified plywood. Plywood panels and form liners shall not be used more than three times unless further use is acceptable to the Engineer.

B. Rough Form Finish: Forms for this finish shall be applied to the surfaces specified in Section 03 30 00 of these Specifications. Forms for this finish may be the same as specified for the Smooth Form Finish or may be constructed of used plywood panels, unlined steel forms or straight dressed lumber.

C. Formwork for "pan joist" construction shall be either of steel or reinforced fiberglass. Pans shall

be of sufficient stiffness and strength to hold their shape and support construction loads during concrete casting. Do not use pans that are bent out of shape or rusty.

D. Earth cuts used as forms for vertical or sloping surfaces are not permitted.

2.02 ACCESSORIES

A. Form ties for use in all liquid containment structure walls shall be selected to prevent form deflection. Form ties shall be as follows:

1. Standard one-piece crimped snap ties with a 1-inch snapback. Ties shall be provided with smooth rods, and plastic cones, or other means for forming a conical cone to ensure that the form tie is broken off back of the concrete face. The cone-shaped depressions at the surface of the concrete shall be at least 1-inch out diameter to allow filling and patching with the specified grout. Ties shall be provided with an integral water stop at the center, which tightly fits the form tie so that they cannot be moved from the mid-point of the tie.

2. Removable taper ties may be used when approved by the Engineer.

3. All of the assemblies shall permit tightening of the forms and be of such type that leaves no tie metal, or any other tie material, within 1-1/2-inch of the surface after use.

B. Form ties for use in all other walls shall be one of the assemblies specified in Article 2.02, Paragraph A, except that water stops are not required.

C. Form releasing agent for liquid containment structures in water treatment plants shall be non-toxic and leave no residue on or in the concrete unless safe for potable water (certified as compliant with NSF 61).

D. Form releasing agents for liquid containment structures in water treatment plants shall be equal to Sealtight Duogard by W.R. Meadows.

E. Form releasing agents shall permit coating the concrete surface without additional surface preparation.

F. Form releasing agents shall be a non-staining form coating compound.

G. Simulated split face CMU form liner shall be ABS material, 10-use, equal to Model “8” x “16” Rock Face Block”, Model No. 70271 as manufactured by Symons Corporation. Utilize form liner and provide form release agent in accordance with manufacturer’s written instructions and these Specifications.

3.00 EXECUTION

3.01 FORM CONSTRUCTION

A. Formwork shall be designed, erected, and removed in accordance with the latest edition of ACI 347 and as follows:

1. Construct forms complying with ACI 347 and ACI SP-4 to the sizes, shape, lines, and dimensions of members as indicated on the Drawings. Forms shall be properly braced or tied together to maintain position and shape. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. During concrete placement, the Contractor shall monitor plumb and string lines form positions and immediately correct deficiencies.

2. Forms shall be substantial and sufficiently rigid and tight to prevent leakage of water, cement and fines during placing and vibrating the concrete. Specifically, the bottom of wall forms that rest on concrete footings or slabs shall be provided with a gasket to prevent loss of fines and concrete paste during placement and vibration of concrete.

3. Construct forms so that they can be easily removed without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Forms for exposed concrete shall be carefully made and accurately

placed to obtain correct shape and lines.

4. Joints shall be butted tight. Arrangements of panels shall be orderly and symmetrical, and use of small pieces shall be avoided. Unless otherwise indicated, forms shall be chamfered 3/4-inch for external corners and edges of concrete, including top of walls, which will be exposed to view in the finished work.
5. The Contractor shall be fully responsible for the adequacy of the formwork in its entirety and any forms that are unsafe or inadequate in any respect shall promptly be removed from the work and replaced. Forms shall be securely braced against lateral deflection and instability to safely support the loads they will sustain and to maintain their dimensional and surface correctness to produce members required by the Drawings. Form ties shall be spaced close enough to avoid bulges and variations in the required cross-sectional dimensions shown on the Drawings for the members being cast.
6. Contractor may reuse forms only if in good condition. Reused forms shall be thoroughly cleaned and may require light sanding between uses to obtain a uniform surface texture on all exposed concrete surface. Forms shall not be reused if they have developed defects that would affect the surface texture of exposed concrete. Split, frayed, dented, worn, delaminated or otherwise damaged form facing material will not be acceptable. Do not use patched forms for exposed concrete surfaces or liquid containment structures. In the case of forms for the inside wall surfaces of liquid containment structures, unused tie rod holes in forms shall be covered with metal caps.
7. Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar. Wire ties for holding forms are not permitted. No form-tying device or part thereof, other than metal, shall be left embedded in concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap ties, which cause spalling of the concrete upon form stripping or tie removal, will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal tie rods extending through the concrete are used to support or strengthen forms, the rods shall remain embedded and shall terminate not less than 1-inch back from the formed face or faces of concrete.
8. Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of the walls in liquid containment structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A mechanical EPDM rubber expanding plug equal to the X-Plug by Greenstreak Group, Inc or approved equal shall be seated at the mid-point of the wall and shall be installed in accordance with the manufacturer's written instructions. The hole shall be completely filled with non-shrink grout. For above grade walls, the outer 2-inches of the exposed face shall be filled with a cement grout with a color and texture to match the surrounding wall surface.
9. Box out for chases, recesses or other openings required in the completed work.
10. Install all the items (sleeves, inserts, hangers, anchors, etc.), to be supported by the formwork as required by the work.
11. Install pipe sleeves, wall pipes and wall sleeves, as shown or specified, for all piping penetrating walls and slabs. The use of block-outs in walls is prohibited. Pipe sleeves shall be used in slabs for plumbing pipes and wiring conduits.
12. Inspect formwork and remove deleterious material immediately before concrete is placed. Provide a sufficient number of temporary cleanout openings at the base of wall and column formwork to facilitate cleaning, inspection and the application of grout to the column bases.
13. The use of reinforcing steel, partially embedded in concrete, as toe pins or form spacers is prohibited.

3.02 FALSEWORK

A. The Contractor shall be responsible for the design, engineering, construction, maintenance and safety of all false work, including staging, walkways, forms, ladders, and similar appurtenances, which shall equal or exceed the applicable requirements of the provisions of the OSHA Safety and health Standard of Construction, and the requirements herein.

B. The Contractor shall design and construct false work to provide the necessary rigidity and to support the loads. Falsework for the support of the superstructure shall be designed to support the loads that would be imposed if the entire superstructure were placed at one time.

C. The Contractor shall place false work upon a solid footing, safe against undermining, and protected against softening.

3.03 TOLERANCES FOR FORMED SURFACES

Tolerances shall be limited to the criteria in the latest edition of ACI 117, except as indicated.

A. Deviation from the Level or from the Grades Shown on the Drawings

1. In Slab Soffits, Beam Soffits and Tops of Slabs, Measured Before Removal of Supporting Shores:

a. In any 10 Foot Length: 1/4-inch.

b. In any Bay or in any 20 Foot Length: 3/8-inch.

c. Maximum for the Entire Length: 3/4-inch.

d. Except where F_F and F_L values are more stringent as indicated in Specification Section 03 30 00 or on the Drawings.

B. Deviation in Cross-Sectional Dimensions of Columns and Beams and in the Thickness of Slabs and Walls: -1/4-inch, +1/2-inch.

C. Deviation in Sizes of Pipe Sleeves, Wall Pipes and Wall Sleeves: None.

D. Deviation in Location of Pipe Sleeves, Wall Pipes and Wall Sleeves: $\pm$1/8-inch.

E. Footings

1. Deviations in Dimensions in Plan: -1/2-inch, +2-inches.

2. Misplacement or Eccentricity: Two percent of the footing width in the direction of misplacement but not more than: 2-inches.

3. Thickness: Decrease in specified thickness - none; increase in specified thickness 25 percent unless otherwise approved by the Engineer.

4. Tolerances above apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels or embedded items.

3.04 APPLICATION OF FORM COATING

Before the placing of reinforcing, faces of all forms to be in contact with the concrete shall receive a thorough coating of the liquid form-releasing agent specified, applied in compliance with the manufacturer's instructions.

3.05 INSPECTION

Inspect all the work in accordance with Section 03 30 00 of these Specifications.

3.06 REMOVAL OF FORMS

A. Forms shall be removed in a manner that will ensure the safety of the workers, ensure the serviceability and the structural integrity of the structure. The forms and shoring shall remain in place for the following minimum concrete strengths and periods of time after the casting of the concrete is completed, whichever is more stringent:

	Form Removal, Days	Reshoring, Days	Reshoring, Concrete Strength
Beams and Slabs (Soffits)	7	14	28-day

B. Formwork for beam and slab soffits shall be designed so that they can be removed without removal of sufficient original shores to adequately support the work until such time that the concrete strength reaches its specified 28-day strength.

C. Removal of forms shall be coordinated with the selected method of curing concrete specified in Section 03 30 00.

D. Wood forms shall be completely removed from all the work to avoid termite infestation.

E. All elevated concrete shall be shored and/or reshored to the foundation until the structure is complete and the concrete has reached its 28-day strength.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

This section specifies requirements for concrete joints, including joint fillers and sealants, and embedded items for all cast-in-place concrete except as noted below.

1.02 SUBMITTALS

A. Shop Drawings. Submit shop drawings showing all concrete joints, proposed sequences for concrete placement and type of concrete specified. This information may be shown on the reinforcing steel shop drawings.

B. Product Data. Submit manufacturer's technical literature on product brands, proposed for use by the Contractor. The submittal shall include the manufacturer's installation and/or application instruction. Submittals shall be made on the following products:

1. Expansion joint fillers.
2. Joint sealing compound and primer.
3. Bonding agent.
4. Elastomeric compression seal.
5. Plastic adhesive water stop.

C. Laboratory Reports.

1. Submit certification by a certified independent testing laboratory that the water stops meet or exceed the physical requirements of CRD-C572.

2. Submit reports from a certified independent testing laboratory certifying that the elastomeric compression seal type preformed expansion joint sealer conforms to ASTM D 2628.

PART 2 - PRODUCTS

2.01 EXPANSION AND ISOLATION JOINT FILLER

A. Bituminous Joint Filler. Preformed bituminous type conforming to ASTM D 994 or cane fiber asphalt-impregnated type conforming to ASTM D 1751. Provide 3/4-inch-thick filler unless otherwise shown. Use bituminous joint filler at the following locations:

1. Expansion joints between paving and structures.

2.02 JOINT SEALING COMPOUND

Joint sealing compound used on joints in liquid containing structures shall be suitable for continuously submerged service. Provide joint primer according to manufacturer's recommendation.

A. Joint sealing compound conforming to ASTM D 1190 shall be used at the following joints:

1. Expansion joints between paving and structures.

B. Single- or multi-component urethane joint sealing compound conforming to ASTM C 920, Grade 25. Type, grade and use classification shall be as required for the specific location of use. Material shall be suitable for use in continuously submerged service. Use at the following joints:

1. Expansion joints in liquid containing structures.

2.03 CONCRETE BONDING AGENTS

A. Epoxy Bonding Agent. Shall permanently bond fresh wet concrete to cured concrete and shall conform to ASTM C 881, Type II. Bonding agent shall develop the full strength of the concrete. Grade and class shall be as required for the project application. A field service representative of the manufacturer shall be present during initial application to instruct the Contractor in the proper

use of the product when so requested by the Architect/Engineer or the Contractor.

B. Latex Bonding Agent. Non-re-emulsifiable latex base liquid formulated for bonding wet concrete to hardened concrete and for mixing with cement mortar. Bonding agent shall be certified by the manufacturer for use in a continuously submerged environment.

2.04 BOND BREAKER

30-pound asphalt saturated felt.

2.05 EXPANSION JOINT DOWELS

Smooth steel bars conforming to the requirements of Section 03 21 01, CONCRETE REINFORCEMENT. Cut dowels to length at shop or mill before delivery to the site. Dowels must be straight and clean, free of loose flaky rust and loose scale. Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and extends no more than 0.04 inch from the end.

2.07 WATER STOPS

See plans for location and type required.

A. PVC Water stops. PVC water stops shall be made of virgin polyvinyl chloride compound and shall conform to the requirements of the Corps of Engineers' Specification CRD-C572. The water stops shall be produced by an extrusion process and shall be uniform in dimension, homogeneous and free from porosity. Unless otherwise shown, use water stops of 5-inch minimum width and 3/8- inch minimum thickness. Water stop construction:

1. Construction Joints and Control Joints. Serrated type with center bulb.
2. Expansion Joints. Dumbbell type with a minimum 3/4-inch inside diameter center bulb.

2.08 MISCELLANEOUS EMBEDDED METAL ITEMS

Miscellaneous embedded metal items shall conform to the requirements of the section of the specifications to which they apply.

PART 3 - EXECUTION

3.01 GENERAL

A. Place embedded items to least impair strength of the structure. Obtain approval of locations for embedded items not shown on the structural drawings before placement of concrete. Should locations of embedded items be detrimental to the strength of the structure, notify the Engineer and relocate items as directed by the Engineer.

B. Do not cut or reposition reinforcing steel to facilitate installation of inserts, conduit, sleeves, anchor bolts, mechanical openings and similar items without prior approval of the Engineer, except that reinforcing bars may be moved one bar diameter or within tolerances specified in Section 03 21 01, CONCRETE REINFORCEMENT without prior approval.

3.02 CONSTRUCTION JOINTS

A. Make construction joints only at locations shown on the contract drawings, the reviewed shop drawings or as directed or approved by the Engineer. Any additional construction joints or relocation of construction joints shown on the drawings, proposed by the Contractor, shall be submitted for review.

B. Joints shall be located to least impair strength of the structure. In general, locate joints near the middle of spans of slabs, beams and girders. However, if a beam intersects a girder at the joint, offset joints in girders a distance equal to twice the width of the beam. Locate joints in walls and columns at the underside of floors, slabs, beams or girders and at tops of footings or floor slabs. Place beams, girders, column capitals and drop panels monolithic with slabs. Place brackets and

haunches monolithic with walls and columns.

C. All joints shall be perpendicular to main reinforcement. Continue all reinforcing steel and WWF across construction joints. Unless otherwise shown, provide longitudinal keys at least 1-1/2 inches deep by one third of the wall thickness, centered in the wall, in all joints in walls and slabs and between walls and slabs or footings. When joints in beams are allowed, provide shear key and inclined dowels as directed by the Architect/Engineer.

D. Construction joints in slabs on ground shall have a groove in the top of the slab, at the joint, as detailed to receive joint sealant.

E. Prepare joints by roughening the concrete surface in a manner that will expose aggregate uniformly. Remove laitance, loosened particles of aggregate, damaged concrete at surface, and other substances that may prevent complete adhesion. Prior to placing concrete, coat the joint surface with a mixture of neat cement grout.

F. In lieu of the above method for securing bond between new and set concrete, the following optional method may be used. Use a latex bonding agent as specified applied to roughened and cleaned surfaces of set concrete in strict accordance with manufacturer's recommendations and these specifications with respect to preparation of surfaces and applications of bond agent.

G. Provide water stops in all wall and slab construction joints as specified and where shown on the drawings.

3.03 EXPANSION JOINTS

A. Do not extend reinforcement or other embedded metal items that are continuously bonded to concrete through any expansion joints.

B. Position expansion joint filler material accurately. Support against displacement during concrete placement and vibration. Place filler the full depth of the member less an allowance to form a groove for sealant as detailed.

3.04 DOWELS

Where indicated on drawings, install smooth dowels at right angles to construction joints and expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the drawings, apply oil or grease to one end of all dowels through expansion joints.

3.05 ISOLATION JOINTS

A. Do not extend reinforcement or other embedded metal items through any isolation joints.

B. Position expansion joint filler material accurately. Support against displacement during concrete placement and vibration. Place filler the full depth of the member less an allowance to form a groove for sealant as detailed.

3.06 CONTRACTION JOINTS

A. Make top grooves for contraction joints in slabs on grade as detailed and seal as specified. Grooves may be made with forms or may be sawed.

3.07 EPOXY BONDED JOINTS

Epoxy bonded joints shall be used only where shown on the drawings, where specified, or upon written approval of the Architect/Engineer. Prepare surface to be bonded and apply bonding agent in strict accordance with the manufacturer's instructions and ACI 503.2, except that surface preparation by acid etching will not be allowed. When ACI 503.2 references ACI 301, delete ACI 301 and substitute the project specifications' Cast-in-Place Concrete section. Forms in the area of the bonded joint shall be properly protected so that any bonding agent that may be inadvertently applied to the form will not bond the form to the concrete.

3.08 WATER STOPS

A. Provide water stops in all horizontal and vertical joints in foundation slabs and peripheral walls of all structures up to a minimum of 12 inches above final ground level and all walls and slabs of liquid-containing structures or compartments to a minimum of 12 inches above maximum liquid level unless specifically shown otherwise on the drawings. In addition, provide water stops in joints of interior walls of liquid containing structures when shown on the drawings.

B. Water stops shall be 5″ x 3/8″ PVC water stops except at locations where premolded plastic adhesive water stops or hydrophilic water stops are shown on the drawings.

C. Each piece of premolded water stop shall be of maximum practicable length for a minimal number of end joints.

1. Make splices at intersections and at ends of pieces in a manner most appropriate to the material being used and in accordance with manufacturer's recommendations. Joints must develop effective water tightness fully equal to that of continuous water stop material, must permanently develop not less than 50 percent of mechanical strength of parent section, and must permanently retain flexibility. Whenever possible, the manufacturer's thermostatic splicing tool shall be used.

D. Accurately position and support water stops against displacement during concrete placement.

3.09 SEALING JOINTS

A. Apply sealant at all expansion and isolation joints, construction joints in slabs on grade and at other locations as shown on the drawings.

B. Thoroughly clean and prime joints to be sealed before applying sealant.

C. Apply sealants in accordance with manufacturer's recommendations.

D. Sealant shall be applied when the ambient temperature is between 40°F and 90°F, unless recommended otherwise by the sealant manufacturer.

E. During pouring operations, exercise care to prevent sealant from spilling onto surfaces adjacent to grooves.

3.10 SETTING ANCHOR BOLTS

A. Set anchor bolts specified in other sections according to this section.

B. Install equipment anchor bolts as required by the equipment manufacturer.

C. Provide accurately made templates for positioning anchor bolts.

3.11 OTHER EMBEDDED ITEMS

A. It is the Contractor's responsibility to coordinate the requirements for embedded items and to ensure that embedded items are properly placed.

B. Accurately position and support embedded items against displacement during concrete placement.

C. Voids in sleeves, inserts, anchors, etc., shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

D. Steel items, except reinforcing, shall be galvanized unless specified or shown otherwise. Galvanized embedded items shall not be in contact with the reinforcing steel or un-galvanized steel items.

E. Conduits, pipes and inserts of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.

F. Except when plans for conduits and pipes are approved by the Engineer, conduits and pipes embedded within a slab, wall or beam (other than those merely passing through) shall satisfy the following:

1. They shall not be larger in outside dimension than 1/3 the overall thickness of slab, wall or beam in which they are embedded.
2. They shall not be spaced closer than three diameters or widths on center.
3. They shall not significantly impair the strength of the member.

END OF SECTION

1.00 General

Scope

The work included in this section consists of furnishing all labor, materials, and equipment necessary to provide and properly fabricate and place all concrete reinforcement steel, welded wire fabric, couplers, and inserts for use in the reinforced concrete construction. This includes all wires, clips, supports, chairs, spacers and other accessories.

The furnishing, fabrication and construction of the concrete reinforcement shall be in accordance with ACI 301, ACI 315, CRSI and as shown and indicated on the Drawings and specified in this section.

1.01 Submittals

A. Shop Drawings

1. All shop drawings shall be of the same size. Reproductions of the Drawings for use as shop drawings are not permitted. Shop drawings shall include placing drawings, bending details, splice locations, and bar lists with bar marks. All details and notes appearing on the Drawings, giving information for the placing of reinforcing steel, shall be shown on the shop drawings. Shop drawings will not be reviewed without such information.
2. Shop drawings shall comply with ACI 315, Details and Detailing of Concrete Reinforcement and CRSI Manual of Standard Practice, showing bar schedules, arrangement of reinforcement, stirrup spacing, layout of splices, layout of ties, and diagrams of bent bars. Shop drawings shall include special reinforcement required, such as corner bars and openings through concrete structures.
3. Wall reinforcing shall be shown in elevation.
4. Show location and size of all penetrations greater than 6-inches in diameter or across the opening with the corresponding added reinforcing around the penetrations.
5. Submittals shall be complete for each structure. Partial submittals are not permitted and will be returned unmarked. Each submittal shall clearly indicate the structure and Drawing numbers for which the work applies. The identifying numbers of the shop drawings for each structure shall be in numerical order with a unique designation for each structure.
6. Location and arrangement of accessories shall be clearly indicated.
7. All shop drawings shall be checked by the fabricator and Contractor before being submitted to the Engineer.

B. Mill tests of reinforcing steel shall be submitted prior to use for each 15 tons or less shipped to the site. Tests shall be conducted in conformance with ASTM A 615, and methods prescribed therein.

1. Cost of mill tests shall be borne by Contractor.
2. Three copies of each test report stating whether the material meets the requirements of the ASTM specifications shall be submitted to the Engineer.
3. Certified copies of the mill tests may be considered evidence of compliance provided such tests are regularly conducted by the reinforcement supplier by experienced, competent personnel using adequate testing equipment. In case of doubt as to the adequacy or accuracy of the mill tests, the Engineer may require the Contractor to furnish, at no additional cost to the Owner, test results from an independent testing laboratory acceptable to the Engineer on mill samples or delivered steel reinforcement.

C. Manufacturer's Literature and Certifications: The Contractor shall submit manufacturer's literature for all accessories which contains written instructions and recommendations for installation and certified test reports to verify load capacity where applicable.

2.00 Products

2.01 Bar Reinforcement

A. Bar reinforcement shall be deformed-type bars conforming to ASTM A 615. Reinforcement shall be manufactured from new billet steel of American manufacture, Grade 60.

B. Bar reinforcement shall be shop fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 and ACI 318.

C. Bars shall be bent cold. Bars shall be pre-fabricated to detail and delivered on the job plainly tagged and ready to set.

2.03 Deformed Bar Anchors

A. Deformed bar anchors shall be manufactured from cold-rolled, deformed-type bars conforming to the requirements of AWS D1.1 and ASTM A 1064 with a minimum yield strength of 70 ksi and tensile strength of 80 ksi.

B. Deformed bar anchors shall be manufactured by Nelson Stud Welding, Inc., Elyria, Ohio or Stud Welding Associates, Inc., Strongsville, Ohio.

2.04 Accessories

A. Supports for Reinforcement: Provide supports for reinforcement in compliance with CRSI Manual of Standard Practice, including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcing in place.

B. All chairs, spacers, bolsters and other devices shall have plastic-covered or galvanized steel legs at formed slabs and beams, and plastic-covered for all walls and liquid containment structures. For slabs on grade, bare metal is acceptable.

C. For slabs on grade 10-inches or less, all bottom slab reinforcing shall be supported on chairs and/or bolsters as required to properly position the bars or welded wire fabric. The chairs and/or bolsters shall be supported on precast concrete pads bearing on the subgrade. The concrete pads shall be at least 6 x 6-inches and be no more than 1-1/2-inches thick. Pads shall be cast from [Group II Class "A"] concrete or from mortar made up of one part cement and two parts sand, with tie wires embedded.

D. For slabs on grade greater than 10-inches, bottom slab reinforcing shall be supported directly on concrete blocks bearing on the subgrade or the system noted above for slabs 10-inches or less.

E. Mechanical Couplers: Mechanical couplers shall be provided only where indicated on the Drawings and where approved by the Engineer. The couplers shall be ICC-ES certified and shall develop a tensile strength that exceeds 125 percent of the yield strength of the reinforcement bars being spliced at each splice. Splice locations shall be staggered. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with specifically forged ends which provide upset threads which do not decrease the basic cross section of the bar. All couplers shall be tested to ASTM A1034 Standard Test Method for Testing Mechanical Splices for Steel Reinforcing Bars.

F. Epoxy for drilling and grouting reinforcing bars shall meet the requirements in Section 03 15 19.

3.00 Execution

3.01 Storage of Materials

Reinforcing steel delivered to the site, not immediately placed in forms, shall be protected from mud and excessive rust-producing conditions by storing in a well-drained area and supported off the ground. All reinforcing shall be properly tagged with their bar marks and location in the structure clearly noted.

3.02 Tolerances

A. Allowable tolerances shall be in accordance with the latest edition of ACI 117, except as indicated.

B. Allowable tolerances for fabricating steel reinforcement shall be as follows:

Item	Maximum Tolerance, Inches	
Sheared Length of Bars	+1	-1
Depth of Truss Bars	+0.0	-1/2
Outside Dimensions of Stirrups, Ties and Spirals	+1/2	-1/2
Location of Bends	+1	-1

C. Allowable tolerances for placing steel reinforcement shall be as follows:

Item	Maximum Tolerance, Inches	
Concrete Cover from Outside of Bar to Finished Surface	+1/4	-0.0
Lateral Spacing of Bars in Plane of Reinforcement in Beams and Joists	+1/4	-0.0
Lateral Spacing of Bars in Plane of Reinforcement in Slabs and Walls	+1	-1
Spacing of Stirrups, Ties and Spirals Along Longitudinal Axis of Member	+1/2	-1/4
Height of Bottom Bars in Slabs, Beams and Joists	+1/4	-1/4
Height of Top Bars in Slabs, Beams and Joists Depth 8" and Less Depth 9" - 24" Depths 25" and Greater	+1/4 +1/2 +1	-1/4 -1/2 -1

3.03 Fabrication

A. Field fabrication of reinforcing steel is not permitted.

B. Reinforcing steel shall be accurately fabricated to the dimensions shown.

C. Reinforcing bars shall be bent cold and shall not be bent in a manner which will damage the material.

3.04 Placement and Anchorage

A. Space metal chairs, bolsters, spacers and hangers in accordance with ACI 315.

B. Reinforcement and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale, form release agent, rust, mortar or other foreign substances or coatings immediately before concrete is placed. Bars with kinks or bends not shown on the plans shall not be used.

C. Reinforcement shall be accurately placed in accordance with the Drawings and shall be

adequately secured in position with not less than 16 gauge annealed wire or suitable clips at intersections. Set wire ties so that ends are directed into the member and not toward the face of the concrete. Reinforcement shall be held securely in position, at the required distance from the forms, during concrete placement. Nails shall not be driven into outside forms to support reinforcement. Tack welding may not be used to secure reinforcement.

D. Install welded wire reinforcement for concrete slabs on ground and as otherwise indicated. Lap all joints 12-inches and wire securely. Extend mesh to within 2-inches of sides and ends of slabs. Sheets that do not lay flat when in their intended position will be rejected. Tags designating the wire size and spacing shall be left on each sheet until ready for use. Tuck ends of welded mesh well down into edge of beams or walls. Do not leave unreinforced border strips. Welded wire reinforcement shall not contain loose rust. All welded wire reinforcement shall be supported and tied in its proper location. The construction practice of placing welded wire reinforcement on the ground and hooking it into place in the freshly placed concrete shall not be permitted. Supports shall be spaced not more than 3-feet on center in any direction.

E. Conduits: Where conduits are permitted in slabs as noted on the Drawings, low conduit shall be tied with wire to the upper side of bottom reinforcing in the transverse direction and top conduit shall be tied with wire to lower side of top reinforcing in the transverse direction. Where parallel conduits occur, they shall not be spaced closer than four diameters on center (using larger conduit) and separated from reinforcing by not less than 4-inches clear.

F. Reinforcement partially embedded in concrete shall not be bent in the field unless permitted by the Engineer.

G. Weld deformed bar anchors to A36 steel plates in accordance with Chapter 7 of AWS D1.1 using a stud welding gun.

H. Properly cap all vertical reinforcement steel.

B. Reinforcement shall be protected by concrete cover as shown and noted on the Drawings.

3.06 Splicing

A. Splicing of reinforcement shall be as shown and indicated on the Drawings. Splices not shown on the Drawings shall be Class "B" splice, in accordance with ACI 318. Any changes to the location and type of splices desired by the Contractor must be specifically requested and must meet with the acceptance of the Engineer before they can be used.

B. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress between bars by bond.

C. Mechanical splices may be used instead of lap splices provided that their location and type meets with the acceptance of the Engineer.

D. Welded splices are not permitted.

E. Couplers which are located at a joint face shall be the type which can be set either flush or recessed from the face as indicated. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections (form savers) shall be recessed a minimum of 1/2-inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O- ring seal and recess filled with sealant to prevent any contact with water or other corrosive materials.

3.07 Inspection

A. Inspect all the work in accordance with Section 03 30 00 of these Specifications.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. Comply with the following sections of ACI 301 unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."

B. Comply with ACI 117.

2.1.1 POLYMER CONCRETE

A. Polymer concrete shall be Sauereisen Epoxy Polymer Concrete No. 165, or Owner approved equal. Polymer concrete shall be used for cast-in-place manhole bases where called for in the plans.

PHYSICAL PROPERTIES	
Application time	
Working time at 70°F	30 minutes
Initial set at 70°F	8 Hours
Compressive strength (ASTMC-579)	
At 24 Hours	3,355 psi (235.85 g/cm^2)
At 7 days	16,215 psi (1139.91 kg/cm^2)

At 28 days	18,417 psi (1294.71 kg/cm^2)
Density (ASTM C-580)	140.27 pcf (2.2 gm/cm^3)
Flexural strength (ASTM C-580)	3,729 psi (262.2 kg/cm^2)
Maximum service temperature	200^{o}F (93.3^{o}C)
Modulus of elasticity (ASTM C-580)	1.75 x 10^6 psi (1.2 x 10^5 kg/cm^2)
Shrinkage (ASTM C-531) 7 days	0.090%
Tensile strength (ASTM C-307)	2,014 psi (141.6 kg/cm^2)

Use of this, or other approved product, shall be per the manufacturer's recommended practice.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
D. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.3 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
B. Cementitious Materials:
   1. Portland Cement: ASTM C 150/C 150M, Type I/II.
   2. Fly Ash: ASTM C 618, Class C or F.
   3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
   4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag cement.
C. Normal-Weight Aggregate: ASTM C 33/C 33M, 1-1/2-inch (38-mm) nominal maximum aggregate size.
D. Air-Entraining Admixture: ASTM C 260/C 260M.
E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
F. Water: ASTM C 94/C 94M.

2.4 RELATED MATERIALS

A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
D. Water: Potable.
E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 CONCRETE MIXTURES

A. Comply with ACI 301.
B. Normal-Weight Concrete:
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum W/C Ratio: 0.45.
   3. Cementitious Materials: Use fly ash, pozzolan, slag cement, and blended hydraulic cement as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
   4. Slump Limit: 5 inches 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
   5. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116, and furnish batch ticket information.
   1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR-RETARDER INSTALLATION

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
   1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

3.6 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Do not add water to concrete during delivery, at Project site, or during placement.

D. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding 1/2 inch.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
   1. Apply to concrete surfaces exposed to public view,.

C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-rubbed finish.
   2. Grout-cleaned finish.
   3. Cork-floated finish.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
   1. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 305.1 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Tests: Perform according to ACI 301.
   1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Description

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 REFERENCES

A. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311.5R - Batch Plant Inspection and Field Testing of Ready Mixed Concrete.

H. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures.

I. ACI 318 - Building Code Requirements for Reinforced Concrete.

J. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

K. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

L. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

M. ASTM A 767 - Standard Specifications for Zinc-coated (Galvanized) Bars for Concrete Reinforcement.

N. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

O. ASTM A 884 - Specification for Epoxy-coated Steel Wire and Welded Wire Fabric for Reinforcement.

P. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

Q. ASTM C33 - Standard Specification for Concrete Aggregates.

R. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

S. ASTM C42 - Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

T. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

U. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

V. ASTM C138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

W. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

X. ASTM C150 - Standard Specification for Portland Cement.

Y. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.

Z. ASTM C191 - Standard Test Methods for Time of Setting of Hydraulic Cement

AA. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

AB. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

AC. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

AD. ASTM C309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

AE. ASTM C685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

AF. ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures

AG. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

AH. ASTM C1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory

Evaluation.

AI. CRSI MSP-1 - Manual of Standard Practice.

AJ. CRSI - Placing Reinforcing Bars.

AK. NRMCA - Concrete Plant Standards.

AL. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

1.03 SUBMITTALS

A. Conform to Section 01 33 00 - Submittals.

B. Submit proposed mix design and test data for each type and strength of concrete in the Work.

C. Submit laboratory reports prepared by an 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 the Engineer.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. 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.

H. Related Sections

Section 01 27 00 – Unit Prices
Section 01 33 00 – Submittals

Section 33 05 13 – Sanitary Sewer Manholes, Frames, and Covers

1.04 HANDLING AND STORAGE

A. Cement: Store cement off of the ground in a well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to the coating.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C150, Type II cement.

2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in the form of Na_2O + $0.658K_20$.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C94.

C. Aggregate:

1. Coarse Aggregate: ASTM C33. Unless otherwise indicated, use the following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of the narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.

2. Fine Aggregate: ASTM C33.

3. Determine the potential reactivity of fine and coarse aggregate in accordance with the Appendix to ASTM C33.

D. Air Entraining Admixtures: ASTM C260.

E. Chemical Admixtures:

1. Water Reducers: ASTM C494, Type A.

2. Water Reducing Retarders: ASTM C494, Type D.

3. High Range Water Reducers (Superplasticizers): ASTM C494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A615, ASTM A767, or ASTM A 775, grade 40 or grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.

2. Where shown, use welded wire fabric with wire conforming to ASTM A185 or ASTM A884. Supply the gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.

3. Wire: ASTM A82. Use 16-1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C309.

I. Non-Shrink Grout

Grout shall be non-shrink in the plastic state and show no expansion after set as tested in accordance with ASTM C827 and shall develop compressive strength not less than 3,000 psi with a trowel able mix within 24 hours per ASTM C109. The placement time shall be not less than 45 minutes based on initial set per ASTM C191. Test results shall be furnished by the manufacturer and submitted to the Engineer.

2.02 FORMWORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair the finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2-inch (nominal) lumber, or 3/4-inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Formwork for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4-inch minimum thickness, preferably oiled at the mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in a gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present a smooth surface and which line up properly.

2.03 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C94, or

concrete produced by volumetric batching and continuous mixing in accordance with ASTM C685.

2.04 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C685.

B. Measure water and liquid admixtures by volume.

2.05 DESIGN MIX

A. Use design mixes prepared by a certified testing laboratory in accordance with ASTM C1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to the Engineer for review.

C. Proportioning based on field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, if approved by the Engineer.

D. Classification:

CLASS	TYPE	MINIMUM COMPRESSIVE STRENGTH (LBS/SQ. IN.)		MAXIMUM W/C RATIO	AIR CONTENT (PERCENT)	CONSISTENCY RANGE IN SLUMP (INCHES)
		7-DAY	28-DAY			
A	Structural	3200	4000	0.45	4± 1	2 to 4
B	Pipe Block Fill, Thrust Block	----	1500	----	4± 1	5 to 7
G	Encasement	----	2000	----	4± 1	3 to 6

E. Determine air content in accordance with ASTM C138, ASTM C173 or ASTM C231.

F. Use of Concrete Classes: Use classes of concrete as indicated on the Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, and concrete fill unless indicated otherwise. Use Class G for concrete encasement. Use Class A for all other applications.

PART 3 EXECUTION

3.01 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within the tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate cleanout openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back formwork with a sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer the liner on the job before using. Facing may be constructed of 3/4-inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4-inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Engineer, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before the concrete is placed, wet surface of forms which will come in contact with concrete.

3.02 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by the Engineer and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2-1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on the Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of the Engineer. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

3.03 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C94, Sections 8 through 11. Produce ready-mixed concrete using an automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C685, Sections 6 through 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of the Engineer before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to the site shall be accompanied by batch tickets providing the information required by ASTM C94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing the information required by ASTM C685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in the shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until the concrete has cured for a minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by the Engineer.

3.04 PLACING CONCRETE

A. Give sufficient advance notice to the Engineer (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to the Engineer’s approval.

B. Schedule concrete placing to permit completion of finishing operations in

daylight hours. However, if necessary to continue after daylight hours, light the site as required. If rainfall occurs after placing operations are started, provide covering to protect the work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken an initial set; do not place any strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for the size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move the vibrator vertically through the layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.05 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.

2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Engineer. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.

3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.06 WATER STOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for the extent of the joint; make splices necessary to provide such continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace water stops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until the next pour. When a waterstop will remain exposed for 2 days or more, shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

C. Splicing PVC Water stops:

1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with the manufacturer's printed instructions.

2. Butt end-to-end joints of two identical waterstop sections may be made in the forms during placement of water stop material.

3. Prior to placement in formwork, prefabricate waterstop joints involving more than two ends to be joined together, an angle cut, an alignment change, or the joining of two dissimilar waterstop sections, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon inspection and approval by the Engineer, install prefabricated waterstop joint assemblies in formwork, and butt-weld ends of the 24-inch strips to the straight-run portions of water stop in the forms.

D. Setting PVC Water stops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of the work to ensure proper embedment in concrete and to prevent folding over of the waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.

2. Where a waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to a waterstop in a future concrete placement, terminate the waterstop 6 inches below the top of the wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying to the Specifications.

F. Resilient Water stop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.

2. When requested by the Engineer, provide technical assistance by manufacturer's representative in the field at no additional cost to the District.

3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.

4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop a minimum of 6 inches and place in contact with the PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form a smooth joining surface.

5. At the free top of walls without connecting slabs, stop the resilient waterstop and grooves (where used) 6 inches from the top in vertical wall joints.

6. Bentonite Water stop:

    a. Locate bentonite waterstop as near as possible to the center of the joint and extend continuous around the entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.

    b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1-1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.

    c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no way harm the material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.

    d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth if necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using an epoxy grout which completely fills voids and irregularities beneath the waterstop material. Prior to installation, wire brush the concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

    e. In addition to the adhesive backing provided with the waterstop, secure bentonite waterstop in place with concrete nails and washers at 12-inch maximum spacing.

7. Adhesive Waterstop:

   a. With a wire brush thoroughly clean the concrete surface on which the waterstop is to be placed and then coat with primer.

   b. If the surface is too rough to allow the waterstop to form a complete contact, grind to form an adequately smooth surface.

   c. Install the waterstop with the top protective paper left in place. Overlap joints between strips a minimum of 1 inch and cover back over with protective paper.

   d. Do not remove protective paper until just before final formwork completion. Concrete shall be placed immediately. The time that the waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.07 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for a period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from the concrete surface after placing and finishing. A curing day is any calendar day in which the temperature is above 50 degrees F for at least 19 hours. Colder days may be counted if air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at the end of calendar days equal to twice the required number of curing days. However, leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

B. Cure formed surfaces by leaving forms in place for the full curing period. Keep wood forms wet during the curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Unformed Surfaces: Cure by membrane curing compound method.

   1. After concrete has received a final finish and surplus water sheen has disappeared, immediately seal surface with a uniform coating of approved curing compound, applied at the rate of coverage recommended by manufacturer or as directed by the Engineer. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of the compound.

   2. Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of

compound between nozzle and concrete surface during spraying operations.

3. Do not apply compound to a dry surface. If concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or if rain falls on a newly coated surface before film has dried sufficiently to resist damage, apply an additional coat of compound at the specified rate of coverage.

3.08 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for the required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached the specified 28-day strength, unless directed otherwise by the Engineer.

3.09 DEFECTIVE WORK

A. Immediately repair any defective work discovered after forms have been removed. If concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace the entire section. Payment for defective work is the sole responsibility of the Contractor.

3.10 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use a stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with the surface.

B. Apply a rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet the surface with a brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface to paste, to remove form marks and projections, and to produce a smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing,

allow paste on the surface to reset; then wash surface with clean water. Leave structure with a clean, neat and uniform-appearing finish.

C. Apply a wood float finish to concrete slabs.

3.11 FIELD QUALITY CONTROL

A. Unless otherwise directed by Engineer, the following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by an approved independent testing agency, and conform to the requirements of ASTM C1077.

1. Take concrete samples in accordance with ASTM C172.

2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test the specimens in accordance with ASTM C31 and ASTM C39.

3. When taking compression test specimens, test each sample for slump according to ASTM C143, for temperature according to ASTM C1064, for air content according to ASTM C231, and for unit weight according to ASTM C138.

4. Inspect, sample and test concrete in accordance with ASTM C94, Section 13, 14, and 15, and ACI 311-5R.

B. Test Cores: Conform to ASTM C42.

C. Testing High Early Strength Concrete: When Type III cement is used in concrete, the specified 7-day and 28-day compressive strengths shall be applicable at 3 and 7 days, respectively.

D. 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. If additional curing fails to produce the required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by the Engineer, at no additional cost to the District.

3.12 PROTECTION

A. Protect concrete against damage until final acceptance.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic, and whenever such precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of the structure needed to resist the loading are complete and have reached the specified 28-day compressive strength, except as authorized otherwise by the Engineer.

PART 4 MEASUREMENT AND PAYMENT

4.01 MEASUREMENT AND PAYMENT

Will be in accordance with Section 01 29 00.

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes

1. Controlled low strength material (CLSM) for use in the following:

a. Flowable backfill.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 1 - General Requirements.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement

a. Measurement for this Item shall be by the face cubic yard to the depth specified of material complete in place. Volume will be computed based on the measured area and type, verified by field measurements.

2. Payment

a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per cubic yard of “CLSM” installed for:

1. Various thicknesses

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification, unless a date is specifically cited.

2. American Society for Testing and Materials (ASTM):

a. C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

b. C 33 - Standard Specification for Concrete Aggregates.

c. C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

d. C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

e. C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

f. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

g. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

h. D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3).

1.04 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

Submit data completely describing products.

B. Shop Drawings

Submit full mix details, including mix design calculations for mix proposed for use.

C. Test and Evaluation Reports

1. Sieve Analysis
    a. Submit sieve analyses of fine and coarse aggregates being used. Resubmit at any time there is a significant change in grading of materials.
2. Trial Batch Test Data
    a. Submit data for each test cylinder.
    b. Submit data that identifies mix and slump for each test cylinder.

1.05 QUALITY ASSURANCE

A. Preconstruction Testing

1. Compression Testing
    a. Test 8 cylinders, four (4) at three (3) days and four (4) at 28 days.
2. Slump Test

B. Field Samples

Not less than three (3) cylinder specimens will be tested for each 150 cubic yards of controlled low strength material and not less than three (3) specimens for each half-day's placement

2.00 PRODUCTS

2.01 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Performance / Design Criteria

1. Total calculated air content
    a. Not less than 8.0 percent or greater than 12.0 percent.
2. Minimum unconfined compressive strength
    a. Not less than 50 pounds per square inch measured at 28 days.
3. Maximum unconfined compressive strength
    a. Not greater than 150 pounds per square inch measured at 28 days.
    b. The long-term strength (90 days) shall be limited to 200 psi such that material could be re-excavated with conventional excavation equipment in the future if necessary.
4. Wet density
    a. No greater than 132 pounds per cubic foot.
5. Color
    a. No coloration required unless noted.
    b. Submit dye or other coloration means for approval.

B. Materials

1. Portland cement

a. Type II low alkali Portland cement.

2. Fly ash

a. Class F fly ash in accordance with ASTM C 618.

3. Admixture

a. Air entraining admixture in accordance with ASTM C 260.

4. Fine aggregate

a. Concrete sand (does not need to be in accordance with ASTM C 33).

b. No more than 12 percent of fine aggregate shall pass a No. 200 sieve

c. No plastic fines shall be present.

5. Coarse aggregate

a. Pea gravel no larger than 3/8 inch.

C. Mixes

1. Suggested design mix

Material	Weight	Specific Gravity	Absolute Volume Cubic Foot
Cement	30 pounds	3.15	0.15
Fly Ash	300 pounds	2.30	2.09
Water	280 pounds	1.00	4.54
Coarse Aggregate	1,465 pounds	2.68	8.76
Fine Aggregate	1,465 pounds	2.68	8.46
Admixture	4-6 ounces	-	2.70
TOTAL	3,543 pounds	-	27.00

3.00 EXECUTION

3.01 PRE-CONSTRUCTION TESTING

A. Preparing Trial Batch

1. After mix design has been accepted by Engineer, have trial batch of the accepted mix design prepared by testing laboratory acceptable to Construction Manager.

2. Prepare trial batches using specified cementitious materials and aggregates proposed to be used for the Work.

3. Prepare trial batch with sufficient quantity to determine slump, workability, consistency, and to provide sufficient test cylinders.

B. Trial Batch Test Cylinders

1. Prepare test cylinders in accordance with ASTM C 31 with the following exceptions:

a. Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.

b. Do not rod the concrete mix.

c. Strike off the excess material.

2. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.

3. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.

4. The test cylinders may be capped with standard sulfur compound or neoprene pads:

a. Perform the capping carefully to prevent premature fractures.

b. Use neoprene pads a minimum of 1/2 inch thick and 1/2 inch larger in diameter than the test cylinders.

c. Do not perform initial compression test until the cylinders reach a minimum age of 3 days.

C. Compression Testing

1. Test 4 test cylinders at 3 days and 4 at 28 days in accordance with ASTM C 39 except as modified herein:

a. The compression strength of the 4 test cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but shall not exceed maximum compression strength.

b. If the trial batch tests do not meet the Specifications for strength or density, revise and resubmit the mix design, and prepare additional trial batch and tests. Repeat until an acceptable trial batch is produced that meets the Specifications.

c. All the trial batches and acceptability of materials shall be paid by the Contractor.

d. After acceptance, do not change the mix design without submitting a new mix design, trial batches, and test information.

D. Slump Testing

1. Determine slump in accordance with ASTM C 143 with the following exceptions:

a. Do not rod the concrete material.

b. Place material in slump cone in one semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.

3.02 INSTALLATION

A. Prior to placement, soils located below controlled low strength material placement shall be scarified to a depth of 8 inches, uniform moisture conditioned to or above the optimum moisture content, and compacted to a minimum of 95 percent relative compaction in accordance with ASTM D 1557 at the direction of the Engineer.

B. Place controlled low strength material by any method which preserves the quality of the material in terms of compressive strength and density:

1. Limit lift heights of CLSM placed against structures and other facilities that could be damaged due to the pressure from the CLSM, to the lesser of four (4) feet or the lift height indicated on the Drawings. Do not place another lift of CLSM until the last lift of CLSM has set and gained sufficient strength to prevent lateral load due to the weight of the next lift of CLSM.

2. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.

3. Transport and place material so that it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
4. Use a slump of the placed material greater than nine (9) inches, and sufficient to allow the material to flow freely during placement:
    a. After trial batch testing and acceptance, maintain slump developed during testing during construction at all times within plus or minus one (1) inch.
5. Use a slump, consistency, workability, flow characteristics, and pump ability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity that compaction or mechanical vibration is not required.
6. When using as embedment for pipe take appropriate measures to ensure line and grade of pipe.

3.03 FIELD QUALITY CONTROL

A. General

1. Make provisions for and furnish all material for the test specimens, and provide manual assistance to assist the Engineer in preparing said specimens.
2. Be responsible for the care of and providing curing condition for the test specimens.

B. Tests

1. During the progress of construction, perform tests as directed by the Owner to determine whether the controlled low strength material, as being produced, complies with the requirements specified hereinbefore. Testing shall be in accordance with Section 01 45 23 – TESTING AND INSPECTING SERVICES.
2. Test cylinders
    a. Prepare test cylinders in accordance with ASTM C 31 with the following exceptions:
        i. Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
        ii. Do not rod the concrete mix.
        iii. Strike off the excess material.
3. Place the cylinders in a safe location away from the construction activities. Keep the cylinders moist by covering with wet burlap, or equivalent. Do not sprinkle water directly on the cylinders.
    a. Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
4. Not less than 3 cylinder specimens will be tested for each 150 cubic yards of controlled low strength material and not less than 3 specimens for each half day's placement:
    a. Test 1 cylinder at 3 days and 2 at 28 days in accordance with ASTM C 39 except as modified herein.
    b. The compression strength of the cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but shall not exceed maximum compression strength.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Concrete base material for trench repair

1.2 REFERENCES

A. Reference Standards
1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.

B. ASTM International (ASTM):
1. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. C33, Standard Specification for Concrete Aggregates.
3. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
5. C172, Standard Practice for Sampling Freshly Mixed Concrete.
6. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
7. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
8. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
9. C1064, Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 - SUBMITTALS.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Submit proposed mix design for Engineer’s review a minimum of 2 weeks prior to start of low-density concrete backfill work.

PART 2 - PRODUCTS

2.1 PRODUCT TYPES AND MATERIALS

A. Mix Design
1. Performance requirements
a. Concrete Base Material for Trench Repair
1) 28-day compressive strength of not less than 750 psi and not more than 1,200 psi.

B. Materials
1. Portland cement
a. Type II low alkali Portland cement as specified in Section 03 30 00.
2. Fly ash
a. Class F fly ash in accordance with ASTM C618.
3. Water

a. As specified in Section 03 30 53.

4. Admixture
   a. Air entraining admixture in accordance with ASTM C260.
5. Fine aggregate
   a. Concrete sand (does not need to be in accordance with ASTM C33).
   b. No more than 12 percent of fine aggregate shall pass a No. 200 sieve, and no plastic fines shall be present.
6. Coarse aggregate
   a. Pea gravel no larger than 3/8 inch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Place concrete base material by any method that preserves the quality of the material in terms of compressive strength and density.
   1. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.
   2. Transport and place material so that it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
   3. Use a slump, consistency, workability, flow characteristics, and pumpability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity that compaction or mechanical vibration is not required.

3.2 FIELD QUALITY CONTROL

A. General
   1. Make provisions for and furnish all material for the test specimens, and provide manual assistance to assist the Engineer in preparing said specimens.
   2. Be responsible for the care of and providing curing condition for the test specimens.

B. Concrete Tests: Perform testing of composite samples of fresh concrete obtained according to ASTM C172 according to the following requirements:
   1. Testing Frequency: Obtain 1 composite sample for each day's pour of each concrete mixture up to 25 cubic yards, plus 1 set for each additional 50 cubic yards or fraction thereof.
   2. Slump: ASTM C143; 1 test at point of placement for each composite sample, but not less than 1 test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C231, pressure method, for normal-weight concrete; 1 test for each composite sample, but not less than 1 test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C1064; 1 test hourly when air temperature is 40 degrees Fahrenheit and below and when 80 degrees Fahrenheit and above, and 1 test for each composite sample.
   5. Compression Test Specimens: ASTM C31.
      a. Cast and laboratory cure 4 cylinders for each composite sample.
         1) Do not transport field cast cylinders until they have cured for a minimum of 24 hours.
   6. Compressive-Strength Tests: ASTM C39
      a. Test 1 cylinder at 7 days.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section includes the requirements for the provision of concrete finishing, including the repair of surface defects, cracks and finishing of concrete surfaces, including both formed and unformed; the sealing of concrete surfaces; and the installation of concrete fill and topping.

1.02 SUBMITTALS

Submit manufacturer’s technical literature on product brands, proposed for use by the Contractor, for review. The submittal shall include the manufacturer's installation and/or application instruction. Submittals shall be made on the following products:

A. Sealer.

B. Latex bonding agent.

C. Proprietary patching material.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Latex Bonding Agent. Latex bonding agent shall be a non-reemulsifiable latex base liquid formulated for bonding wet concrete to hardened concrete and for mixing with cement mortar. Bonding agent shall be suitable for use under continuously submerged conditions. Certification by the manufacturer will be required. Acceptable product is SBR Latex by The Euclid Chemical Company or approved substitution.

B. Bonding Grout. Prepare bonding grout by mixing approximately one part cement to one part fine sand passing a No. 30 mesh sieve. Mix with water to a consistency of thick cream. As an alternate bonding grout, the Contractor may use a commercially prepared bonding agent used in strict accordance with the manufacturer’s recommendations and instructions. The bonding agent must be suitable for use continuously submerged in wastewater. Certification by the manufacturer will be required. Submit manufacturer’s technical information on any proposed bonding agent.

C. Patching Mortar.

1. Make patching mortar of the same materials and of approximately the same proportions as concrete, except omit coarse aggregate. Substitute white Portland cement for part of the gray Portland cement on exposed concrete in order to produce a color matching the color of surrounding concrete. Determine color by making a trial patch. Use the minimum amount of mixing water required for handling and placing. Mix patching mortar in advance and allow to stand. Mix frequently with a trowel until it has reached the stiffest consistency that will permit placing. Do not add water.

2. If permitted or required, proprietary compounds for adhesion or as patching ingredients may be used in lieu of or in addition to the foregoing patching materials. Use such compounds according to the manufacturer’s recommendations. Material must be suitable for use under continuously submerged conditions. Certification by the manufacturer will be required.

D. Epoxy Adhesive. The compound shall be a 2-component, 100 percent solids, 100 percent reactive compound suitable for use on dry or damp surfaces, “Euco Epoxy No. 452MV” or “Eucoepoxy LPL” by The Euclid Chemical Company, “Sikadure Hi-Mod” by The Sika Chemical Corporation, or approved substitution.

PART 3 - EXECUTION

3.01 REPAIRING SURFACE DEFECTS

A. Defective Areas. Repair defective areas immediately after the removal of forms. Remove honeycombed and other defective concrete down to sound concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to concrete surface. To prevent absorption of water from patching mortar, dampen the defective area and a strip 6 inches wide surrounding the area to be patched. After surface water has evaporated from the area to be patched, thoroughly brush a coat of bond grout into surface. A latex bonding agent may be used in lieu of the bonding grout. The bonding agent must be used in conformance with the manufacturer's recommendations and instructions. When bond grout begins to lose its water sheen, apply the premixed patching mortar. Thoroughly consolidate the mortar into place and strike off to leave the patch slightly higher than the surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finishing. Keep the patched area damp for 7 days. Do not use metal tools in finishing patches in a formed wall which will be exposed.

B. Tie Holes. Patch the holes immediately after removal of forms. After cleaning and thoroughly dampening the tie hole, fill solid with patching mortar.

C. Cracks. Cracks in excess of 0.01 inch shall be repaired by pressure injection of a moisture-insensitive, epoxy-resin system. Submit proposed material and method of repair for approval prior to making repairs.

D. Structural Repair. Any required structural repairs shall be made after prior approval of the Engineer as to method and procedure, using the specified epoxy adhesive and/or approved epoxy mortar.

3.02 FINISHING OF FORMED SURFACES

A. Rough Form Finish.

1. No form facing material is required on rough form finish surfaces.

2. Patch tie holes and defects, and fins exceeding 1/4 inch in height shall be chipped off.

3. A rough form finish may be used on concrete surfaces which will be concealed from view by earth in the completed structure except the top 2 feet of walls below final top of ground elevation and full depth of grade beams shall have a smooth form finish. In addition, surfaces scheduled to be permanently exposed during future expansion, at locations shown on the drawings, shall have a smooth form finish.

B. Smooth Form Finish.

1. The form facing shall produce a smooth, hard, uniform texture on the concrete. Use plywood or fiberboard linings or forms in as large sheets as practicable and with smooth, even edges and close joints.

2. Patch tie holes and defects. Rub fins and join marks with wooden blocks to leave a smooth, unmarred finished surface. Remove all sharp edges on surfaces to receive a protective liner.

3. Provide a smooth form finish on all formed surfaces exposed to view in the completed structure.

C. Related Unformed Surfaces. Tops of piers, walls, bent caps and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed. Float unformed surfaces to a texture reasonably consistent with that of the formed surfaces. Final treatment on formed surfaces shall continue uniformly across the unformed surfaces.

3.03 FINISHING SLABS AND SIMILAR FLAT SURFACES TO CLASS A, B OR C FINISH

A. Shaping to Contour. Use strike-off templates or approved compacting-type screeds riding on screed strips or edge forms to bring concrete surface to the proper contour.

B. Consolidation. Thoroughly consolidate concrete in slabs and use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade. Obtain consolidation of slabs and

floors with vibrating bridge screeds, roller pipe screeds, or other approved means. Concrete to be consolidated must be as dry as practicable. Do not permit manipulation of surfaces prior to finishing operations.

C. Tolerances for Finished Surfaces. Tolerances are checked by placing a straightedge of specified length anywhere on the slab. The gap between slab and straightedge must not exceed the tolerance listed for the specified class.

Class	Straightedge Length in Feet	Tolerance in Inches
A	10	1/8
B	10	1/4
C	2	1/4

D. Broom or Belt Finish.

1. Immediately after completing the floated finish, draw a broom or burlap belt across the surface to give a coarse transverse scored texture.
2. Provide a broom or belt finish for the following:
   a. Sidewalks & concrete drives
   b. Ramps.

3.04 CURING

Curing of concrete shall conform to the requirements of Section 03 30 53, CAST-IN-PLACE CONCRETE.

END OF SECTION

03 61 15 ANNULAR BACKFILL FOR CARRIER PIPE IN TUNNELS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This Section specifies requirements for developing and preparing mix designs, testing and verifying mixes, batching, transporting, and placing annular backfill between the casing or liner plate and the final carrier pipe as follows:

1. Annular Backfill for Fiberglass Reinforced Pipe shall be low density cellular concrete.

1.02 RELATED SECTIONS

A. The following Sections apply to the Work of this Section. Other Sections not referenced below shall also apply to the extent required for proper performance of this Work.

1. Section 33 05 24 – INSTALLATION OF CARRIER PIPE IN TUNNEL

1.03 REFERENCE CODE AND STANDARDS

The applicable provisions of the following standards and codes shall apply as if written here in their entirety:

A. American Concrete Institute (ACI): ACI 214,

ACI 214	Recommended Practice for Evaluation of Strength Test Results of Concrete

B. American National Standards Institute (ANSI):

ANSI-B40.1	Gauge - Pressure, Indicating Dial Type - Elastic Element

C. American Society for Testing and Materials (ASTM):

ASTM C33	Specification for Concrete Aggregates
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars
ASTM C117	Test Method for Material Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136	Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C150	Specification for Portland Cement
ASTM C231	Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Specification for Air-Entraining Admixtures for Concrete
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C494	Specification for Chemical Admixtures for Concrete
ASTM C495	Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
ASTM C567	Standard Test Method for Unit Weight of Structural Lightweight Concrete

ASTM C618	Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
ASTM C796	Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam
ASTM C869	Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete

1.04 SUBMITTALS

A. Submittals shall be made in compliance with Section 01 33 00 – SUBMITTALS.

B. Working Drawings and Methods Statements for low density cellular concrete or conventional grout as applicable:

1. Means and methods for proportioning, mixing, batching, and delivering concrete or grout, including the storage of raw materials.
2. Details for transporting, placing, and consolidating concrete or grout. Integrate with and describe the sequencing of this work with the installation of pipe as specified in Section 33 05 24 – INSTALLATION OF CARRIER PIPE IN TUNNEL.
3. Lift drawings showing details of delivery pipes, slicklines, injection ports, break between pour bulkheads, casing seals or tunnel end bulkheads, and other materials.
4. Calculations for preventing flotation and deformation of the final lining (carrier pipe). Provide calculation for each lift planned to place backfill.
5. Descriptions of labor, equipment and supplies required to perform the work.
6. Cross-sections and profiles showing the arrangement of transportation, handling, and placing equipment including passing clearances.
7. Details of pumping pressures and rates, placement sequences and volumes, lift thicknesses, including the theoretical quantity for each placement.
8. Methods for diverting construction water and groundwater and protecting concrete or grout.

C. Mix Designs: The Contractor shall submit concrete or grout mix designs.

D. Quality Control

1. Qualifications: The Contractor shall provide information regarding the proposed specialty firm for batching and pumping cellular concrete, the individuals responsible for development of mix designs, the individuals overseeing placement of cellular concrete, and field sampling and testing personnel, including qualifications of their employer.
2. Certifications:
   a. Certificates of compliance for materials incorporated into the Work.
   b. Calibration certificates for gauges, scales, and meters in accordance with ANSI B40.1.
   c. Written certification from the pipe manufacturer that the pipe is capable of handling the proposed pumping and hydrostatic pressures.
3. Written certification from the manufacturer of the foaming agent material manufacturer that: (1) ingredients used in cellular concrete or conventional grout are compatible, (2) the method whereby the cellular concrete foaming agent is introduced to the batching system is acceptable, and (3) that the concreting supervisor is knowledgeable in the formulation and adjustment of mix designs.
4. Quality Control Plans:
   a. Procedures for producing cellular concrete or conventional grout, including procedures

for verifying mix ingredient quality and performing sampling, testing, and record keeping.

b. Methods for controlling critical mix parameters, such as cellular concrete or conventional grout density.

c. Methods for assuring that the annular spaces between the carrier pipe and the casings or liner plate are filled.

d. Methods for assuring that injection pressures do not damage adjacent work or the carrier pipe.

e. Method for determining when pipe bracing and supports may be removed.

5. Recordkeeping: Daily records shall be submitted no later than the end of each working day for the following:

a. Delivery tickets.

b. Daily reports and records of cellular concrete or conventional grout placement, including:

1) Number and classification of men and equipment.
2) Beginning and ending stations or elevations of placements, beginning and ending time for the pour, and volume.
3) Test information, including times, locations, and results of tests.
4) Notation of any downtime or interruption to production, including length of time and reason.

6. Notifications: Twenty-four hours in advance of (excluding non-work days) all placements.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Cellular Concrete Specialty Contractor: Minimum of 10 years of recent, successful experience in batching and placing cellular concrete for at least three tunnel projects of the general type, size, and diameter as required for this project.

2. Concreting Supervisor: Experienced in similar tunnel conditions and knowledgeable in the formulation and adjustment of mix designs.

3. Field Sampling and Testing Personnel: Qualified employees of an ACI-certified testing laboratory.

B. Acceptance Criteria:

1. Compression Tests: Evaluate and accept in accordance with ACI 214.

2. Density: Within 15% percent of the design value.

C. Preconstruction Meeting:

1. Notify Inspector two weeks before implementation of placement of concrete backfill.

2. Coordinate meetings with preconstruction meeting to review details of the backfill operation, including mixing, placement procedures and sequencing, and testing and inspection for each type of backfill.

D. Testing:

1. General: Test non-cellular concrete compressive strength in accordance with Section 03 30 53 – CAST-IN-PLACE CONCRETE. Contractor shall take three 3-inch diameter cylinders for each sample to be tested.

2. General: Test cellular concrete compressive strength in accordance with ASTM C495, and mimicking in-situ pressures except that cylinders shall be cast using styrofoam molds.

Plastic molds will not be permitted. Test specimen shall not be oven cured. Specimen shall be capped with plaster of Paris, not sulfur caps.

3. Pre-Production Testing: Take one set comprising four cylinders for each proposed mix. Perform compressive strength tests on one set of samples at 56 days.
4. Production Testing: Perform production testing at the batch plant and at the placement location as specified in this Section.

1.06 DESIGN CRITERIA

A. Low Density Cellular Concrete:
   1. Cementitious content shall be no less than 200 lb/cy.
   2. Water content shall be no more than 65 percent.
   3. Wet density shall be no less than 45 lb/cubic ft.
   4. Minimum compressive strengths shall be 100 psi after 7 days and 300 psi after 28 days.

B. Conventional Grout:
   1. Conventional grout shall consist of a pumpable mix of cement, water free from organics and deleterious materials, sand, and a small amount of bentonite for pumpability and stability. The unit weight shall not be less than 140 lbs per cubic ft.

C. Backfill Concrete Joints: Joints shall be oriented perpendicular to the longitudinal centerline of the pipe, at least 12 inches from pipe joints.

D. Tolerances: The minimum annular clearance between tunnel supports and pipe shall be 8 inches.

1.07 SEQUENCING AND SCHEDULING

A. The Contractor shall provide access at all times to the Inspector to view and inspect the work specified herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Except as modified in this Section, the Contractor shall conform to the requirements of Section 03 30 53 – CAST-IN-PLACE CONCRETE for all materials.

B. Foaming Agent: Foaming agent shall conform to the requirements of ASTM C869 when tested in accordance with ASTM C796. The foaming agent shall maintain stability until the cement sets to form a self-supporting matrix comprising closed cells and low water absorptive characteristics. Foaming agent shall be Mearl Geofoam Liquid Concentrate (the Mearl Corporation, Roselle Park, New Jersey); Rheocell 15 (Master Builders Inc., Cleveland, Ohio); WF 304 Foam Concentrate (Cellufoam Concrete Systems, Scarborough, Ontario); or MaxFlow Foaming Agent Concentrate (MaxFlow Environmental Corp., Black Mountain, North Carolina).

C. Admixtures: Admixtures shall not contain chlorides, substances that promote corrosion, and for cellular concrete, admixtures shall be certified for use with foaming agent by foaming agent manufacturer.
   1. Air-entraining admixtures shall conform to ASTM C260, and shall be nontoxic after 30 days and shall contain no chlorides. Admixtures shall be Master Builders MB-AE 90 or Sika AER (Sikamix 104).

2. Water-reducing admixtures shall conform to ASTM C494, Type A or D, shall contain no chlorides, shall be nontoxic after 30 days, and shall be compatible with the air-entraining admixtures. The amount of admixture added to the concrete shall be in accordance with the Manufacturer's recommendations. Admixtures shall be Master Builders Pozzolith polymer-type normal setting, Plastocrete (Sikamix 160) Normal Set, or Sika Chemical Corporation.

D. Retarder/Water Reducer: ASTM C494, Type D.

E. Plasticizer/Water Reducer: ASTM C494, Type A.

F. Cement: ASTM C150, Type II.

G. Fly Ash: ASTM C618, Class F, except that fly ash with carbon content greater than 6 percent may be used.

H. Fine Aggregate: ASTM C33.

I. Water: ASTM C94, with a pH not less than 6.7.

J. Sand: If used, sand shall conform to requirements of Section 03 30 53 – CAST-IN-PLACE CONCRETE.

2.02 EQUIPMENT

A. General: Equipment shall be of sufficient size and capacity to batch and pump required volumes of concrete backfill over the distance required and through injection ports at a uniform flow rate and under the required constant pressure in an underground environment. No trucking of concrete backfill is allowed. The system shall be capable of generating a non- foamed slurry unit weight within ±15 percent of the design unit weight. Equipment shall be maintained in good operating condition. An adequate inventory of spare parts and backup equipment shall be available on site.

B. Batching: Slurry shall be batched mechanically in a manner ensuring consistency of the mix.

C. Foam Generator for Cellular Concrete: 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.

D. 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 ±1 gallon to measure the volume of water added to dry mix ingredients.

E. Pumping: Pumping equipment shall be capable of pumping concrete without pulsation or segregation. Pumping equipment shall be operated to convey a continuous, uniform stream of concrete without air pockets. Pumping equipment shall be equipped with a device to limit pumping pressure as required to prevent damage to steel pipe.

F. Piping, Injection Hoses, Ports, Valves, and Connections: Concrete shall be conveyed to placement points using steel piping or rubber hoses, with all components having an internal diameter of at least 2 inches. 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.

G. Pressure Gauges: Pressure gauges shall display up to 150% of the maximum allowable pressure and be accurate to within 0.5% over the full range of the gauge. Pressure gauges shall be certified and calibrated in accordance with ANSI B40.1, Grade 2A. Pressure gauges

shall be oil-filled type gauges attached to a saddle-type diaphragm seal.

2.03 SOURCE QUALITY CONTROL

A. The Contractor shall provide delivery and measurement of materials from batching equipment to within the accuracies specified in ASTM C94. Scales shall be tested periodically in a manner and at intervals set forth in the approved Quality Control Plan.

B. Fine aggregate, when used, shall be sampled and tested in accordance with ASTM C33 and at the frequency specified in the approved Quality Control Plan.

C. Fly ash shall be sampled and tested in accordance with ASTM C311 at least once daily.

D. Equipment to generate foam for cellular concrete shall be tested and calibrated each day for density and volume output.

E. The wet density of cellular concrete shall be sampled and tested in accordance with the following schedule, before the introduction of the foaming agent, noting the time and temperature every 30 minutes, after a change in the mix batched, and whenever compression test cylinders are made.

F. Mix design tickets shall be provided for cellular concrete backfill used each day, identifying the mix design criteria.

G. Delivery tickets for each load of backfill concrete shall be provided in accordance with ASTM C94.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. The limits of each backfill placement shall be established based on size and capacity of batching and placing equipment, and mix parameters such as initial set time.

B. Lift heights shall be limited to avoid pipe flotation and to maintain cellular concrete parameters within specified limits.

C. Arrange and route utilities to provide ready and available services during backfill placement.

D. Temporary track systems used during tunnel construction may be left in place if the minimum indicated clearances are maintained and timber ties are removed.

3.02 PREPARATION

A. General: Verify that locations where backfill is to be placed are clean and free of standing or running water. Where used, seal or otherwise protect sheeting, panning, and drainage systems from infiltration by backfill. Verify that the pipe has been installed as specified in Section 33 05 24 – INSTALLATION OF CARRIER PIPE IN TUNNEL.

B. Bulkheads: Erect full-height vertical bulkheads snug between excavated rock surface or tunnel support system and pipe no closer than 12 inches from the leading edge of the pipe. 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 backfilling operations.

3.03 PREPARATION OF GROUT HOLES / INJECTION PORTS

A. Each grout hole shall be drilled or cleaned out to allow for free flow of contact grout. Clean- out

of holes shall be performed with suitable equipment such that the hole will not obstruct the free flow of annular backfill grouting. All holes to be grouted or to which contact grout may be communicated shall be drilled or cleaned. A valve shall be affixed to each hole cleaned and the valve shall be opened for grout injection or return flow.

3.04 PLACEMENT OF ANNULAR BACKFILL

A. General: Methods employed shall completely fill the annular space behind the pipe with concrete. Where water inflows or zones of water seepage exceed 2 gallons per minute, erect panning to divert groundwater inflows away from backfill placement.

B. Lift Placement Requirements: Use methods as required to avoid pipe flotation and damage to the pipe. Inject concrete on either side of the pipe simultaneously. Complete each lift for a particular section of tunnel being backfilled before starting the next lift in that length of tunnel being backfilled and before starting the first lift of a succeeding length of tunnel being backfilled.

3.05 FIELD QUALITY CONTROL

A. General: Collect samples of fresh cellular concrete at the injection point or discharge point, as the case may be. Measure and record the volume of backfill placed. Compare actual volume placed for each length of tunnel being backfilled with the theoretical volume for that length of tunnel being backfilled. Use grout hole connections in the pipe to monitor the backfill placement operations.

B. Compression Tests: Take two sets of two cylinders for every 200 cubic yard batched, but no less than two sets per day. Test two cylinders at 28 days and test the additional two cylinders at 56 days.

C. Heat of Hydration Monitoring: Monitor the temperature rise during curing of backfill materials to confirm that the specified criteria have been achieved. Measure the temperature of the pipe after placement of each lift of backfill at the following times: immediately after placement, 30 minutes, 1 hour, 2 hours, and 4 hours.

D. Wet Density Test for Cellular Concrete: Sample at the injection point every 30 minutes, after a change in the mix batched, and whenever compression test cylinders are made.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

This section includes the requirements for the provision of grouting.

1.02 SUBMITTALS

Acceptable brands of materials are specified herein. If substitutions are proposed by the Contractor, submit the following information on the proposed substitution for approval before delivery to the project:

A. Manufacturer's technical literature including manufacturer's specifications for mixing and placing of the grout.

B. Results of tests performed by a certified independent testing laboratory showing conformance to ASTM C 1107 and the requirements of this specification.

C. Provide test data from an independent laboratory indicating that the grout, when placed at a fluid consistency, will achieve 95 percent bearing under a 4-foot by 4-foot base plate.

1.03 QUALITY ASSURANCE

Manufacturers of proprietary products shall make available, at no cost and upon 72 hours' notification, the services of a qualified, full-time employee to aid in assuring proper use of the product under job conditions.

1.04 DELIVERY AND STORAGE

A. Nonshrink grout shall be delivered to the project in unopened containers and shall bear intact manufacturer's labels. Containers that are torn or damaged such that the nonshrink groutmaterial has been exposed to the elements shall be discarded.

B. Store all nonshrink grout material in dry shelter and protect from moisture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Euclid Chemical Company, "Euco N-S Grout."

B. Master Builders, "Masterflow 713."

C. U.S. Grout Corporation, "Five Star Grout."

D. Or approved substitution.

2.02 NONSHRINK GROUT

A. Grout shall contain nonmetallic natural aggregate and shall be nonstaining and noncorrosive. Grout shall be pre-blended factory-packaged material manufactured, under rigid quality control, specifically for use in transferring heavy loads. The nonshrink grout shall conform to the following requirements:

1. ASTM C 1107, Grade C.
2. Resist attack by oil and water.
3. Have minimum initial setting time of approximately 1 hour at 70°F.
4. Have a minimum compressive strength in the fluid consistency of 6500 psi at 28 days.
5. Shall not contain any chlorides or additives which may contribute to corrosion.
6. Shall be non-bleeding and non-segregating at a fluid consistency.

7. Provide total shrinkage compensation which provides a maximum bearing surface for the greatest overall support.

8. Free of gas-producing or gas-releasing agents.

2.03 WATER

A. Water used for mixing the grout shall be potable.

2.04 PEA GRAVEL

A. Clean pea gravel conforming to ASTM C 33 coarse aggregate graded so that at least 90 percent passes a 3/8-inch sieve and 90 percent is retained by a No. 4 sieve.

2.05 MEMBRANE-FORMING CURING COMPOUND

A. Conform to the requirements of Section 03 30 53, CAST-IN-PLACE CONCRETE.

PART 3 - EXECUTION

3.01 PROCEDURES

A. Installation methods and procedures shall conform to the printed instructions of the grout manufacturer and these specifications. Where there is a conflict between these specifications and the printed instructions of the grout manufacturer, the printed instructions of the grout manufacturer shall take precedence.

3.02 PREPARATION

B. Remove all defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping or other similar means, until a sound, clean concrete surface is achieved.

C. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.

D. Remove foreign materials from all surfaces in contact with grout.

E. Align, level and maintain final positioning of all components to be grouted. Coat shim with a thin film of grease or wax to facilitate removal.

F. Provide relief holes to avoid trapping air beneath the base plate.

G. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.

H. Saturate all concrete surfaces with clean water for the period of time specified by the manufacturer. Remove excess water and leave none standing.

I. Immediately before grouting, clean any contaminated surfaces.

3.03 FORMWORK

A. Build leak-proof forms that are strong and securely anchored and shored to withstand grout pressures. Forms shall be built high enough to provide a "head" of grout where it is required to force grout into difficult locations.

B. Provide enough clearance between the formwork and the area to be grouted to permit proper placement of grout.

3.04 MIXES

A. For less than a 4-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of grout material and water.

B. For greater than 4-inch clearances where coarse aggregate will not obstruct free passage of the

grout, the grout may be extended by adding clean pea gravel if allowed or recommended by the grout manufacturer. Follow the manufacturer's recommendation for the maximum amount of pea gravel that may be added.

C. Use the minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

3.05 MIXING

A. Mixing of nonshrink grout shall be in strict conformance to the recommendations of the grout manufacturer.

B. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

C. After the grout has been mixed, do not add more water for any reason.

3.06 PLACING

A. Place nonshrink-grouting material quickly and continuously by the most practical means permissible: pouring, pumping or under gravity pressure. Do not use either pneumatic-pressure or dry packing methods without written permission of the Engineer.

B. Follow established concreting procedures observing precautions for hot and cold weather concreting.

C. When practical, apply grout from one side only to avoid entrapping air.

D. Final installation shall be thoroughly compacted and free from air pockets. To facilitate placement, a 1/2- to 1-inch chain or metal strap may be pulled back and forth under the equipment during grouting. Remove chain or strap before initial set takes place.

E. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment, except when approved by the grout manufacturer.

F. Do not remove leveling shims for at least 48 hours after grout has been placed. After shims have been removed, fill voids with nonshrink grout.

3.07 CURING

A. Cure grout for 3 days after placing by keeping wet and covering with curing paper, by coating with a concrete membrane-forming curing compound, or by other preapproved method.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Modifications to existing concrete structures, including:
      a. Manholes
      b. Junction boxes
      c. Vaults
      d. Retaining walls
      e. Wing and head walls
      f. Culverts
   2. This section does not include modifications to Reinforced Concrete Pipe.

1.02 REFERENCES

A. Reference Standards
   1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
   2. ASTM International (ASTM):
      a. A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
      b. C881, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
      c. C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Sheer.
      d. D570, Standard Test Method for Water Absorption of Plastics.
      e. D638, Standard Test Method for Tensile Properties of Plastics.
      f. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
      g. D732, Standard Test Method for Shear Strength of Plastics by Punch Tool.
      h. D790, Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

B. Where reference is made to 1 of the above standards, the revision in effect at the time of bid opening applies.

1.03 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 - SUBMITTALS.

B. All submittals shall be approved by the Owner prior to delivery and/or fabrication for specials.

1.04 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Submit manufacturer's Product Data on all product brands proposed for use to the Engineer for review.
   2. Include the manufacturer's installation and/or application instructions.

1.05 QUALITY ASSURANCE

A. When removing materials or portions of existing structures and when making openings in existing structures, take precautions and all erect all necessary barriers, shoring and bracing, and other protective devices to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust, and to prevent damage to the structures or contents by falling or flying debris.

B. Core sanitary sewer manhole penetrations.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

PART 2 - PRODUCTS

2.01 PRODUCT TYPES AND MATERIALS

A. Manufacturers
   1. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
      a. Available Products
         1) Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
      b. Available Manufacturers
         1) Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. Materials
   1. General
      a. Comply with this Section and any state or local regulations.

C. Steel Reinforcement
   1. Reinforcing Bars
      a. ASTM A615, Grade 60, deformed.

D. Epoxy Bonding Agent
   1. A 2-component, solvent-free, asbestos-free, moisture-insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type V, and the additional requirements specified herein.
   2. Properties of the cured material
      a. Compressive Strength (ASTM D695)
         1) 8,500 psi minimum at 28 days
      b. Tensile Strength (ASTM D638)
         1) 4,000 psi minimum at 14 days
      c. Flexural Strength (ASTM D790 - Modulus of Rupture)
         1) 6,300 psi minimum at 14 days
      d. Shear Strength (ASTM D732)
         1) 5,000 psi minimum at 14 days
      e. Water Absorption (ASTM D570 - 2 hour boil)
         1) 1 percent maximum at 14 days
      f. Bond Strength (ASTM C882) Hardened to Plastic
         1) 1,500 psi minimum at 14 days moist cure
      g. Color
         1) Gray
      h. Available Manufacturers:
         1) Sika Corporation, Lyndhurst, New Jersey - Sikadur 32, Hi-Mod
         2) BASF, Cleveland, Ohio - Concresive 1438

E. Epoxy Paste
   1. A 2-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used

to bond dissimilar materials to concrete such as setting railing posts, dowels, anchor bolts, and all-threads into hardened concrete and complying with the requirements of ASTM C881, Type I, Grade 3, and the additional requirements specified herein.

2. Properties of the cured material
   a. Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days
   b. Tensile Strength (ASTM D638): 3,000-psi minimum at 14 days. Elongation at Break - 0.3 percent minimum
   c. Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days
   d. Shear Strength (ASTM D732): 2,800 psi minimum at 14 days
   e. Water Absorption (ASTM D570): 1.0 percent maximum at 7 days
   f. Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure
   g. Color: Concrete grey
   h. Available Manufacturers
      1) Overhead Applications
         a) Sika Corporation, Lyndhurst, New Jersey - Sikadur 32, Hi-Mod LV
         b) BASF - Concresive 1438
      2) All Other Applications
         a) Sika Corporation, Lyndhurst, New Jersey - Sikadur Hi-mod LV 31
         b) BASF - Concresive 1401

F. Repair Mortars

1. Provide an asbestos free, moisture insensitive, polymer-modified, Portland cement-based cementitious trowel grade mortar for repairs on horizontal or vertical surfaces.
   a. Available Manufacturers
      1) Sika Corporation, Lyndhurst New Jersey - SikaTop 122
      2) BASF – Emaco Nanocrete R3

G. Pipe Penetration Sealants

1. 1 component polyurethane, extrudable swelling bentonite-free water stop that is chemically resistant, not soluble in water and capable of withstanding wet/dry cycling.
   a. Available Manufacturers
      1) Sika Corporation, Lyndhurst New Jersey – SikaSwell S-2
      2) Approved equal

PART 3 - EXECUTION

3.01 PREPARATION

A. General

1. Cut, repair, reuse, demolish, excavate or otherwise modify parts of the existing structures or appurtenances, as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc., are specified in respective Sections. Comply with other requirements of this of Section and as shown on the Drawings.
2. Store, mix, and apply all commercial products specified in this Section in strict compliance with the manufacturer's recommendations.
3. Make repairs in all cases where concrete is repaired in the vicinity of an expansion joint or control joint to preserve the isolation between components on either side of the joint.
4. When drilling holes for dowels/bolts at new or existing concrete, stop drilling if rebar is encountered and relocate the hole to avoid rebar as approved by the Engineer. Do not cut rebar without prior approval by the Engineer.

B. Concrete Removal

1. Remove concrete designated to be removed to specific limits as shown on the Drawings or

directed by the Engineer, by chipping, jackhammering, or saw cutting as appropriate in areas where concrete is to be taken out. Do not jackhammer sanitary sewer manhole penetrations. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged.

2. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the saw cut surface, apply a coating or surface treatment of epoxy paste to the entire cut surface to a thickness of 1/4 inch.
3. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, provide a 1-inch deep saw cut on each exposed surface of the existing concrete at the edge of concrete removal.
4. Repair concrete specified to be left in place that is damaged using approved means to the satisfaction of the Engineer.
5. The Engineer may from time to time direct additional repairs to existing concrete. Make these repairs as specified or by such other methods as may be appropriate.

C. Connection Surface Preparation

1. Prepare connection surfaces as specified below for concrete areas requiring patching, repairs or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.
2. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e., sandblasting, grinding, etc., as approved by the Engineer. Be sure the areas are not less than 1/2-inch in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.
3. If reinforcing steel is exposed, it must be cleaned by wire brush or other similar means to remove all contaminants, rust, etc., as approved by the Engineer. If 1/2 of the diameter of the reinforcing steel is exposed, chip out behind the steel. Chip a minimum of 1 inch behind the steel. Do not Damage reinforcing to be saved during the demolition operation.
4. Clean reinforcing from existing demolished concrete that is shown to be incorporated in new concrete by wire brush or other similar means to remove all loose material and products of corrosion before proceeding with the repair. Cut, bend, or lap to new reinforcing as shown on the Drawings and provided with 1-inch minimum cover all around.
5. The following are specific concrete surface preparation "methods" to be used where called for on the Drawings, specified herein, or as directed by the Engineer.
   a. Method A
      1) After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water.
      2) Brush on a 1/16-inch layer of cement and water mixed to the consistency of a heavy paste.
      3) Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.
   b. Method B
      1) After the existing concrete surface has been roughened and cleaned, apply epoxy-bonding agent at connection surface.
      2) Comply strictly with the manufacturer's recommendations for the field preparation and application of the epoxy-bonding agent.
      3) Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.
   c. Method C
      1) Drill a hole 1/4 inch larger than the diameter of the dowel.
      2) Blow the hole clear of loose particles and dust just prior to installing epoxy. First, fill the drilled hole with epoxy paste, then butter the dowels/bolts with paste then insert

by tapping.

3) Unless otherwise shown on the Drawings, drill and set deformed bars to a depth of 10 bar diameters and smooth bars to a depth of 15 bar diameters.
4) If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.

d. Method D
   1) Combination of Method B and C.

ND OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for mechanical and electrical equipment.
2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Metal ladders.
4. Metal floor plate.
5. Metal bollards.
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:

1. Section 03 30 53 – CAST-IN-PLACE CONCRETE for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 F, ambient; 180 F, material surfaces.

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

B. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1, “Structural Welding Code - Steel.”
2. AWS D1.2, “Structural Welding Code - Aluminum.”

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36.

B. Steel Tubing: ASTM A500, cold-formed steel tubing.

C. Steel Pipe: ASTM A53, standard weight (Schedule 40) unless otherwise indicated.

D. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches, minimum.

2. Material: Galvanized steel, ASTM A653, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B632, Alloy 6061-T6.

D. Aluminum Castings: ASTM B26, Alloy 443.0-F.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners. Select fasteners for type, grade, and class required.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 2.

C. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488, conducted by a qualified independent testing agency.

D. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47 malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329.

E. Post-Installed Anchors: Adhesive anchors.

1. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2

stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

2.8 METAL FLOOR PLATE

A. Fabricate from rolled-aluminum-alloy tread plate of thickness indicated below:

1. Thickness: 3/8 inch or as indicated.

B. Include aluminum angle stiffeners, and fixed and removable sections as indicated.

C. Provide flush aluminum bar drop handles for lifting removable sections, one at each end of each section.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete construction.

C. Galvanize miscellaneous steel trim.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

B. Prime bollards with primer specified in Section 09 96 35 Protective Coatings."

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.12 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153 for steel and iron hardware and with ASTM A123 for other steel and iron products.

1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

2.15 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.

2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

B. Fill bollards solidly with concrete, mounding top surface to shed water.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink grout, nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Nonmetal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

1.2 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.3 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFC Cable Systems; a part of Atkore International.
b. Allied Tube & Conduit; a part of Atkore International.
c. Anamet Electrical, Inc.

d. Calconduit.
e. Electri-Flex Company.
f. FSR Inc.
g. Korkap.
h. Opti-Com Manufacturing Network, Inc (OMNI).
i. O-Z/Gedney; a brand of Emerson Industrial Automation.
j. Perma-Cote.
k. Picoma Industries, Inc.
l. Plasti-Bond.
m. Republic Conduit.
n. Southwire Company.
o. Thomas & Betts Corporation; A Member of the ABB Group.
p. Topaz Electric; a division of Topaz Lighting Corp.
q. Western Tube and Conduit Corporation.
r. Wheatland Tube Company.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. GRC: Comply with ANSI C80.1 and UL 6.
4. IMC: Comply with ANSI C80.6 and UL 1242.

a. Comply with NEMA RN 1.
b. Coating Thickness: 0.040 inch, minimum.

5. EMT: Comply with ANSI C80.3 and UL 797.
6. FMC: Comply with UL 1; zinc-coated steel.
7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFC Cable Systems; a part of Atkore International.
b. Allied Tube & Conduit; a part of Atkore International.
c. Anamet Electrical, Inc.
d. Calconduit.
e. Electri-Flex Company.
f. FSR Inc.
g. Korkap.
h. Opti-Com Manufacturing Network, Inc (OMNI).
i. O-Z/Gedney; a brand of Emerson Industrial Automation.
j. Perma-Cote.
k. Picoma Industries, Inc.
l. Plasti-Bond.
m. Republic Conduit.
n. Southwire Company.
o. Thomas & Betts Corporation; A Member of the ABB Group.
p. Topaz Electric; a division of Topaz Lighting Corp.
q. Western Tube and Conduit Corporation.

r. Wheatland Tube Company.

2. Comply with NEMA FB 1 and UL 514B.

3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:

a. Material: Steel.
b. Type: compression.

7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFC Cable Systems; a part of Atkore International.
b. Anamet Electrical, Inc.
c. Arnco Corporation.
d. CANTEX INC.
e. CertainTeed Corporation.
f. Champion Fiberglass, Inc.
g. Condux International, Inc.
h. Electri-Flex Company.
i. FRE Composites.
j. Kraloy.
k. Lamson & Sessions.
l. Niedax Inc.
m. RACO; Hubbell.
n. Thomas & Betts Corporation; A Member of the ABB Group.
o. Topaz Electric; a division of Topaz Lighting Corp.
p. United Fiberglass.

2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fiberglass:

a. Comply with NEMA TC 14.
b. Comply with UL 2515 for aboveground raceways.
c. Comply with UL 2420 for belowground raceways.

4. ENT: Comply with NEMA TC 13 and UL 1653.
5. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
6. LFNC: Comply with UL 1660.
7. Rigid HDPE: Comply with UL 651A.
8. Continuous HDPE: Comply with UL 651A.
9. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
10. RTRC: Comply with UL 2515A and NEMA TC 14.

B. Nonmetallic Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFC Cable Systems; a part of Atkore International.
b. Anamet Electrical, Inc.
c. Arnco Corporation.
d. CANTEX INC.
e. CertainTeed Corporation.
f. Champion Fiberglass, Inc.
g. Condux International, Inc.
h. Electri-Flex Company.
i. FRE Composites.
j. Kraloy.
k. Lamson & Sessions.
l. Niedax Inc.
m. RACO; Hubbell.
n. Thomas & Betts Corporation; A Member of the ABB Group.
o. Topaz Electric; a division of Topaz Lighting Corp.
p. United Fiberglass.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.

3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

a. Fittings for LFNC: Comply with UL 514B.

4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. B-line, an Eaton business.
2. Hoffman; a brand of Pentair Equipment Protection.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 3R unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Moulded Products, Inc.
2. Hoffman; a brand of Pentair Equipment Protection.
3. Lamson & Sessions.
4. Niedax Inc.

B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.

D. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvents and Adhesives: As recommended by conduit manufacturer.

2.5 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. **Manufacturer's standard enamel finish.**.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. MonoSystems, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected from **manufacturer's standard** colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hubbell Incorporated.
b. MonoSystems, Inc.
c. Panduit Corp.
d. Wiremold / Legrand.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Adalet.
2. Crouse-Hinds, an Eaton business.
3. EGS/Appleton Electric.
4. Erickson Electrical Equipment Company.
5. FSR Inc.
6. Hoffman; a brand of Pentair Equipment Protection.
7. Hubbell Incorporated.
8. Hubbell Incorporated; Wiring Device-Kellems.
9. Kraloy.
10. Milbank Manufacturing Co.
11. MonoSystems, Inc.
12. Oldcastle Enclosure Solutions.
13. O-Z/Gedney; a brand of Emerson Industrial Automation.
14. Plasti-Bond.
15. RACO; Hubbell.

16. Spring City Electrical Manufacturing Company.
17. Thomas & Betts Corporation; A Member of the ABB Group.
18. Topaz Electric; a division of Topaz Lighting Corp.
19. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, **ferrous alloy**, Type FD, with gasketed cover.

E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, **galvanized, cast iron** with gasketed cover.

G. Gangable boxes **are prohibited**.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. NewBasis.
   d. Oldcastle Precast, Inc.
   e. Quazite: Hubbell Power Systems, Inc.
   f. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
3. Configuration: Designed for flush burial with **integral closed** bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, **"ELECTRIC."**.

7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
8. Handholes **12 Inches Wide by 24 Inches Long**and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of **polymer concrete**.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Armorcast Products Company.
   b. Carson Industries LLC.
   c. NewBasis.
   d. Nordic Fiberglass, Inc.
   e. Oldcastle Precast, Inc.
   f. Quazite: Hubbell Power Systems, Inc.
   g. Synertech Moulded Products.

2. Standard: Comply with SCTE 77.
3. Color of Frame and Cover: **Gray**.
4. Configuration: Designed for flush burial with **integral closed**] bottom unless otherwise indicated.
5. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
6. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
7. Cover Legend: Molded lettering, **"ELECTRIC."**.
8. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes **12 Inches Wide by 24 Inches Long**and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.8 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: **GRC**.
2. Concealed Conduit, Aboveground: **EMT**.
3. Underground Conduit: RNC, **Type EPC-40-PVC**, **concrete encased**.
4. Boxes and Enclosures, Aboveground: NEMA 250, **Type 4**.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: **EMT**.
2. Exposed, Not Subject to Severe Physical Damage: **EMT**.
3. Exposed and Subject to Severe Physical Damage: **GRC**.

C. Minimum Raceway Size:**3/4-inch**trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use **or**, **steel** fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds **120 deg F**.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

C. Keep raceways at least 6 inchesaway from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

D. Complete raceway installation before starting conductor installation.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inchesof changes in direction.

G. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

H. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

I. Support conduit within 12 inchesof enclosures to which attached.

J. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inchtrade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-footintervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of **2 inches**of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inchtrade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

P. Cut conduit perpendicular to the length. For conduits 2-inchtrade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lbtensile strength. Leave at least 12 inchesof slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

R. Surface Raceways:

1. Install surface raceway with a minimum 2-inchradius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inchesand with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

S. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

T. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC **and EMT** conduit that is located where environmental temperature change may exceed 100 deg Fand that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: **125 deg F**temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: **155 deg F** temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: **125 deg F** temperature change.
    d. Attics: **135 deg F**temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg Fof temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg Fof temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **36 inches**of flexible conduit for **recessed and semirecessed luminaires,** equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to **bottom** of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

AA. Locate boxes so that cover or plate will not span different building finishes.

BB. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

DD. Set metal floor boxes level and flush with finished floor surface.

EE. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 31 20 00 "Earth Moving" for pipe less than 6 inchesin nominal diameter.
2. Install backfill as specified in Section 31 20 00 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inchesof finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 31 20 00 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inchesof concrete for a minimum of 12 incheson each side of the coupling.
    b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inchesfrom edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inchsieve to No. 4sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inchabove finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.6 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Stripping and stockpiling rock.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and removing site utilities or abandoning site utilities in place.
   8. Temporary erosion and sedimentation control.

B. Related Requirements:

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Contractor is to contact Owner for permission to remove any trees of significant size are within the construction zone and need to be removed.
      a. Significant trees that are with the construction zone shall be identified in the initial construction survey and located for the Owner.

B. Topsoil stripping and stockpiling program.

C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify the utilities identified in the plans for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed, or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than three days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 12 inches below exposed subgrade.
   3. Chip removed tree branches and dispose of off-site or prepare a stockpile and distribution plan to place chipped material on disturbed areas as part of the Contractor’s site stabilization plan.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches,and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 10 feet max.
   2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity that needs to be stockpiled or reused.
   3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

Conform to requirements of Section 01 33 00 - SUBMITTALS.

A. Submit sieve analysis of aggregates conforming to requirements of this Specification.

PART 2 - PRODUCTS

2.01 COARSE AGGREGATES

A. Coarse Aggregate: 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 of, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to following gradation requirements.

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

PART 3 - EXECUTION

3.01 PREPARATION AND INSTALLATION

A. Provide stabilized construction roads and exits at construction, staging, parking, storage, and disposal areas to keep street clean of mud carried by construction vehicles and equipment. Construct erosion and sediment controls in accordance with Drawings and Specification requirements.

B. Do not clear grub or rough-cut until erosion and sediment control systems are in place, unless approved by The Engineer to allow soil testing and surveying.

C. Maintain existing construction site erosion and sediment control systems until acceptance of the Work or until removal of existing systems is approved by the Engineer.

D. Regularly inspect, repair or replace components of stabilized construction exits. Unless otherwise directed, maintain stabilized construction roads and exits until the Owner accepts the Work. Remove stabilized construction roads and exits promptly when directed by the Engineer. Discard removed materials off-site.

E. Remove and dispose of sediment deposits at designated spoil site for Project.

F. If a spoil site is not designated on Drawings, dispose of sediment off-site at a location not in or adjacent to stream or flood plain. Contractor shall assume responsibility for off-site disposal.

G. Spread compacted and stabilized sediment evenly throughout site. Do not allow sediment to flush into streams or drainage ways. Dispose of contaminated sediment in accordance with existing federal, state, and local rules and regulations.

H. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated rights-of-way

and easements for construction. Immediately repair damage to erosion and sediment control systems caused by construction traffic.

3.02 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits and truck washing areas, when approved by the Engineer, of sizes and at locations shown on Drawings or as specified in this Section.

C. Clean tires to remove sediment on vehicles leaving construction areas prior to entering public right-of-ways. Construct truck-washing areas needed to remove sediment. Wash trucks on stabilized areas that drain into drainage systems protected by erosion and sediment control measures.

D. Stabilized construction exits and other stabilized areas shall be constructed to maintain minimum roadway widths of 14 feet for one-way traffic and 20 feet for two-way traffic and of sufficient width to allow ingress and egress.

E. Grade roads and parking areas to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar materials to prevent sediment from entering public right-of-ways, receiving streams or storm water conveyance systems.

F. Inspect and maintain stabilized areas daily. Provide periodic top dressing with additional coarse aggregates to maintain required depth. Repair and clean out damaged control systems used to trap sediment. Immediately remove spilled, dropped, washed, or tracked sediment from public right-of-ways.

G. Maintain lengths of stabilized areas as shown on Drawings or a minimum of 50 feet. Maintain a minimum thickness of 8 inches. Maintain minimum widths at all points of ingress or egress.

H. Stabilize other areas with the same thickness, and width of coarse aggregate required for stabilized construction exits, except where shown otherwise on Drawings.

I. Stabilized areas may be widened or lengthened to accommodate truck washing areas when authorized by the Engineer

J. Clean street daily before end of workday. When excess sediments have tracked onto streets, the Engineer may direct Contractor to clean street as often as necessary. Remove and legally dispose of sediments.

K. Use other erosion and sediment control measures to prevent sediment runoff during rain periods and non-working hours and when storm discharges are expected.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for walks, pavements, turf and grasses and plants.
   3. Excavating and backfilling for buildings and structures.
   4. Drainage course for concrete slabs-on-grade.
   5. Subbase course for concrete walks and pavements.
   6. Subbase course and base course for asphalt paving.
   7. Subsurface drainage backfill for walls and trenches.
   8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
   1. Section 01 32 33 "Photographic Documentation" for recording pre-excavation and earth-moving progress.
   2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   3. Section 32 92 19 "Seeding" for finish grading in turf and grass areas, including preparing and placing planting soil for areas to be seeded.

1.3 UNIT PRICES

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.
1. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hpflywheel power and developing a minimum of 47,992-lbfbreakout force with a general-purpose bare bucket.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Geofoam.
4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site soil material proposed for fill and backfill as follows:

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify utilities in the plans for area where Project is located before beginning earth-moving operations.
C. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 01 50 00 "Temporary Facilities and Controls" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inchsieve and not more than 12 percent passing a No. 200sieve.
E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inchsieve and not more than 8 percent passing a No. 200 sieve.
F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inchsieve and not more than 12 percent passing a No. 200sieve.
G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inchsieve and not more than 8 percent passing a No. 200sieve.
H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inchsieve and zero to 5 percent passing a No. 8sieve.
I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inchsieve and zero to 5 percent passing a No. 4 sieve.
J. Sand: ASTM C33/C33M; fine aggregate.
K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:
   1. Portland Cement: ASTM C150/C150M, Type II.
   2. Fly Ash: ASTM C618, Class C or F.
   3. Normal-Weight Aggregate: ASTM C33/C33M, 3/4-inch nominal maximum aggregate size.
   4. Foaming Agent: ASTM C869/C869M.

5. Water: ASTM C94/C94M.
6. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce low-density, controlled low-strength material with the following physical properties:
1. Compressive Strength: 80 psi, when tested according to ASTM C495/C495M.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 incheswide and 4 milsthick, continuously inscribed with a description of the utility; colored as follows:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 incheswide and 4 milsthick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inchesdeep; colored as follows:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
B. Protect and maintain erosion and sedimentation controls during earth-moving operations.
C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 18 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches beneath bottom of concrete slabs-on-grade.
      f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch.If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches each side of pipe or conduit.
C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells,

joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.8 SUBGRADE INSPECTION

A. Notify Owner when excavations have reached required subgrade.
B. If Owner determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.
B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
C. Backfill voids with satisfactory soil while removing shoring and bracing.
D. Initial Backfill:
    1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 2 inch in any dimension, to a height of 12 inches over the pipe or conduit.
        a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
    2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.
E. Final Backfill:
    1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
    2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation, if directed by Owner.
F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations as follows:
    1. Under grass and planted areas, use satisfactory soil material.
    2. Under walks and pavements, use satisfactory soil material.
    3. Under steps and ramps, use engineered fill.
    4. Under building slabs, use engineered fill.
C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within the optimum moisture content specified in the project's geotechnical report.
    1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
    2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content specified in the project's geotechnical report and is too wet to compact to specified dry density.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry density according to ASTM D698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.
5. Contractor shall inspect trench 6 months after completion and if trench as settled to create a noticeable depression, Contractor shall fill in said depression to match surround grades.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1 inch.

3.17 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase course and base course to required crown elevations and cross-slope grades.
3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry denisity according to ASTM D698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry density according to ASTM D698.

3.18 FIELD QUALITY CONTROL

A. Special Inspections: Owner as the option to engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material classification and maximum lift thickness comply with requirements.
   3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner may engage a qualified geotechnical engineering testing agency to perform tests and inspections for the Owner's Quality Assurance Program.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
   2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
   3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 200 feet or less of trench length but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.19 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by Owner; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.20 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

1.00 GENERAL

1.01 SCOPE

A. This section shall apply to all excavation.

B. Construct all permanent work in areas free from water. Design, construct and maintain all wells, pumps, vacuum systems, sumps, dikes, levees, cofferdams and diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.

C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and subsurface, to the lines, grades and conditions existing prior to the damage, at no additional cost to the Owner.

1.02 QUALITY ASSURANCE

A. Shall conform to Section 01 40 00 of these Specifications.

B. Work on the City of Allen street rights-of-way shall be in accordance with the City of Allen Standard Specifications.

2.00 PRODUCTS [NOT USED]

2.01 MATERIALS AND CONSTRUCTION

A. Pervious Backfill: Pervious backfill shall be natural or manufactured sand or crushed stone, free draining and predominant in sand size particles.

3.00 EXECUTION

3.01 CARE OF WATER

A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.

B. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work. Any and all dewatering of the pond at the Golf Course to install sheet piling or other earth moving operations, shall be done by pumping.

C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables and to drain impervious surfaces at final excavation elevation.

D. Dewater by means that will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.

E. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances and regulations.

F. Do not overload or obstruct existing drainage facilities.

G. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same Specifications as those governing the compacted fill. Fill or grout all temporary dewatering wells unless otherwise directed by the Engineer.

H. When the temporary works will not adversely affect any item of permanent work or the planned

usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances, breeching of dikes, levees and cofferdams may be required.

3.02 DEWATERING

A. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed and disposed as approved by Engineer or Owner.

B. Excavations shall be continuously dewatered to maintain a ground water level no higher than three to four feet below the lowest point in the excavation. Dewatering systems shall be designed to allow for localized variations in the depth of excavations required to reach a suitable foundation. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.

C. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the Owner.

D. Piezometric observation wells are required to monitor the ground water level to insure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

SECTION

A. Furnish labor, materials, equipment, and incidentals necessary to mix and place a flowable mortar fill, consisting of Portland cement, fine aggregate, fly ash, and water in the proper proportions as specified herein. Flowable fill shall be used to bed and backfill around piping and utilities where indicated.

1.02 STANDARDS

A. Materials shall meet recommendation for mix design and placement, as published by National Ready Mixed Concrete Association. The applicable provisions of the following references and standards shall apply to this Section as if written herein in their entirety

1. ASTM C 33 - Specification for Concrete Aggregates
2. ASTM C40 – Test Method for Organic Impurities in Fine Aggregate For Concrete
3. ASTM C150 – Specification for Portland Cement
4. ASTM C618 – Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as Mineral Admixture in Portland Cement Concrete

5. COE – CRD-C611.80

1.03 QUALITY ASSURANCE

A. Factory Testing: The Contractor shall be responsible for the design of the material. A trial mix shall be designed by an independent testing laboratory, retained by the Contractor. The testing laboratory shall submit verification that the materials and proportions of the trial mix design meets the requirement of the Specifications. Concrete mix additive such as "Darafill" manufactured by Grace Construction Products or equal products may be required to achieve the low strength and the flowability requirements. In lieu of trial mix design, Contractor may submit a mix design used successfully in previous similar work, for similar materials for approval by Engineer. The Contractor shall not make changes in materials (gradation, source, brand, or proportions) of the mixture after having been approved, except by specific approval of the Engineer.

B. Pre-Job Testing: Pre-job testing with actual equipment and intended configuration of concrete Sample may be required to determine whether the material can be excavated. The testing equipment and configuration of concrete Sample shall be determined by the Owner's representative.

1.04 Owner Testing: It is the responsibility of the Contractor to achieve and maintain the quality of material required by this Section. However, the Owner may secure the services of an independent testing laboratory to verify the quality of the material. The Owner shall have the right to require additional testing, strengthening, or replacement of concrete that has failed to meet the minimum requirements of this Section.

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 “Submittal Procedures” and shall include a trial mix design as Record Data and Certified Test Reports for compressive strength tests.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. Concrete shall be proportioned to give the necessary workability and strength and shall conform

to the following governing requirements:

1. 28 Day Compressive Strength-psi - 70-150 psi
2. Min Cement Lbs. Per Cu. Yd. - 50 lbs/Cu. Yd.
3. Fine Aggregate Lbs. Per Cu. Yd. - 2720 lbs/Cu. Yd.
4. Max Water Lbs. Per Cu. Yd. - 290 lbs/Cu. Yd.
5. Max Fly Ash Lbs Per Cu. Yd. - 150 lbs/Cu. Yd.

2.02 MATERIALS

A. Cement: Portland cement conforming to the specifications and test for Type I Portland cement per ASTM C150.

B. Fine Aggregate: Fine aggregate consisting of natural, washed and screened sand having clean, hard, strong, durable, uncoated grains complying with the requirements for ASTM C 33. The sand shall generally be of such size that all will pass a 3/8-inch sieve, at least 95 percent pass at 1/4-inch screen and at least 80 percent pass a No. 8 sieve. Aggregate shall not contain strong alkali, or organic material that gives a color darker than the standard color when tested in accordance with ASTM C40.

C. Fly Ash/Pozzolans: Fly ash shall be an ASTM C618, Class "C" fly ash.

D. Water: Water for concrete shall be clean and free from oil, acid, alkali, organic matter or other harmful impurities. Water that is suitable for drinking or for ordinary household use will be acceptable for concrete. Where available, water shall be obtained from mains of a waterworks system.

E. Additive: "Darafill" may be required to meet the strength and flowability requirements of this Section.

2.03 PROPORTIONING AND MIXING

A. In the determination of the amount of water required for mix, consideration shall be given to the moisture content of the aggregate. The net amount of water in the mix will be the amount added at the mixer; plus the free water in the aggregate; and minus the absorption of the aggregate, based on a 30-minute absorption period. No water allowance shall be made for evaporation after batching.

B. The methods of measurement of materials shall be such that the proportions of water to cement can be closely controlled during the progress of the Work and easily checked at any time by the Owner's representative. To avoid unnecessary or haphazard changes in consistency, the aggregate shall be obtained from sources which will insure a uniform quality and grading during any single day's operation and they shall be delivered to the Work and handled in such a manner that the variation in moisture content will not interfere with the steady production of concrete of reasonable degree of uniformity. Sources of supply shall be approved by the Owner's representative.

C. All material shall be separately and accurately measured. Measurement may be made by weight or by volume, as determined by the Contractor; however; all equipment for measurement of materials shall be subject to approval by the Owner's representative.

D. The proportions of the mix shall be such as to produce material that can be placed readily into the void area without spading or vibrating, and without segregation or undue accumulation of water or laitance of the surface.

E. When additive is contained in the concrete mix, the additive ingredients, proportions and placement of the additive shall be per manufacturer's recommendations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall give the Owner's representative sufficient advance notice before starting to place material in any area to permit inspection of the area and to prepare for pouring.

B. Conduct the operation of depositing and compacting the material so as to form a compact, dense, impervious mass.

C. Flowable fill shall be placed the full depth into the trenches. The fill shall be brought up uniformly to the elevation shown on the Drawings. Flowable fill shall be protected from traffic for a period of 72 hours.

D. The material shall be placed against undisturbed trench walls, and shall not be placed on or against frozen ground.

E. Material shall be placed in lifts or other measures shall be taken to prevent pipe flotation. Material shall be allowed to harden before placing next lift.

END OF SECTION

1.00 GENERAL

A. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Procurement and Contracting Requirements
2. Division 01 – General Requirements
3. Section 02 16 10 – Excavation Safety
4. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete
5. Section 03 34 13 – Controlled Low Strength Material (CLSM)
6. Section 31 25 00 – Erosion and Sediment Control
7. Section 31 41 33 – Trench Safety Requirements
8. Appendix A - FINAL REPORT_94175317 Geo Report - Buffalo Creek Interceptor Sewer_S
9. Appendix B - GeoReport for Country Club Pond Wall 94195009_S

1.01 SCOPE

A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.

B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.

C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.

The trench is divided into four specific areas:

1. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
2. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
3. Initial Backfill: The area above the haunching material and 12-inches above the top of the barrel of the pipe.
4. Backfill: The area above the initial backfill.

D. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment, storage of excavated material, proximity of manmade improvements to be protected, available easement or right-of-way and prevailing practice in the area.

1.02 QUALITY ASSURANCE

A. Density: All references to “maximum dry density” shall mean the maximum dry density defined by the “Maximum Density-Optimum Moisture Test”, ASTM D 698. Determination of the density of bedding, haunching, or backfill materials in place shall meet with the requirements of ASTM D 1556, “Density of Soil in Place by the Sand Cone Method”, ASTM D 2937, “Density of Soil in Place by the Drive-Cylinder Method” or ASTM D 6938, “In-Place Density/Water content of Soil/Soil Aggregate by Nuclear Methods Shallow Depth”.

B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specifications shall be performed by an independent testing laboratory in accordance with Section 01 40 00 of these Specifications. All imported fill materials shall meet the requirements of on-site fill materials.

1.03 SAFETY

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P “Excavation, Trenching & Shoring” as described in OSHA publication 2226.

2.00 PRODUCTS

2.01 EMBEDMENT

A. Unless specified otherwise, embedment shall be fine crushed rock aggregate, Grade 56 or 57, in accordance with AASHTO and shown on the Drawings.

B. Filter Fabric [Woven Type]

1. Filter fabric associated with embedment in sandy soils shall be a polypropylene woven fabric. The fabric shall be a high modulus type with good separation capabilities. The fabric shall be inert to biological degradation and naturally occurring chemicals, alkalis and acids.

2. The fabric shall have an equivalent opening size (EOS or AOS) of 20 to 45. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Method	Minimum Value
Grab Tensile Strength	lbs.	ASTM D 4632	200
Grab Tensile Elongation	%	ASTM D 4632	30 (max.)
Mullen Burst Strength	psi	ASTM D 3786	400
Trapezoid Tear Strength	lbs.	ASTM D 4533	75
Puncture Strength	lbs.	ASTM D 3787	75

3. If ordered by the Engineer, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 10 days during initial pipe installation.

4. Filter fabric shall be Mirafi 500X, Amoco 2002 or Exxon GTF-200 or approved equal.

C. Filter Fabric [Non-Woven Type]

1. Filter fabric associated with embedment in sandy soils shall be a UV stabilized, spun bonded, continuous filament, needlepunched, polypropylene, nonwoven geotextile.

2. The fabric shall have an equivalent open size (EOS or AOS) of 120 - 70. The fabric shall also conform to the minimum property values listed in the following table:

Fabric Property	Unit	Test Procedure	Average Value	
			Typical	Minimum
Weight	oz./yd2	ASTM D 3776	8.3	

Thickness	mils	ASTM D 1777	105	
Grab Strength	lbs.	ASTM D 4632	240	210
Grab Elongation	%	ASTM D 4632	>50	50
Tear Strength	lbs.	ASTM D 4533	100	85
Mullen Burst	psi	ASTM D 3786	350	320
Puncture Resistance	lbs.	ASTM D 4833	115	100
Permittivity	sec-1	ASTM D 4491	1.7	
Water Permeability	cm/sec	ASTM D 4491	0.4	
Water Flow Rate	gpm/ft2	ASTM D 4491	120	
UV Resistance (500 hrs.)	%	ASTM D 4355	>85	
Ph			2 - 13	

3. If ordered by the Engineer, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 10 days during initial pipe installation.
4. Filter fabric shall be Polyfelt TS 700, Trevira 1125 or SuPac 7-MP or approved equal.

2.02 INITIAL BACKFILL

Initial backfill material shall be crushed stone as specified in Paragraph 2.01 above.

2.03 BACKFILL

Final backfill material shall be native onsite materials, shall not contain rock larger than 2-inches at its greatest diameter, cinders, stumps, limbs, man-made wastes and other unsuitable materials compacted to 95% of maximum density per ASTM D698. .

2.04 CONCRETE

Concrete for encasement and reinforcement shall be in accordance with Section 03 30 00 and details shown in construction drawings.

3.00 EXECUTION

3.01 TRENCH EXCAVATION

A. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.

B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions that provide the proper support and protection of the pipe and other structures and accessories.

C. Trench Width for Pipelines

1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe.

Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.

2. Excavate the top portion of the trench to any width within the construction easement or right-of-way that will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.

3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 9-inches clearance between the rock and any part of the pipe barrel or manhole.

4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use Engineer approved the next higher Class or Type of bedding and haunching for the full trench width as actually cut. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.

D. Depth

1. The trenches shall be excavated to the required depth or elevation that allow for the placement of the pipe and bedding to the dimensions shown on the Drawings.

2. Where rock is encountered in trenches for pipelines, excavate to the minimum depth that will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory.

E. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.

2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.02 SHEETING, BRACING AND SHORING

A. Sheeting, bracing and shoring shall be performed in the following instances:

1. Where sloping of the trench walls do not adequately protect persons within the trench from slides or cave-ins.

2. In caving ground.

3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted, braced and shored.

4. Where necessary to prevent damage to adjoining buildings, structures, roadways, pavement, utilities, trees or private properties, which are required to remain.

5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.

6. Bore pits for trenchless pipe installation.

7. Low water crossing.

B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970, as amended.

C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.

D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing structures and live loads. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities.

E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be “dragged” with the bottom of the shield extending below the top of the pipe or utility. Contractor shall filly any voids left between embedment and undisturbed trench wall and compact in the same manner as in the embedment zone.

F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed or is within three feet of an existing structure, utility, or pipeline. Cut off any sheeting left in place at least two feet below the surface.

G. Sheet piling within five feet of an existing structure shall remain in place, unless otherwise directed by the Engineer.

3.03 ROCK EXCAVATION

A. Definition of Rock: Any material that cannot be excavated with conventional excavating equipment, and is removed by drilling or other prior Engineer and Owner approved method, and occupies an original volume of at least one-half cubic yard.

B. Blasting: Blasting is not permitted.

C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.

3.04 DEWATERING EXCAVATIONS

A. Dewatering excavations shall conform to Section 31 23 19.16 in addition to Paragraph 3.04 of this Section.

B. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.

C. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.

D. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the utility crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.

E. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.

F. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used

as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench. Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.

G. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.05 TRENCH FOUNDATION AND STABILIZATION

A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.

B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer shall then authorize payment for trench stabilization.

C. Should the undisturbed material encountered at the trench bottom constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone [or surge stone] as directed by the Engineer.

D. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Place the crushed stone in the bottom of the trench and compact. Place the filter fabric over this stone and support the fabric along the trench walls until the bedding, haunching and pipe have been placed at the proper grade. The ends of the fabric shall be laid over the haunching material prior to the placement of the initial backfill.

E. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06 EMBEDMENT

A. Prior to placement of embedment material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.

B. Material under the pipe shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings. All embedment shall extend the full width of the trench bottom. The pipe shall be placed and brought to grade by tamping the material or by removal of the excess amount of the material under the pipe. Adjustment to grade line shall be made by scraping away or filling with material under the pipe. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the material below for the length of the pipe, except immediately at the joint.

C. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

D. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean

and free of any water, loose rocks, boulders or dirt clods.

F. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

G. Excessive Width and Depth

1. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used.

2. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

H. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.07 INITIAL BACKFILL

A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.

B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 12-inches above the pipe barrel. Layer depths shall be a maximum of 6-inches.

C. Backfill on both sides of the pipe simultaneously to prevent side pressures.

D. Compact each layer thoroughly with suitable hand tools or tamping equipment.

E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.

3.08 CONCRETE ENCASEMENT FOR PIPELINES

Where concrete encasement is shown on the Drawings for pipelines, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of embedment, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.09 BACKFILL

A. Backfill carefully to restore the ground surface to its original condition.

B. The top 6-inches shall be topsoil obtained as specified in “Trench Excavation” of this Section.

C. Excavated material which is unsuitable for backfilling, and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil may be neatly distributed and spread over the site, if approved by the Engineer. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.

D. If materials excavated from the trench are not suitable for use as backfill materials, provide select backfill material conforming to the requirements of this Section.

E. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:

1. In 6-inch layers, if using light power tamping equipment, such as a “jumping jack”.

2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet.

3. In 24-inch layers, if using a hydra-hammer.

F. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.

G. Final backfill shall be compacted to a minimum 95 percent of the maximum dry density, per ASTM D698.

3.10 ADDITIONAL MATERIAL

Where final grades above the pre-construction grades are required to maintain minimum cover, additional fill material will be as shown on the Drawings. Utilize excess material excavated from the trench, if the material is suitable. If excess excavated materials are not suitable, or if the quantity available is not sufficient, provide additional suitable fill material.

3.11 BACKFILL UNDER ROADS

Compact backfill underlying pavement and sidewalks and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.

3.12 TESTING AND INSPECTION

Testing and Inspection shall conform to 01 40 00 Section of these Specifications in addition to the following requirements:

A. The soils testing laboratory is responsible for the following:

1. Compaction tests in accordance with Article 1.01 of this Section.
2. Field density tests for each two feet of lift, one test for each 2,000 feet of pipe installed or more frequently if ordered by the Engineer.
3. Inspecting and testing stripped site, subgrades and proposed fill materials.

B. The Contractor's duties relative to testing include:

1. Paying costs for all testing and re-testing where initial tests reveal non-conformance with specified requirements.
2. Notifying laboratory of conditions requiring testing.
3. Coordinating with laboratory for field testing.
4. Providing excavation as necessary for laboratory personnel to conduct tests.

C. Inspection

1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.
2. Foundations and shallow spread footing foundations are required to be inspected by a Geotechnical engineer, who shall verify suitable bearing and construction.

D. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes

1. This Work includes furnishing all labor, materials, equipment and incidentals necessary to perform all installation, maintenance, removal and area cleanup related to sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; installation of temporary access ways and staging areas, silt fences, sediment protection at storm drain inlets, sediment removal and disposal, device maintenance, removal or temporary devices, temporary mulching, erosion control blankets and final cleanup.

B. Related Specification Sections include but are not necessarily limited to

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 1 - General Requirements.
3. Section 32 92 19 – Seeding.

1.02 PAYMENT PROCEDURES

Payment Procedures shall conform to Section 01 29 00 of these Specifications.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00 of these Specifications.

1.04 QUALITY ASSURANCE

The Contractor shall be responsible for the timely installation of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas or into the stream system via surface runoff or underground drainage systems. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off-site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. No additional charges to the Owner will be considered for delivery, storage, and handling.

2.00 PRODUCTS

2.01 MATERIALS

A. Stabilized Construction Entrance

1. Crushed stone shall be 3” to 5” hard stone at greatest dimension.

B. Silt Fence

1. Posts shall be painted or galvanized steel Tee posts.
   a. Minimum of three (3) feet in length
   b. Minimum weight of 1.3 pounds per foot
   c. Shall have self-fastening tabs and a 5” x 4” (nominal) steel anchor plate at bottom.
   d. Posts and anchor plates shall conform to ASTM A702.
2. Welded wire fabric shall be 4x4 – W1.4xW1.4.
3. Fabric shall be a woven, polypropylene, ultraviolet resistant material such as Mirafi 100X as manufactured by Mirafi, Inc., Charlotte, NC, or approved equal.
4. Tie wires for securing silt fence fabric to wire mesh shall be light gauge metal clips (hog rings), or 1/32-inch diameter soft aluminum wire.

5. Pre-fabricated commercial silt fence may be substituted for built-in-field fence.
    a. Pre-fabricated silt fence shall be “Envirofence” as manufactured by Mirafi Inc., Charlotte, NC, or approved equal.

C. Erosion Control Blanket

1. Shall be AMXCO Curlex Blanket as manufactured by American Excelsior Company, Arlington, TX or approved equal.

3.00 EXECUTION

3.01 INSTALLATION

A. Stabilized Construction Entrance

1. Stabilized construction entrance shall be constructed at locations indicated on the Drawings and as necessary to prevent off-site movement of sediment produced by construction activities as directed by the Engineer.
2. Construction shall be according to construction entrance detail shown on the Drawings.

A. Silt Fence

1. Silt fences shall be positioned as indicated on the Drawings and as necessary to prevent off-site movement of sediment produced by construction activities as directed by the Engineer.
2. Dig trench approximately 6” x 6” along proposed fence lines.
3. Drive metal-stakes, six (6) feet on center (maximum) at back edge of trenches. Stakes shall be driven one (1) foot (minimum) into ground.
4. Hang woven wire mesh on posts, setting bottom of wire in bottom of trench. Secure wire to posts with self-fastening tabs.
5. Hang filter fabric on wire carrying to bottom of trench with about 12-inches of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and secure with tie wires 12-inch O.C. both ways. The silt fence shall be a minimum of 24 inches high.
6. Backfill trench with excavated material and tamp.
7. Install pre-fabricated silt fence according to manufacturer’s instructions.

B. Erosion Control Blanket

1. Erosion control blankets shall be installed in any areas exceeding 5:1 slope and in areas as required for seeding.
2. The area to be covered shall be properly prepared, fertilized and seeded before the blanket is applied.
3. When the blanket is unrolled, the netting shall be on top of the fibers in contact with the soil over the entire area. The blankets shall be applied in the direction of water flow and stapled.
    a. The staples shall be made of wire, 0.091-inch in diameter or greater, “U” shaped with legs 10-inches in length and 12-inch crown.
    b. The staples shall be driven vertically into the ground, spaced approximately two (2) linear feet apart on each side with one row in the center alternately spaced between each side row.
4. Adjoining blankets shall be overlapped and shall utilize a common row of staples to attach.
    a. Side overlaps shall be 4-inch minimum.

3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Contractor shall make a visual inspection of all sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas, Contractor shall promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Stabilized Construction Entrance

a. Vehicles shall be cleaned to remove sediment prior to entrance onto a public roadway. When washing is required, it shall be done on an area stabilized with crushed stone with drainage flowing away from both the street and the stabilized entrance.

b. All sediment shall be prevented from entering any storm drain, ditch or watercourse using approved methods.

c. Area surrounding the construction entrance shall be kept clean by periodically sweeping for debris and overflowed crushed stone.

2. Silt Fences

a. Remove accumulated sediment once it builds up to one-half of the height of the fabric.

b. Replace damaged fabric, or patch with a 2-foot minimum overlap.

c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.

3.03 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner.

B. Re-grade all areas disturbed during this process and stabilize against erosion with surfacing materials as specified and as shown on the Drawings.

END OF SECTION

PART 1 - GENERAL

1. 01 DESCRIPTION

This item shall govern the excavation of all materials encountered for placing riprap, disposal of excess material and backfilling around the completed riprap to the grade indicated on the Drawings. The work shall include all pumping and bailing, furnishing and placing riprap of rock or concrete in accordance with the details and to the dimensions indicated on the Drawings.

The work conducted under this item pertains to riprap for protection of slopes, cuts, fills, drainage facilities and other features susceptible to erosion.

1. 02 SUBMITTALS

A. The submittal requirements for this specification item shall include:

1. The type, size, gradation, physical properties and source of rock riprap material; test data for specific gravity, absorption, soundness; and field verification of the rock riprap gradation including a size distribution plot and a list of the measured D15, D50, D85, and D100 (Rock Riprap Gradation Table, this section).
2. The type, size, and source of broken concrete riprap material.
3. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix.
4. Proposed proportioning of materials for the mortar mix.
5. Type, details and installation requirements for reinforcement, joint material, tie backs and anchors.
6. Description of filter fabric including characteristics, test data and manufacturer's recommendations for installation.
7. The type, size, gradation and source of granular filter material.

B. Where vegetated soil-riprap is used, and proposed materials differ from the materials already approved for use elsewhere on the project, the submittal requirements also include:

1. Identification of the seed species, source, mixture, pure live seed (PLS) as listed on the analysis tags, and certification tags from all seed bags per Section 32 92 16, Hydro mulch Seeding.
2. Soil retention blanket material type, evidence that the material is listed on the TxDOT Approved Products List, one (1) full set of manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.
3. Identification of fill soil class, source, and characteristics of proposed borrow material as described in Section 32 23 00, Excavation, Bedding and Backfill for Utilities.
4. Identification of topsoil source and characteristics including textural (clay/silt/sand) percentage.

1. 03 REFERENCES

A. ASTM D 5240 - Standard Test Method for Evaluation of Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate

B. ASTM D 5519 - Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials

C. ASTM D 6473 - Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control

D. Tex-403-A - Test Procedure for Saturated Surface-Dry Specific Gravity and Absorption of Aggregates

E. Tex-411-A - Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate

F. Federal Highway Administration, 1989, Design of Riprap Revetment, Hydraulic Engineering Circular HEC-11, FHWA-1P-89-016

G. National Cooperative Highway Research Program, 2006, Riprap Design Criteria, Recommended Specifications, and Design Criteria, NCHRP Report 568

H. United States Bureau of Reclamation, 1983, Hydraulic Design of Stilling Basins and Energy Dissipaters, Engineering Monograph No. 25

I. U.S Department of Agriculture, 1983, Soil Conservation Service, Riprap for Slope Protection Against Wave Action, Technical Release No. 69, February

J. US Army Corps of Engineers, 1994. Hydraulic Design of Flood Control Channels, US Army Corps of Engineers Engineer Manual EM 1110-2-1601

K. Federal Highway Administration, 1998. "Geosynthetic Design and Construction Guidelines," FHWA-HI-95-038

PART 2 - PRODUCTS

A. Rock

1. The rock shall be suitable in all respects for the purpose intended. Rock sources shall be selected well in advance of the time the rock will be required and shall be pre-approved by the Engineer. Rock used for riprap shall be hard, durable, and angular in shape and consist of clean field rock or rough unhewn quarry rock as nearly uniform in section as practicable. Neither the width nor the thickness of a single rock shall be less than one-third of its length. The rocks shall be dense, resistant to weathering and water action, and free of overburden, spoils, shale, and organic material. Shale, chalk, and limestone with shale or chalk seams shall not be acceptable. Rounded rock (river rock) shall not be acceptable.

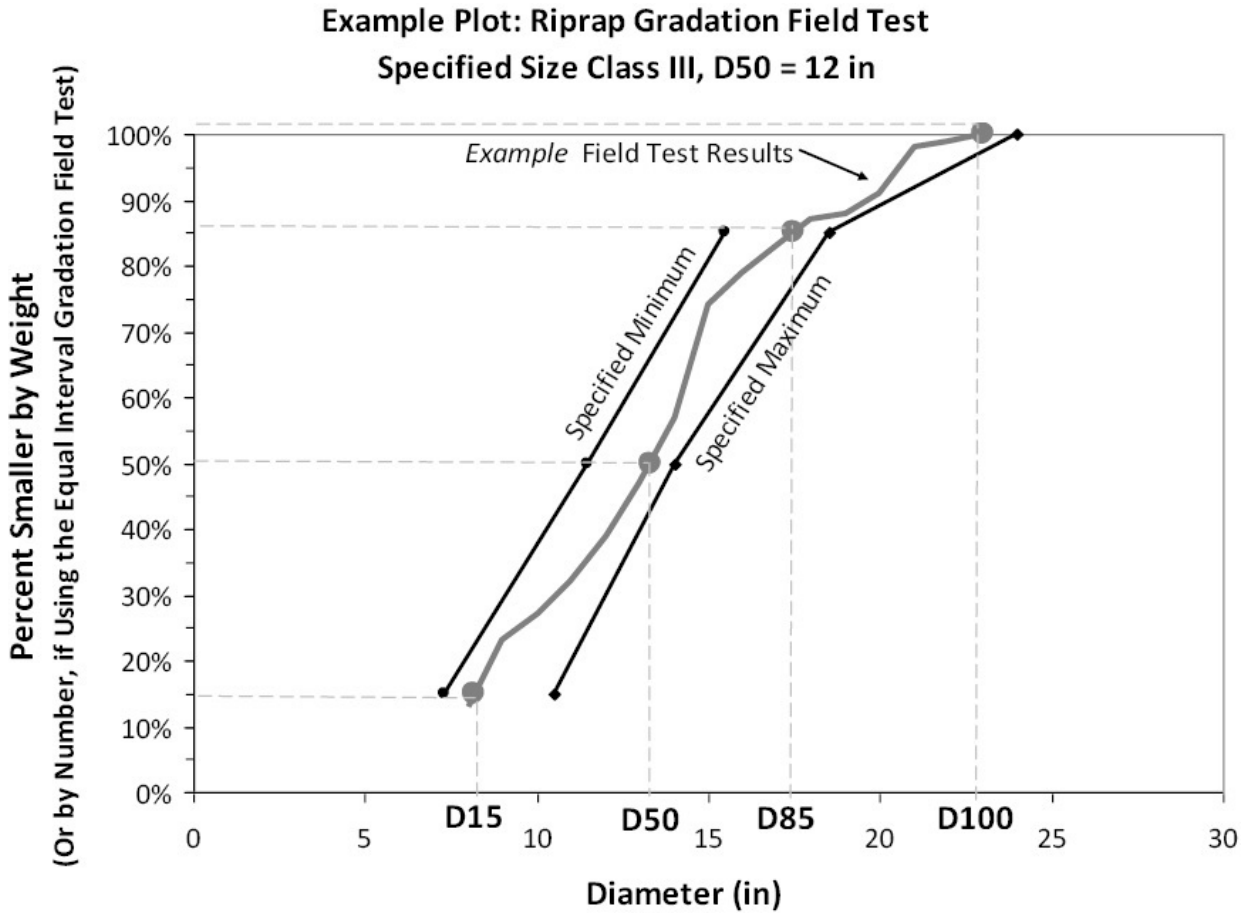
2. The rock durability shall be evaluated by laboratory tests for specific gravity, absorption, and soundness. The minimum specific gravity shall be 2.4 (150 pounds per cubic foot) and the maximum absorption 4.2% using ASTM D 6473 or Tex-403-A. Soundness shall be tested in accordance with ASTM D 5240 or Tex-411-A and weight loss shall not exceed 18% after 5 cycles of magnesium sulfate solution, nor 14% after 5 cycles of sodium sulfate solution.

3. The rock riprap material shall be provided as a gradation of larger and smaller rock sizes associated with a rock class or median diameter (D50). Rock diameter for angular material represents the length of the intermediate axis of an individual rock. The material gradation shall conform to the table below for the class sizes corresponding to the D50. The D15, D50, D85, and D100 are the rock sizes for which 15%, 50%, 85%, and 100% of the total sample are of equal size or smaller, respectively.

Rock Riprap Gradation Table								
Rock Riprap Class by Median Particle Diameter (D50)		D15 (in)		D50 (in)		D85 (in)		D100 (in)
Class	Diameter (in)	Min	Max	Min	Max	Min	Max	Max
I	6	3.7	5.2	5.7	6.9	7.8	9.2	12.0
II	9	5.5	7.8	8.5	10.5	11.5	14.0	18.0
III	12	7.3	10.5	11.5	14.0	15.5	18.5	24.0
IV	15	9.2	13.0	14.5	17.5	19.5	23.0	30.0
V	18	11.0	15.5	17.0	20.5	23.5	27.5	36.0
VI	21	13.0	18.5	20.0	24.0	27.5	32.5	42.0
VII	24	14.5	21.0	23.0	27.5	31.0	37.0	48.0
VIII	30	18.5	26.0	28.5	34.5	39.0	46.0	60.0
IX	36	22.0	31.5	34.0	41.5	47.0	55.5	72.0
X	42	25.5	36.5	40.0	48.5	54.5	64.5	84.0

4. Reference: NCHRP Report 568.
5. Conversion to weight-based gradation: W = 0.0275D3Sg where W is rock size in lbs, D is diameter in inches and Sg is the specific gravity of the rock.
6. Conformance of rock riprap to the gradation requirements shall be accomplished by field tests for rock sizes that cannot be analyzed via sieve or mechanical sorting machines. In order to perform a field test, the contractor shall provide a sample of the proposed rock riprap material meeting the gradation for the specified size class. Gradation field tests shall follow the equal interval test procedure in NCHRP Report 568, Section 3.2.3, ASTM D 5519, or the modified equal interval method. The general steps of the modified equal interval method are:
7. Spread a representative, well-mixed sample of riprap to form a flat, rectangular pile. The thickness of the pile should be approximately equal to the D100. The length and width of the footprint should be determined based on the rock size and the minimum sample size that is requested by the Engineer.
8. With a tape measure, create a linear transect across the sample pile. Mark each rock that falls directly under the tape measure at an equal interval. The interval should be two feet or greater, depending on the D50, such that no rock is marked more than once.

9. Lay additional transects parallel to the first transect, at a spacing equal to the interval between marked rocks. Repeat Step B for each transect such that the marked rocks form an equally spaced grid across the pile.
10. Measure the diameter of each marked rock across the intermediate (middle or B) axis. The number of rocks measured shall be equal or greater than the minimum sample size.
11. Analyze the data by sorting and plotting a curve of percent smaller by number vs diameter. Identify the diameters.
12. Gradation tests shall result in: (1) a size distribution plot comparing the measured sample data with the specified diameter ranges for the rock size class (example below), and (2) the calculated D100, D85, D50, and D15 of the rock sample. The sample gradation is acceptable if the calculated diameters fall within the specified ranges of the applicable gradation. The acceptability of rock that falls outside the specified gradation ranges shall be at the discretion of the Engineer.



Approved rock riprap samples shall be stored onsite as a reference for ongoing visual inspection of additional materials supplied. Supplementary tests may be required for supply materials where visual inspection determines there may be a deviation from the required gradation. Labor, equipment and site location needed to assist in checking gradation shall be provided by the contractor at no additional cost to the owner.

B. Broken Concrete

1. The rock used for mortar riprap may consist of broken concrete removed under the contract or obtained from other approved sources. Broken concrete shall be as nearly uniform in section as practicable and of the sizes indicated in Section 591S.4.A, "Dry Riprap".

C. Concrete

1. Cast in place concrete shall be Class A Concrete and shall conform to Section 03 30 53, Cast-in-Place Concrete.

D. Grout and Mortar

1. Grout and mortar shall consist of 1 part Portland Cement and 3 parts sand, thoroughly mixed with water. Mortar shall have a consistency such that it can be easily handled and spread by trowel. Grout shall have a consistency such that it will flow into and completely fill all joints.

E. Joints

1. Premolded expansion joint material shall conform to Section 03 15 14, Concrete Joints and Embedded Items.

F. Tie Backs and Anchors

1. Galvanized tie backs and anchors shall be as indicated on the Drawings.

G. Filter Fabric

1. Filter fabric shall be installed beneath riprap.
2. The following filter fabric shall be used:
   a. Soils other than ML or OH in accordance with ASTM D2487
      1) Needle punch, nonwoven goetextile composed of polypropylene fibers
      2) Fibers shall retain their relative position
      3) Inert to biological degradation
      4) Resist naturally occurring chemicals
      5) UV Resistant
      6) Mirafi 140N by Tencate, or approved equal
   b. Soils Classified as ML or OH in accordance with ASTM D2487
      1) High-tenacity monofilament polypropylene woven yarn
      2) Percent open area of 8 to 10 percent
      3) Fibers shall retain their relative position
      4) Inert to biological degradation
      5) Resist naturally occurring chemicals
      6) UV Resistant
      7) Mirafi FW402 by Tencate, or approved equal.

H. Granular Filter

1. Aggregate used for granular filters shall conform to Section.

I. Soils

1. For vegetated soil-rock riprap, soil shall be integrated with the rock riprap at 30% soil to 70% rock by volume with minimal voids. Unless specified otherwise in the Drawings, soil that is placed below six inches (6") below the riprap top surface shall be Class A Select Borrow material, as described in Section 31 22 00, Grading, and referred to herein as "fill soil." Soil that is placed within the top six inches (6") of the riprap top surface shall be topsoil material as described in Section 32 91 16.13, Top Soil.

J. Seed

1. For vegetated soil-rock riprap, the type of seed mix and application rates shall be as

specified on the Drawings and within the Section 32 92 16, Hydro mulch Seeding.

K. Soil retention blanket.

1. For vegetated soil-rock riprap, soil retention blanket shall be TxDOT-approved Class 1 Type C or D, shall be made of 100% biodegradable fibers.

PART 3 - EXECUTION

A. Prior to commencement of this work, all required erosion control and tree protection measures shall be in place and utilities located and protected as set forth in the "General Conditions". Construction equipment shall not be operated within the drip line of trees unless indicated on the Drawings. Construction materials shall not be placed under the canopies of trees. Spalls and small stones used to fill open joints and voids in rock riprap shall be rocked and wedged to provide a tight fit.

B. Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor and it shall become his sole responsibility to dispose of this material in an environmentally sound manner off the limits of the right of way at a permitted disposal site.

C. Areas to be protected by rock riprap shall be free of brush, trees, stumps and other objectionable materials and be graded to a smooth compacted surface. All soft or spongy material shall be removed and replaced with appropriate material to the depths shown on the plans or as directed by the engineer. Unacceptable subgrade conditions shall be reworked according to the Engineer's recommendations. Excavation areas shall be maintained until the riprap is placed.

D. Dry Rock Riprap

1. The mass of rock riprap shall be placed as to be in conformance with the required gradation mixtures, to the lines, grades and layers thickness that is shown on the drawings.

2. When the riprap will be placed on an erodible soil, as determined by the Engineer or designated representative, a layer of geotextile filter fabric or a granular filter layer shall be placed, prior to placement of the riprap material. In some cases, multiple layers of granular filter material of varying gradations may be required. The median rock riprap size (D50), rock riprap layer thickness, filter type, when applicable the number of granular filter layers, granular filter aggregate gradations (grade/size classification), granular layer thicknesses shall be specified on the plans. The minimum granular filter layer thickness shall be 4 inches (102 mm). Geotextile filter fabric shall conform to Standard Specification No. 620 and be installed with sufficient anchoring and overlap between seams according to the manufacturer's recommendations to ensure full filter barrier protection of the subgrade after riprap installation. When specified on the plans a four (4) inch minimum thickness granular cushion layer of gravel or sand may be placed over the filter fabric to prevent damage the fabric during placement of rock riprap.

3. Rock riprap shall be machine placed and distributed such that there will be no large accumulations of either larger or smaller sizes. Placing rock riprap by dumping into chutes or similar methods shall not be permitted. The rocks shall be placed in a single layer with close joints. The rock riprap layer thickness shall be no less than the specified maximum stone size (D100) or 1.5 times the D50, whichever produces the greater thickness. In areas exposed to flowing water the rock riprap layer thickness should be no less than 2.0 times the D50. The upright axis of the rocks shall make an angle of approximately 90 degrees with the embankment slope. The courses shall be placed from the bottom of the embankment upward, with the larger rocks being placed on the lower courses. Open joints shall be filled with spalls. Rocks shall be arranged to present a uniform finished top surface such that the variation between tops of adjacent rocks shall not exceed 3 inches (75 mm). Rocks that project more than the allowable amount in the finished work shall be replaced,

embedded deeper or chipped.

E. Mortared Rock Riprap

1. Rock for this purpose, as far as practicable, shall be selected as to size and shape in order to secure fairly large, flat-surfaced rock which may be laid with a true and even surface and a minimum of voids. Fifty percent of the mass rock shall be broad flat rocks, weighing between 100 and 150 pounds (45 and 69 kilograms) each, placed with the flat surface uppermost and parallel to the slope. The largest rock shall be placed near the base of the slope. The spaces between the larger rocks shall be filled with rocks of suitable size, leaving the surface smooth, reasonably tight and conforming to the contour required on the Drawings. In general, the rocks shall be placed with a degree of care that will insure plane surfaces with variation from the true plane of no more than 3 inches in 4 feet (no more than 60 mm per meter). Warped and curved surfaces shall have the same general degree of accuracy as indicated for plane surfaces.

2. Before placing mortar, the rocks shall be wetted thoroughly and as each of the larger rocks is placed, it shall be surrounded by fresh mortar and adjacent rocks shall be shoved into contact. After the larger rocks are in place, all of the spaces or opening(s) between them shall be filled with mortar and the smaller rocks then placed by shoving them into position, forcing excess mortar to the surface and insuring that each rock is carefully and firmly embedded laterally. After the work described above has been completed, all excess mortar forced up shall be spread uniformly to completely fill all surface voids. All surface joints then shall be pointed up roughly, either with flush joints or with shallow, smooth raked joints.

F. Vegetated Soil-Rock Riprap

1. Adjacent stockpiles of rock riprap, fill soil, and topsoil shall be created and there shall be no premixing of fill soil, topsoil and rock prior to placement. Sufficient soil volume shall be provided to result in a final, complete-in-place ratio of 30% soil to 70% rock riprap by volume.

2. Place underlying filter material and first layer of rock riprap in accordance with 591S.4.A to a thickness equivalent to the D50 rock size or half the design rock layer thickness, whichever is greater. Place a layer of soil over and within the rock voids such that the top of the soil layer is approximately 75% of the rock layer thickness. Work the soil into the rock layer voids by wetting, prodding with a rock bar, and/or vibratory compaction until the soil height is approximately 50% of the rock height. If the soil height becomes less than 50% of the rock height then repeat the previous steps.

3. Place the second layer of rock riprap per 591S.4.A up to the final design grade. Place soil over and within the rock riprap, working it into the voids as in the previous step and repeating application as needed until the top of the soil layer approximately matches the top surface of the rock riprap. Excess soil shall not be placed in the voids to the extent that the rock riprap is displaced. The resulting soil-riprap surface shall be smooth, with no lumps or depressions greater than two inches (±2") from the final design grade.

4. Once the soil-rock matrix is placed, the surface of the soil-rock riprap shall be seeded per the Drawings and covered with biodegradable erosion control fabric.

G. Concrete Riprap

1. Concrete for riprap shall be placed as indicated on the Drawings or as directed by the Engineer or designated representative. Unless otherwise indicated on the Drawings, concrete riprap shall be reinforced using wire or bar reinforcement.

2. Concrete shall be Class A or as indicated otherwise on the Drawings and shall conform to Section 03 30 53, Cast-in Place Concrete.

3. When welded wire reinforcement is indicated, it shall be a minimum of 6 × 6 W1.4 × W1.4 (150 × 150 MW9 × MW9) with a minimum lap of 6 inches (150 mm) at all splices. At the edge of the riprap, the wire fabric shall not be less than 1 inch (25 mm) nor more than 3

inches (75 mm) from the edge of the concrete and shall have no wires projecting beyond the last member parallel to the edge of the concrete.

4. When bar reinforcement is used, the sectional area of steel in each direction shall not be less than the sectional area of the wire fabric described above. The spacing of bar reinforcement shall not exceed 18 inches (450 mm) in each direction and the distance from the edge of concrete to the first parallel bar shall not exceed 6 inches (150 mm).
5. Reinforcement shall be supported properly throughout the placement to maintain its position approximately equidistant from the top and bottom surface of the slab.
6. Unless otherwise noted, expansion joints of the size and type indicated on the Drawings shall be provided at intervals not to exceed 40 feet (12.2 meters) and shall extend the full width and depth of the concrete. Marked joints shall be made 3/8 inch (9.5 mm) deep at 10 foot (3 meter) intervals. All joints shall be perpendicular and at right angles to the forms unless otherwise indicated on the Drawings.
7. Slopes and bottom of the trench for toe walls shall be compacted and the entire area sprinkled before the concrete is placed.
8. After the concrete has been placed, consolidated and shaped to conform to the dimensions indicated on the Drawings and has set sufficiently to avoid slumping, the surface shall be finished with a wooden float to secure a reasonably smooth surface.
9. Immediately following the finishing operation, the riprap shall be cured conforming to Section 03 30 53, Cast-in Place Concrete.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section covers all members to be used in the construction of steel sheet pile. This SPECIFICATION also covers the installation of steel sheet piling and trimming of the sheet pile to the lines and grades shown on the DRAWINGS or as required. This WORK also includes pre-drilling to facilitate driving sheet pile to the designated elevations.

1.2 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 31 23 00, Excavation and Fill.
2. Section 31 23 19, Dewatering.
3. Section 31 23 33, Trenching and Backfilling.
4. Section 31 25 00, Erosion and Sedimentation Controls
5. TXDOT Item 441, Steel Structures
6. TXDOT Item 446, Field Cleaning and Painting Steel

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI): 318/318R, Building Code Requirements for Structural Concrete and Commentary.
2. American Petroleum Institute (API): Spec 5L, Specification for Line Pipe.
3. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   c. A139, Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and Over).
   d. A252, Standard Specification for Welded and Seamless Steel Pipe Piles.
   e. A328, Standard Specification for Steel Sheet Piling.
   f. A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   g. A690, Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments.
   h. A1011/A1011M, Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low- Alloy with Improved Formability.
4. American Water Works Association (AWWA):
   a. C200, Steel Water Pipe—6 in. (50 mm) and Larger.
5. American Welding Society (AWS):
   a. D1.1, Structural Welding Code—Steel.

1.4 SUBMITTALS

A. Provide qualifications of proposed sheet pile installer.

B. CONTRACTOR shall provide information from the manufacturer that indicates the sheet piling meets or exceeds the SPECIFICATIONS listed in this section.
C. CONTRACTOR shall submit verification from the manufacturer that the hammer can deliver the required energy.
D. Splice locations, if necessary, shall be reviewed and accepted by ENGINEER prior to installation.
E. CONTRACTOR shall notify NTMWD Construction Manager when delivery of sheet piles will be arriving. Deliver weight tickets to NTMWD construction manager and submit copy of said weight tickets with pay application.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Sheet piling installer shall have, as a minimum, three (3) successful past installations of sheet piling of comparable overall heights and sections and comparable penetration into soils similar to those found on the PROJECT.

PART 2 - PRODUCTS

2.1 GENERAL

A. All steel sheet piling shall be new and unspliced material throughout, unless otherwise reviewed and accepted by ENGINEER.
B. Steel sheet piles and special fabricated shapes shall be of a design that ensures continuous interlock throughout the entire length when in place.

2.2 MATERIALS

A. Steel sheet piling shall meet the requirements of ASTM A690, (Grade 50).
B. Steel corners, tees, wyes, and crosses shall meet the requirements of ASTM A690.
C. Steel sheet piles required for the PROJECT shall be the type and weight shown on the DRAWINGS. Sheet piling shall be constructed with a weathering finish.
    1. Additional length beyond those indicated on the DRAWINGS may be required to provide for trimming of tops of sheet piling.
D. The interlocks between steel sheet pile sections shall be configured such that the average width of the annular space between all contact points of the interlocks shall be a maximum of one-eighth (1/8) inch, as determined by ENGINEER.
E. Steel sheet piles and interlocks shall not have excessive kinks, camber or twist that would prevent the pile from reasonably free sliding to grade.
F. All fabricated connections shall be made with the use of angles or bent plates, as necessary, and shall be adequately welded or connected with high strength bolts as accepted by ENGINEER.
G. Handling Holes:
    1. If handling holes are provided, they shall be two (2) standard two and nine-sixteenth (2-9/16) inch diameter handling holes located six (6) inches from one end.
    2. The holes shall be plugged by welding a piece of steel over the hole prior to installing any riprap, backfill or structure cap.
    3. The plated hole shall be watertight.
H. Shop-paint piling with 3.0 mils minimum Dry Film Thickness (DFT) inorganic zinc primer in accordance with the System III-B or IV paint protection system specified in TXDot Item

441, “Steel Structures,” unless otherwise shown on the plans. Apply appearance or intermediate coatings only if specified on the plans. Apply a marine-grade immersion coating system recommended by the manufacturer for marine, immersion service, and meeting the requirements of NORSOK Standard M-501, Coating System No. 7 for piling in marine environments.

1. Submit a manufacturer’s certification that states the material meets the requirements of NORSOK Standard M-501, Coating System No. 7.
2. Submit product data sheets and obtain approval of paint system before performing the work.
3. Paint the portion of the pile to be above finished grade or dredge line, in water, and a minimum distance of 15 ft. below finished grade or dredge line, unless otherwise shown on the plans.
4. Provide coatings for field painting in accordance with TXDot Item 446, “Field Cleaning and Painting Steel.”

2.3 STORAGE AND HANDLING

1. Do not subject piles to damage by impact bending stresses in transporting to and storing piles onsite.
2. Store and handle piles such that corrosion protection coating will not be damaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin sheet pile installation until the earthwork in the area where the piles are to be driven has been completed to the extent that the grade elevation is at no more than twelve (12) inches above or below the top of the piling elevation as indicated on the DRAWINGS.

3.2 PREPARATION

A. Any fill along the alignment of the sheet pile must be in place to sub-grade elevations and compacted prior to driving the sheet pile.

B. Fill material (except riprap, boulders, bedding and grout) is not to be placed around the sheet pile after the sheet pile is in place.

C. **Painting**. Spot clean and paint in accordance with TXDot Item 446, “Field Cleaning and Painting Steel.” Clean and paint damage areas, field splices, or areas missing the shop coat, for IOZ primed piling, with enough epoxy zinc primer to bring the total zinc primer to the minimum 3.0 mils DFT after driving piling. Follow the repair procedures recommended by the manufacturer of the marine grade immersion coating system for piling with marine grade immersion coatings. Apply at least 2.0 mils DFT each of the System III epoxy intermediate coating and appearance coating when a polyurethane appearance coating is specified on the plans. Apply at least 2.0 mils DFT of the System IV appearance coating when an acrylic latex appearance coating is specified on the plans. Use a concrete gray appearance coating unless shown otherwise on the plans. Extend the appearance coat 1 ft. below finished ground line unless the piling is standing in water, in which case extend the appearance coat to the low water line. Replace any earth / backfill removed for this painting after the paint has dried.

3.3 INSTALLATION

A. General:
   1. All welding or gas cutting shall be in accordance with the current standards of the American Welding Society.
   2. Virtual Refusal:
      a. Steel sheet piling shall be driven to the depths shown on the DRAWINGS or to virtual refusal.
      b. Virtual refusal is defined as ten (10) blows per inch with an approved pile hammer.
      c. A pile hammer shall be used to determine virtual refusal.
      d. The hammer shall be operating at the manufacturer's recommended stroke and speed when virtual refusal is measured.

B. Sheet Piling Driving:
   1. Steel sheet piling shall be assembled before driving and then driven as a continuous wall, progressively in stages to keep the piles aligned correctly and minimize the danger of breaking the interlock between the sheets.
   2. Steel sheet piling shall be driven to form a tight bulkhead.
   3. A driving head shall be used and any piling which is damaged in driving or which has broken interlocks between sections shall be pulled and replaced at CONTRACTOR's expense.
   4. The piling shall be driven within the following tolerances:
      a. Alignment:
         1) Sheet pile shall be driven to form a relatively straight line between the termini points shown on the DRAWINGS.
         2) Horizontal deviation of any point from a straight line connecting the two ends of the wall section shall be a maximum of six (6) inches.
      b. Plumbness: Each individual sheet pile section shall be driven vertical, within a horizontal tolerance of two percent (2%) of any vertical length measured along the pile.
      c. Elevation:
         1) Tops of sheet pile sections shall be within a tolerance of one (1) inch from plan elevations.
         2) CONTRACTOR shall not be paid for excess sheet pile trimmed off the end of the pile to meet final grade.

C. CONTRACTOR shall brace and/or provide soil grading as necessary during construction operations in order to provide lateral stability for the sheet pile wall. The sheet pile wall has been designed for the soil grades of the final configuration denoted on the DRAWINGS only. Other temporary configurations during the construction period shall not be allowed.

D. Care shall be taken during driving to keep from causing deformations of the top of the piles, splitting of section, or breaking of the interlock between sections. Care shall also be taken during driving to prevent and correct any tendency of steel sheet piles to twist or get out of plumb.

E. Steel Z piling shall be driven with the ball-end leading. Proper care and planning shall be used to allow for this construction procedure in both immediate and possible future walls.

F. Alternate Z piles shall be reversed end for end for proper interlocking in the "normal" position. Piles shall also be aligned properly to maintain a "normal" driving width.

G. For sheet piles driven into the native soils, pre-drilled soils, or excavated soils a vibratory driver may be used as long as the required depth is obtained.

H. For sheet piles being driven into bedrock, an approved hammer utilizing a minimum hammer energy of 19,000 foot-pounds per square inch of steel section shall be used t o obtain the required depth or virtual refusal. The hammer shall be clearly marked so that it can be identified at the job site.

I. Steel sheet pile that is full length as shown on the DRAWINGS and is required to be driven below the specified cutoff elevation shall be spliced with additional steel sheet piling with a full penetration butt weld.

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes

1. Furnish all labor, materials, and equipment and perform all operations to plan, design, construct, install, maintain, monitor, modify as necessary, and remove upon completion, a Trench Safety System as specified herein.

2. The requirements of this Section apply to all trenches that equal or exceed a depthof five (5) feet, measured from the ground surface at the highest side of the trench to the trench bottom.

B. Related Specification Sections include but are not necessarily limited to

1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.

2. Division 1 - General Requirements.

3. Section 31 23 33 – Trench Excavation and Backfill

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement for this item shall be per linear foot of trench.

B. The price bid shall include all work, labor, equipment, and materials necessary to design and provide a trench safety system in accordance with this Section.

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of thisspecification, unless a date is specifically cited.

2. Texas Statute

a. HB 1569, 71st Regular Legislative Session.

3. Occupational Safety and Health Administration (OSHA)

a. 29 CFR 1926, Subpart P – Excavations, latest revision at time ofconstruction Agreement execution.

1.04 ACTION SUBMITTALS/INFORMATION SUBMITTALS

A. Shop Drawings

1. The Contractor shall be responsible for providing to the Owner an acceptable trench safety plan signed and sealed by a Professional Engineer qualified to do such work and registered in Texas

1.05 QUALITY ASSURANCE

A. The Contractor shall be responsible for complying with state laws and federal regulations relating to trench safety, including those that may be enacted during the performance under this contract.

2.00 PRODUCTS

2.01 GENERAL

A. All materials and products incorporated into the Trench Safety System shall be suitable for their intended uses; shall meet all design criteria and parameters used by the Trench Safety System designer; and shall meet all applicable requirements of OSHA Standards.

3.00 EXECUTION

3.01 PROCEDURES

A. At least ten (10) Calendar Days prior to execution or any excavation operations, and not more than thirty (30) Calendar Days following the execution date of the Construction Agreement, Contractor shall submit a site specific Trench Safety System Conformance Affidavit stating that operations will be conducted in full conformance with the OSHA Standards.

1. The Conformance Letter shall also describe the Trench Safety System techniques proposed to be used on the project.

2. Specific references to the applicable OSHA Standards sections shall be included for each technique to be used.

B. The Trench Safety System Plan shall be in writing, site specific and sufficiently detailed and clear to be understandable and usable by all personnel who will be executing, supervising and witnessing the trenching operations. A copy of the Trench Safety System Plan shall be available at the site of trenching operations at all times. A second copy shall be provided to the Owner for the Owner's records.

C. If borings and/or detailed geotechnical analyses are required to develop the Trench Safety System Plan, they shall be executed by the Contractor at his cost.

D. For trenches having depths greater than the various limits given in the OSHA Standards (8, 12 or 20 feet, depending on the techniques used), a site specific protective system shall be designed by a Licensed Professional Engineer experienced in soil mechanics and structural design. The design shall be signed, sealed and dated by the Professional Engineer, and it shall identify those specific locations where the design is applicable.

3.02 METHODS OF PROVIDING TRENCH SAFETY

A. Protective systems referenced in this Section shall be as defined and described in 29 CFR 1962.652, "Requirements for Protective Systems."

B. It is the duty, responsibility and prerogative of the Contractor to determine the specific applicability of a proposed Trench Safety System for each field condition encountered on the project. Contractor specifically holds the Owner, Engineer, and any of their designated representatives harmless in any actions resulting from the failure or inadequacy of the Trench Safety System used to complete the project.

C. Unless otherwise noted on the drawings or excluded below, Sloping/Benching, Trench Shielding with trench boxes, and/or Sheeting/Shoring/Bracing protective systems may be used on this project.

D. Restrictions on the use of the various protective systems for this project are as follows:

1. Sloping or Benching No Restrictions, except as noted on plans.

2. Trench Shields/Boxes No Restrictions.

3. Sheeting/Shoring/Bracing No Restrictions.

3.03 INSPECTION DUTIES OF CONTRACTOR

A. Provide a Competent Person, as defined in the OSHA Standards, to make frequent inspections of the trenching operations and the Trench Safety System in full conformance with the OSHA Standards.

B. If evidence of a possible cave-in or landslide is apparent, all work in the trench shall immediately cease and not be resumed until all necessary precautions have been taken to safeguard personnel entering the trench.

C. In an emergency that may threaten or affect the safety or welfare of any persons or

properties, the Contractor shall act at his discretion to prevent possible damage, injury or loss. Any additional compensation or time extension claimed for such actions shall be considered in view of the cause of the emergency and in accordance with the Agreement.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Foundation course for surface course or for other base course composed of flexible base constructed in one or more courses in conformity with the typical section.

B. Related Specification Sections include, but are not necessarily limited to:
1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment
1. Measurement
a. Measurement for this Item will be by the square yard of Flexible Base Course for various:
1) Depths
2) Types
3) Gradations
2. Payment
a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per square yard of Flexible Base Course.
3. The price bid shall include:
a. Preparation and correction of subgrade
b. Furnishing of material
c. Hauling
d. Blading
e. Sprinkling
f. Compacting

1.03 REFERENCES

A. Definitions
1. RAP – Recycled Asphalt Pavement.

B. Reference Standards
1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification, unless a date is specifically cited.
2. ASTM International (ASTM):
a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))
3. Texas Department of Transportation (TXDOT):
a. Tex-104-E, Determining Liquid Limits of Soils
b. Tex-106-E, Calculating the Plasticity Index of Soils
c. Tex-107-E, Determining the Bar Linear Shrinkage of Soils
d. Tex-110-E, Particle Size Analysis of Soils
e. Tex-116-E, Ball Mill Method for Determining the Disintegration of Flexible Base Material
f. Tex-117-E, Triaxial Compression for Disturbed Soils and Base Materials
g. Tex-411-A, Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate
h. Tex-413-A, Determining Deleterious Material in Mineral Aggregate

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. Furnish uncontaminated materials of uniform quality that meet the requirements of the Drawings and specifications.
2. Obtain materials from approved sources.
3. Notify Engineer of changes to material sources.
4. The Engineer may sample and test project materials at anytime before compaction throughout the duration of the project to assure specification compliance.

B. Aggregate

1. Furnish aggregate of the type and grade shown on the Drawings and conforming to the requirements of Table 1.
2. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified.
3. Do not use additives such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1, unless shown on the Drawings.

Table 1
Material Requirements

Property	Test Method	Grade 1	Grade 2
Master gradation sieve size (% retained)	Tex-110-E		
2-1/2 in.		–	0
1-3/4 in.		0	0–10
7/8 in.		10–35	–
3/8 in.		30–50	–
No. 4		45–65	45–75
No. 40		70–85	60–85
Liquid limit, % max.[1]	Tex-104-E	35	40
Plasticity index, max.[1]	Tex-106-E	10	12
Wet ball mill, % max.[2]	Tex-116-E	40	45
Wet ball mill, % max. increase passing the No. 40 sieve		20	20
Classification[3]	Tex-117-E	1.0	1.1–2.3
Min. compressive strength[3], psi lateral pressure 0 psi lateral pressure 15 psi		 45 175	 35 175

1. Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.

2. When a soundness value is required by the Drawings, test material in accordance with Tex-411-A.

3. Meet both the classification and the minimum compressive strength, unless otherwise shown on the Drawings.

4. Material Tolerances
   a. The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation.
   b. When target grading is required by the Drawings, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4.

c. The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

5. Material Types
   a. Do not use fillers or binders unless approved.
   b. Furnish the type specified on the Drawings in accordance with the following:
      1) Type A
         a) Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source.
         b) Do not use gravel or multiple sources.
      2) Type B
         a) Only for use as base material for temporary pavement repairs.
         b) Do not exceed 20 percent RAP by weight unless shown on Drawings.
      3) Type D
         a) Type A material or crushed concrete.
         b) Crushed concrete containing gravel will be considered Type D material.
         c) The Engineer may require separate dedicated stockpiles in order to verify compliance.
         d) Crushed concrete must meet the following requirements:
            (1) Table 1 for the grade specified.
            (2) Recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5 percent deleterious material when tested in accordance with TEX-413-A.

C. Water
   1. Furnish water free of industrial wastes and other objectionable matter.

PART 3 - EXECUTION

3.01 PREPARATION

A. General
   1. Shape the subgrade or existing base to conform to the typical sections shown on the Drawings or as directed.
   2. When new base is required to be mixed with existing base:
      a. Deliver, place, and spread the new flexible base in the required amount.
      b. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

B. Subgrade Compaction
   1. Proof roll the roadbed before pulverizing or scarifying in accordance with the following:
      a. Proof Rolling
         1) The Owner's Representative must be on-site during proof rolling operations.
         2) Use equipment that will apply sufficient load to identify soft spots that rut or pump.
            a) Acceptable equipment includes fully loaded single-axle water truck with a 1500-gallon capacity.
         3) Make at least 2 passes with the proof roller (down and back = 1 pass).
         4) Offset each trip by at most 1 tire width.
         5) If an unstable or non-uniform area is found, correct the area.
      b. Correct
         1) Soft spots that rut or pump greater than 3/4 inch
         2) Areas that are unstable or non-uniform

2. Installation of base material cannot proceed until compacted subgrade approved by the City.

3.02 INSTALLATION

A. General
   1. Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content.
   2. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the Drawings or as directed.
   3. Haul approved flexible base in clean, covered trucks.

B. Equipment
   1. General
      a. Provide machinery, tools, and equipment necessary for proper execution of the work.
   2. Rollers
      a. The Contractor may use any type of roller to meet the production rates and quality requirements of the Contract unless otherwise shown on the Drawings or directed.
      b. When specific types of equipment are required, use equipment that meets the specified requirements.
      c. Alternate Equipment.
         1) Instead of the specified equipment, the Contractor may, as approved, operate other compaction equipment that produces equivalent results.
         2) Discontinue the use of the alternate equipment and furnish the specified equipment if the desired results are not achieved.
      d. City may require Contractor to substitute equipment if production rate and quality requirements of the Contract are not met.

C. Placing
   1. Spread and shape flexible base into a uniform layer by approved means the same day as delivered unless otherwise approved.
   2. Place material such that it is mixed to minimize segregation.
   3. Construct layers to the thickness shown on the Drawings, while maintaining the shape of the course.
   4. Where subbase or base course exceeds 6 inches in thickness, construct in 2 or more courses of equal thickness.
   5. Minimum lift depth: 3 inches
   6. Control dust by sprinkling.
   7. Correct or replace segregated areas as directed.
   8. Place successive base courses and finish courses using the same construction methods required for the first course.

D. Compaction
   1. General
      a. Compact using density control unless otherwise shown on the Drawings.
      b. Multiple lifts are permitted when shown on the Drawings or approved.
      c. Bring each layer to the moisture content directed. When necessary, sprinkle the material to the extent necessary to provide not less than the required density.
      d. Compact the full depth of the subbase or base to the extent necessary to remain firm and stable under construction equipment.
   2. Rolling
      a. Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit.

b. On superelevated curves, begin rolling at the low side and progress toward the high side.
c. Offset alternate trips of the roller.
d. Operate rollers at a speed between 2 and 6 mph as directed.
e. Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish before the next course is placed or the project is accepted.
f. Continue work until specification requirements are met.
g. Proof roll the compacted flexible base in accordance with the following:
    1) Proof Rolling
        a) The Owner's Representative must be on-site during proof rolling operations.
        b) Use equipment that will apply sufficient load to identify soft spots that rut or pump.
            (1) Acceptable equipment includes fully loaded single-axle water truck with a 1500-gallon capacity.
        c) Make at least 2 passes with the proof roller (down and back = 1 pass).
        d) Offset each trip by at most 1 tire width.
        e) If an unstable or non-uniform area is found, correct the area.
    2) Correct
        a) Soft spots that rut or pump greater than 3/4 inch.
        b) Areas that are unstable or non-uniform.

3. Tolerances
    a. Maintain the shape of the course by blading.
    b. Completed surface shall be smooth and in conformity with the typical sections shown on the Drawings to the established lines and grades.
    c. For subgrade beneath paving surfaces, correct any deviation in excess of 1/4 inch in cross section in length greater than 16 feet measured longitudinally by loosening, adding or removing material. Reshape and recompact by sprinkling and rolling.
    d. Correct all fractures, settlement or segregation immediately by scarifying the areas affected, adding suitable material as required. Reshape and recompact by sprinkling and rolling.
    e. Should the subbase or base course, due to any reason, lose the required stability, density and finish before the surfacing is complete, it shall be recompacted at the sole expense of the Contractor.
4. Density Control
    a. Minimum Density: 95 percent compaction as determined by ASTM D698.
    b. Moisture content: minus 2 to plus 4 of optimum.

E. Finishing
    1. After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 inch.
    2. Remove loosened material and dispose of it at an approved location.
    3. Seal the clipped surface immediately by rolling with an appropriate size pneumatic tire roller until a smooth surface is attained.
    4. Add small increments of water as needed during rolling.
    5. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the Drawings or as directed.
    6. In areas where surfacing is to be placed, correct grade deviations greater than 1/4 inch in 16 feet measured longitudinally or greater than 1/4 inch over the entire width of the cross-section.
    7. Correct by loosening, adding, or removing material.
    8. Reshape and recompact in accordance with 3.4.C.

3.07 QUALITY CONTROL

A. Density Test

1. Independent Testing Laboratory to measure density of flexible base course.
   a. Notify Owner's Representative when flexible base ready for density testing.
   b. Spacing directed by Engineer (1 per block minimum).
   c. Owner's Representative determines location of density testing.

END OF SECTION

PART 1 - GENERAL

1.01 MEASUREMENT AND PAYMENT

A. Determining Pavement Thickness.

1. Determine pavement thickness by measuring cores taken at points selected by the Engineer. At least one 6-inch diameter core will be taken for each 500 square yards of pavement. The Contractor will pay for these cores.

2. If a deficient thickness is found in an initial core, additional 6-inch diameter cores must be taken along the length of pavement in each direction from the identified point of deficient thickness. Take the additional cores at 10-foot intervals until cores are obtained which measure the designated thickness. The cost of additional cores to determine area of deficient thickness will be paid for by the Contractor.

B. Pavement Meeting or Exceeding Designated Thickness.

1. For pavement constructed to the designated thickness, measure by the square yard of completed and accepted pavement. Measure from back to back of curbs. Payment will be made at the unit price bid per square yard.

2. No additional payment over the contract unit price will be made for pavement exceeding the designated thickness.

C. Pavement Less Than the Designated Thickness.

1. Pavement within 1/4-inch of the designated thickness will be considered of satisfactory thickness. Payment will be made at the unit price bid per square yard.

2. Pavement which is between 1/4-inch and 1/2-inch less than the designated thickness will be considered as deficient thickness and will be paid for at an adjusted unit price. The adjusted unit price will bear the same ratio to the contract unit price as the square of the actual average thickness bears to the square of the designated thickness. The length of the area of deficient thickness will be as determined from additional cores. The width of the area will be the entire width of the pavement within the length thus determined.

3. Pavement which is between 1/2-inch and 3/4-inch less than the designated thickness will be considered as unsatisfactory thickness. No payment will be made for pavement of unsatisfactory thickness. The area of unsatisfactory thickness will be determined by the same method as used to determine the area of deficient thickness. The pavement may be left in place if the Contractor relinquishes any claim for compensation for the area with unsatisfactory thickness. The Contractor may choose to remove the pavement and replace it with pavement of the designated thickness for which pavement will be made as specified. No reimbursement will be granted for removing pavement of unsatisfactory thickness.

4. Pavement which is not within 3/4-inch of the designated thickness is considered as unacceptable thickness. No payment will be made for pavement with unacceptable thickness. The area of unacceptable thickness will be determined as the same method as used to determine the area of deficient thickness. Pavement of unacceptable thickness may not be left in place; remove and replace it with pavement of the designated thickness for which payment will be made as specified. No reimbursement will be granted for removing pavement of unacceptable thickness.

D. Driveway Turnouts. Each driveway turnout will be measured by the square yard of surface area for the completed and accepted turnouts. Payment will be at the unit price bid per square yard.

E. Paving Headers. No separate payment will be made for concrete pavement headers. Include the cost of paving headers in the contract prices for work of which headers are a part.

1.02 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without prior written permission of the Engineer.

B. The class of aggregate being used can be changed before or during the job with proper notice. The new class must meet specifications.

C. Segregated aggregate will be rejected. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

D. Aggregates mixed with dirt, weeds or foreign matter will be rejected.

E. Do not dump or store aggregate in the roadbed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement.

1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or ASTM C 175, Type III.

2. Bulk cement which meets referenced standards may be used if the method of handling is approved by the Engineer. When using bulk cement, provide satisfactory weighing devices.

B. Water. Furnish clean, drinkable water free from injurious amount of oils, acids, alkalis or other deleterious substances.

C. Coarse Aggregate. Provide crushed stone or gravel which is clean, hard, durable and well graded within specified limits. When tested by standard laboratory methods, coarse aggregate must conform to the following requirements:

1. The maximum percentage by weight of deleterious substances must not exceed the following values:

Constituents	Percent By Weight
Removed by decantation	4.0
Shale	0.25
Clay lumps	0.25
Soft fragments	3.0
Other local deleterious substances, such as friable pieces	3.0
The sum of the percentages of above constituents shall not exceed	5.0

2. Furnish coarse aggregate worn no more than 45 percent when tested according to AASHTO T96.

3. Conform to the following grading requirements for aggregate tested on a standard square-opening sieve.

Sieve	Percent Retained
2-1/2 inches	0
1-3/4 inches	0 to 20

3/4 inch	25 to 65
No. 4	95 to 100

D. Fine Aggregate. Provide washed sand having clean, hard, durable grains, well graded from coarse to fine. The sand must be free from soft or flaky particles or other injurious matter. When tested by standard laboratory methods, fine aggregate must conform to the following requirements:

1. Conform to the following grading requirements for aggregates tested on standard sieve.

Screen or Sieve	Percent Retained By Weight
3/8 inch screen	0
1/4 inch screen	0 to 5
20 mesh sieve	15 to 50
100 mesh sieve	85 to 100

2. Weight removed by elutriation test must be not more than 2 percent.

3. When subjected to color test for organic impurities, fine aggregate must not show color darker than standard color.

E. Mineral Filler. The addition of stone dust, sand, or crushed (oyster) shell dust of acceptable quality and cleanliness may be required as mineral filler to improve workability or plasticity of concrete mixture. When mineral filler is used, it must be batched and weighted separately. Filler may be used in amounts not to exceed 15 percent of weight of fine aggregate. When tested with standard laboratory sieves, mineral filler must meet the following requirements.

Passing 30 mesh sieve	95 to 100 percent
Passing 200 mesh sieve	50 to 100 percent

F. Reinforcing Steel.

1. Provide new billet steel manufactured by the open hearth process and conforming to ASTM A 615, Grade 40. Store steel to protect it from mechanical injury and rust. At the time of placement, steel should be free from dirt, scale, rust, paint, oil or other injurious materials.

2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.

3. Wire fabric must be of gauge and facing shown and must meet ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds must have sufficient strength not to be broken during handling or placing. Welding and fabrication of fabric sheets must conform to standards ASTM A 185.

4. Furnish the manufacturers certificate giving property of steel. Provide specimens for testing, when required.

G. Air Entraining Agent. Furnish an air-entraining agent which meets standards of ASTM C 260. Use MB-VR by Master Builders Company, Air-in by Hot Process Corporation-Southern, or approved substitution.

H. Retardant. As retardant provide Pozzolith No. 8 by Master Builders Company, HPS-R by Hunt Process Corporation-Southern, or approved substitution.

I. Expansion Joint Material. Furnish filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven

dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

J. Joint Sealing Compound. Furnish hot-poured elastomeric polymer exceeding Federal Specification SS-S-164.

K. Load Transmission Devices. Provide smooth steel bar dowel, as shown. Steel bars shall conform to standards of ASTM A 615, Grade 60.

L. Metal Supports for Reinforcing Steel and Joint Assembly. Employ metal of approved shape and size. Space supports as directed.

M. Liquid Membrane Forming Compound for Curing Concrete. Provide Type II white pigmented compound conforming to standards of ASTM C 309.

2.02 PROPORTIONING

A. Responsibility. Proportioning of the concrete mix is the responsibility of the Contractor. Design the concrete mixture and furnish a statement giving the proportion of materials in the mix. Submit commercial laboratory report showing that proportions and materials selected will produce laboratory mixed concrete of the specified quality, having strength 10 percent higher than that specified. Testing of design mixes is the Contractor's responsibility.

B. Concrete Mix. Provide a concrete mix that is uniform and workable. Design the mix to produce concrete which will have a compressive strength of 2,400 psi at 7 days and 3,500 psi at 28 days. Settlement of concrete must be at least 1-1/2 inches, but no more than 3 inches, when gauged by a standard slump test.

1. Concrete pavement 5 inches thick must contain at least 5-1/2 sacks of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement. Addition of mineral filler may be required to improve workability or plasticity of concrete.

2. The net amount of water is the amount added at the mixer, plus prewater in the aggregate, minus absorption the aggregate displays in 30 minutes. No water allowance will be made for evaporation after batching.

3. Coarse dry aggregate will not exceed 85 percent of the loose volume of concrete.

4. Add the air-entraining agent to the concrete to produce the effect that could be obtained by use of air-entrained Portland cement, as specified in ASTM C 175. Use the amount needed to entrain 3 percent to 5 percent of air by volume of concrete. Add the agent to the batch in a solution of the mixing water. Batch this solution by means of a mechanical batcher capable of accurate measurement. Ensure a uniform distribution throughout the batch during the specified mixing period.

5. Retardant is required when the temperature exceeds 85°F. Proportion is recommended by the manufacturer. Use the same brand as used for the air-entraining agent. Add and batch the material using the same methods as used for the air-entraining agent.

2.03 MIXING EQUIPMENT

A. Condition. Mixing equipment must be in first class working condition and must be inspected and approved by the Engineer before paving operations will be permitted.

B. Scales.

1. Weigh materials separately and accurately using standard scales attached to a standard batching plant. Consider a sack of cement weighing 94 pounds to be 1 cubic foot.

2. Employ beam type of springless dial type scales. Equip the beam type with a springless

dial indicator showing at least 100 pounds over or under the required weight. Use graduated scales or dial indicator-showing increments of 5 pounds or less.

3. Use scales accurate within 4 pounds per 1,000 pounds per net load in the hopper.

C. Mixer.

1. A capacity of not less than a 14-S mixer, as rated by Mixer Manufacturers Bureau of Associated General Contractors, is required. Provide a speed regulator to hold a mixer to the normal speed of revolution. Equip the mixer with an automatic timer and lock for the discharging device to prevent discharge until all materials have been mixed together for the minimum time required. The timer and lock must operate independently of the drum. Also, provide a bell to indicate completion of a mixing time. The bell must be plainly audible to a distance of 50 feet from the mixer.

2. Equip the mixer with an accurate device to measure water within 1 percent of the total amount required. Construct the measuring drum with an opening to atmospheric pressure when the measured amount of water is inside. Place and construct the drum so that a single batch of water can be discharged into a calibrated tank or a weighing device attached to the mixer, without seriously delaying paving operations. Check the operation of this water measuring device daily.

D. Batch Truck. Batch trucks, for the transportation of measured materials from the batching plant to the mixer, must be covered tight to prevent excessive evaporation or any loss of materials.

2.04 MIXING

A. Central batching and transit mixing will be permitted. A central mixing plant will be allowed upon approval of mixing and handling methods.

B. Mix concrete in a batch-mixer as specified only in such quantities as are required for immediate use. Thoroughly mix aggregate and cement for a period of not less than 50 seconds, computed from the time the last aggregate disappears into the drum until the concrete begins to appear in the discharge chute. Lock the mixer discharge with an automatic timing device until the specified time has elapsed. Introduce water into the drum during the first 15 seconds of mixing. Discharge the entire contents of the drum before the materials are placed for a succeeding batch. Retempering or remixing will not be permitted.

C. For transit mixed concrete use a water type truck mixer. Mix each batch for 100 revolutions at the mixer manufacturer's mixing speed. Perform additional mixing or agitation at the speed specified for agitation.

D. Stamp the time of loading the transit-mix truck on the delivery ticket before the truck leaves the plant. Equip truck mixers with water tank and measuring devices which permit positive measurement of mixing water. When aggregate contains more than 6 percent water, place the concrete within 1/2 hour after the introduction of water. When aggregate contains from 3 percent to 6 percent water, place the concrete within 1/2 hour after the introduction of cement. Transit-mix concrete must conform to other applicable requirements of this section.

PART 3 - E X E C U T I O N

3.01 WEATHER CONDITIONS

Place concrete only when the air temperature is above 35°F and rising. The Contractor is responsible for the quality and strength of concrete placed under any weather conditions.

3.02 EQUIPMENT

Equipment for preparing subgrade and for finishing and compacting must be in good working order and be approved before commencing work.

A. Subgrade Planer and Template.

1. Use a subgrade planer with adjustable cutting blades to trim the subgrade to the exact section shown on the drawing. Select a planer with visible rollers which ride on the form. The planer frame must have sufficient weight so that it will remain on the form at all times, and have such strength and rigidity that, under tests made by changing the support from wheels to center, the planer will not develop deflection of more than 1/8 inch. Tractors used to pull the planer must not produce ruts or indentations in the subgrade. When the slip form method of paving is used, operate the subgrade planer on a prepared track grade or have it controlled by an electronic sensor system operated from a string line that established the horizontal alignment and elevation of the subbase.

2. Provide a template for checking the contour of the subgrade. The template must be long enough to rest upon side forms and have such strength and rigidity that under tests made by changing the support to the center, the template will not show deflection of more than 1/8 inch. Fit the template with accurately adjustable rods projecting downward at 1-foot intervals. Adjust these rods to gauge the cross sections of the slab bottom when the template is resting on the side forms.

B. Machine Finisher. Provide a power-driven, transverse finishing machine designed and operated to strike off and consolidate the concrete. Select a machine with two screeds accurately adjusted to the crown of the pavement and with a frame equipped to ride on the form. Use a finishing machine with rubber tires if it operates on concrete pavement.

C. Hand Finishing.

1. Provide a mechanical strike and tamping template the width of pavement to be finished. Shape the template to the pavement section.

2. Also provide floats of approved design. Provide two bridges for finishing expansion and dummy joints and necessary edging and finishing tools to complete the pavement slab.

D. Burlap Drag for Finishing Slab. Furnish four plies of 10-ounce burlap material fastened to a bridge to form a continuous strip of burlap the full width of the pavement. The 3-foot width of burlap material must be in contact with the pavement surface. Keep the burlap drags clean and free of encrusted mortar.

E. Vibrators. Furnish mechanically operated synchronized vibrators mounted on a tamping bar which rides on the forms. Also employ approved hand-manipulated mechanical vibrators. Furnish vibrators with a frequency of vibration providing the maximum consolidation of concrete without segregation.

F. Traveling Form Paver. A traveling form paver of approved design may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. If a traveling form paver is used, all requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship must be met in full. If a traveling form paver proves inadequate, in the opinion of the Engineer, in providing a pavement which meets the drawings and specification in all respects, its use will be immediately discontinued when so ordered by the Engineer and conventional methods will be used.

1. Equip the traveling paver with a longitudinal transangular finishing float adjustable to crown and grade. The float must be long enough to extend across the pavement practically to the side forms or the edge of the slab.

2. Prior to beginning paving operations, ensure that a continuous deposit of concrete can be made at the paver to minimize starting and stopping. Pave by conventional means those

locations inaccessible to a traveling paver, or having horizontal or vertical curvature that a traveling paver cannot negotiate.

3. Do not place reinforcing steel mechanically. Where the plans require tie bars to be installed for adjacent paving, securely tie and support the bars to prevent displacement. Alternatively, tie bars may be installed with an approved mechanical bar inserted mounted on a traveling-form paver. Replace any pavement in which tie bars assume a final position other than that shown on the drawing, unless corrective alternates are authorized in writing and carried out to the satisfaction of the Engineer.

3.03 SUBGRADE

Properly prepare, shape and compact each section of subgrade before placing forms, steel or concrete. After forms have been set to proper grade and alignment, use a subgrade planer to shape the subgrade to its final cross section. Check the contour of the subgrade with the template.

3.04 FORMS

A. Side Forms. Use metal forms of approved shape and section. A form as deep as the pavement edge thickness is preferred. Forms with depth up to 1-inch greater or less than pavement thickness may be used. Forms with less depth than pavement thickness will be brought to required depth by securely attaching wooden planks of approved section and size to the bottom of the form. Use a form section at least 10 feet in length, and staked in position with at least three pins. Forms must have 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 the concrete. Test the top of each form section with a straight edge and verify that it conforms with requirements for the surface of completed pavement. Use flexible or curbed forms of wood or metal to set the proper radius on curves of 100 feet radius or less.

B. Form Setting.

1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Remove subgrade that will not support the loaded form. Replace and compact subgrade to required density. Accurately set forms to required grade and alignment and, during the entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8-inch in 10 feet of length. Do not remove forms for at least 24 hours after the completion of finishing operations. Provide a supply of forms that will be adequate to comply with this requirement and for orderly and continuous placing of concrete. Set the forms and check the grade for at least 130 feet ahead of the mixer.

2. Adjacent slabs may be used instead of the forms, provided that the concrete is well protected from possible damage by finishing equipment. These adjacent slabs must not be used for forms until the concrete has aged at least 7 days. For short radius curves, forms less than 10 feet in length or curved forms may be used. For curb returns at street intersections and driveways, wood forms of good grade and quality may be used. Do not use any material which, in the opinion of the Engineer, is unsuitable for forms.

3.05 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Accurately place reinforcing steel and joint assemblies and position them securely in accord with details shown. Wire reinforcing bars securely together at intersections and splices. Bars and coatings must be free of rust, dirt or other foreign matter when the concrete is installed.

B. Place pavement joint assemblies at required locations and elevations, and rigidly secure all parts in required positions. Install dowel bars accurately in joint assemblies as shown, each parallel to the pavement surface and to the center line of the pavement and rigidly secure in the required position to prevent displacement during placing and finishing of concrete. Accurately cut header boards, joint filler and other material used for forming joints to receive each dowel bar.

C. Place all reinforcing steel and secure to chairs.

3.06 PLACING

A. Batches not placed as specified within 30 minutes after water or cement has been added will be rejected. Fine aggregate containing more than 6 percent moisture and coarse aggregate containing more than 3 percent moisture will likewise be rejected.

B. Deposit concrete rapidly and continuously on subgrade or subbase in successive batches. Distribute concrete to the required depth and for entire width of the pour by shoveling or by other approved methods. Do not use rakes in handling concrete. At the end of the day or in case of unavoidable interruption of more than 30 minutes, place a transverse construction joint at the point of stopping work, provided that the section on which work has been suspended is not less than 10 feet from the preceding joint. Sections less than 10 feet long must be removed and replaced.

C. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in the edge of the finished pavement will be cause for rejection.

3.07 COMPACTING

A. Consolidate the concrete using an approved mechanical vibratory unit designed to vibrate concrete internally. Extend a vibratory unit across the pavement, not quite touching the side forms. Equip the unit with synchronized vibrators. Space individual vibrators at close enough intervals to vibrate and consolidate the entire width of the pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.08 FINISHING

A. Finish concrete pavement by power-driven transverse finishing machines or by hand finishing methods.

1. Use the transverse finishing machine to make at least two trips over each area. Make the last trip over a given area a continuous run of not less than 40 feet. After transverse screeding, use a hand-operated longitudinal float to test and level the surface to the required grade.

2. Hand finish with a mechanical strike and tamping template as wide as the pavement to be finished. Shape the template to the pavement section. Move the strike template forward in the direction of the work, maintaining a slight excess of material in front of the cutting edge. Make at least two trips over each area. Screed the pavement surface to the required section. Work the screed with a combined transverse and longitudinal motion in the direction work is progressing. Maintain the screed in contact with the forms. Use a longitudinal float to level the surface.

B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with a strike-off screed. Move the strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining the screed in contact with the forms, and maintaining a slight excess of materials in front of the cutting edge. Tamp the concrete with a tamping template. Use a longitudinal float to level the surface.

C. After completion of the straightedge operation, make the first pass of a burlap drag as soon as construction operations permit and before the water sheen has disappeared from the surface. Follow this by as many passes as required to produce the desired texture depth. Permit no unnecessary delays between passes. Keep the drag wet, clean and free from encrusted mortar

during use.

3.09 SURFACE TESTS

The entire surface before the initial set and correct irregularities or undulations. Bring surface within requirements of the following test and then finish. Place an approved 10-foot straightedge parallel to the center of the roadway to bridge any depressions and touch all high spots. Do not permit ordinates measured from the face of the straightedge to the surface of the pavement to exceed 1/16 inch per foot from the nearest point of contact. In no case permit the maximum ordinate to a 10-foot straightedge to exceed 1/8 inch.

3.10 JOINTS

A. Placement. Place joints of the types shown on drawings at required locations and at spacings shown.

B. Construction Joints. Place a transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes where required. Work the concrete well against the bulkhead. The key-way on the longitudinal construction joint may be omitted when a traveling form paver is used, and when No. 5 deformed tie bars, 30 inches long and spaced 18 inches on centers, are used.

C. Expansion Joints. Place expansion joints at radius points of curb returns for cross street intersections, or as shown. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than two lengths of board. Secure pieces to form a straight joint. Shape board filler accurately to the cross section of the concrete slab. Use premolded joint filler, accurately shaped, in curb section. Use load transmission devices of the type and size shown. Use a joint sealing compound as required.

D. Contraction Joints. Make contraction joints straight and place them at spacings shown. Place smoothed, painted and oiled dowels accurately and normal to the joint. Tool the edges of the groove and seal the groove with joint sealing compounds.

E. Longitudinal Weakened Plane Joints. Make a longitudinal weakened plane joint with a deformed metal strip. Adequately stake the metal strip in place to prevent lateral movement of the metal strip while the concrete is being placed.

3.11 MEMBRANE CURING

A. After the concrete surface has been finally finished and the surplus water sheen has disappeared, seal the surface with single uniform coating of an approved curing compound. Apply the compound at the rate of coverage recommended by the manufacturer and as directed by Engineer, but not less than 1 gallon per 180 square feet of surface area. Control and check the rate of application.

B. Thoroughly agitate the compound during use and apply by means of approved mechanical power pressure sprayers, equipped with satisfactory atomizing nozzles. For application on small miscellaneous items, hand powered spray equipment may be used. For all spraying equipment, provide means to prevent loss of compound between the nozzle and the concrete surface while spraying.

C. Thoroughly moisten the surface just before applying the curing compound. Where discontinuities, pin holes or other defects show, or where rain has fallen, immediately apply an additional coat of compound to the newly coated surface before the film has dried sufficiently to resist damage. Apply the added coat at the same rate of coverage as specified.

3.12 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50°F, and weather is not foggy or rainy.

B. Before work is started, the joint sealing equipment shall be in first-class working condition, and be approved by the Engineer. Use a concrete grooving machine or a power-operated wire brush and other equipment such as plow, brooms, brushes and blowers as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. When required, remove the joint filler to the depth shown. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to the depth shown. Pour sufficient joint sealer into the joints so that, upon completion, the surface of the sealer within the joint will be 1/4 inch below the level of the adjacent surface or at an elevation as directed.

3.13 PROTECTION AND OPENING PAVEMENT TO TRAFFIC

Barricade a pavement section from use for at least 72 hours during the curing period. Do not open pavement to traffic until concrete is at least 10 days old. On those sections of pavement open to traffic, seal the joints, clean the pavement and place earth against the pavement edges before permitting use by traffic. Such opening of pavement to traffic in no way relieves the Contractor from his responsibility for the work.

3.14 TESTING

A. Duties. Arrange for the laboratory to inspect and test materials entering the concrete and check the design of concrete mixes to meet specified strengths, uses and finishes. The lab will analyze aggregate for quality, durability, grading and free water content. The lab will take representative specimens of ingredients and mixes; make test cylinders and measure their compressive strength. The lab will check the moisture content of aggregates and control their mix subject to approval.

B. Test Procedures. The laboratory will make tests in conformance with current standard test procedures of ASTM and AASHTO.

C. Test Reports. The laboratory will promptly furnish written reports covering results of tests and inspections to the Engineer and the Contractor.

D. Test Cylinders. Two test cylinders for compressive strength test will be made for each 600 square yards or less of pavement that is placed in one day. Cylinders will be tested at the ages of 7 and 28 days. Cylinders will be made, cured and tested using applicable ASTM standards for sampling and testing.

E. Yield. Make a yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. If such cement content is found to be less than that specified per cubic yard, reduce batch weights until the amount of cement per cubic yard of concrete conforms to requirements.

F. Core Samples. Drill core samples of concrete pavement at locations designated to measure thickness. Drill a minimum of one core for each 600 square yards of pavement. At age of 28 days, each core may be tested for compressive strength according to methods of the ASTM C 42. The 28-day compressive strength of each core tested must be at least 3000 pounds per square inch.

END OF SECTION

Sand Set on Dense Granular Base

Note: This guide specification for U.S. applications is for concrete grid units placed on a sand-bedding course over a compacted dense-graded aggregate base. The text allows an option of topsoil and grass in the grid openings over bedding sand or No. 8 open-graded aggregate in the grid openings and for the bedding course. This specification is for limited vehicular applications such as access roads and emergency fire lanes, as well as intermittently used overflow parking areas.

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Concrete grid units.
2. Bedding sand.
3. Edge restraints.
4. Geotextiles.
5. Open-graded aggregate for the grid openings.
6. Open-graded aggregate bedding course.

B. Related Sections:
1. Section 32 11 23: Flexible Base Courses.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. C 33, Specification for Concrete Aggregates.
2. C 136, Method for Sieve Analysis for Fine and Coarse Aggregate.
3. C 140, Standard Test Methods of Sampling and Testing Concrete Masonry Units.
4. C 979, Standard Specification for Pigments for Integrally Colored Concrete.
5. C 1319, Standard Specification for Concrete Grid Paving Units.
6. D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,000 ft-lbf/ft3 (600 kN-m/m3)).
7. D 2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
8. D 5268, Specification for Topsoil Used for Landscaping Purposes.

B. Interlocking Concrete Pavement Institute (ICPI)
1. Tech Spec technical bulletins.

1.03 SUBMITTALS

A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section. B.

B. Manufacturer's drawings and details: Indicate perimeter conditions, relationship to adjoining materials and assemblies, expansion and control joints, paving slab installation and setting details.

C. Sieve analysis per ASTM C 136 for grading of bedding and base materials.

D. Concrete grid units:
1. Accepted samples become the standard of acceptance for the work.
2. Test results from an independent testing laboratory for compliance of grid paving unit requirements to ASTM C 1319.
3. Manufacturer's catalog literature, installation instructions, and material safety data sheets for the safe handling of the specified materials and products.

1.04 QUALITY ASSURANCE

A. Paving Subcontractor Qualifications:
   1. Engage an experienced installer who has successfully completed grid pavement installations similar in design, material, and extent indicated for this Project.
   2. Hold a current certificate from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

B. Single-source Responsibility: Obtain each color, type, and variety of grids, joint materials and setting materials from single sources with resources to provide products and materials of consistent quality, appearance and physical properties without delaying progress of the Work.

1.05 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section

B. Deliver concrete grid units to the site in steel banded, plastic banded, or plastic wrapped packaging capable of transfer by forklift or clamp lift. Unload grids at job site in such a manner that no damage occurs to the product or existing construction.

C. Cover sand with waterproof covering to prevent exposure to rainfall or removal by wind. Secure the covering in place.

D. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

1.06 ENVIRONMENTAL CONDITIONS

A. Do not install bedding materials or grid units during heavy rain or snowfall.

B. Do not install bedding materials and grid units over frozen base materials.

C. Do not install frozen bedding materials.

PART 2 PRODUCTS

2.01 CONCRETE GRID UNITS

A. Manufacturer: Keystone Hardscapes, 800-747-8971].
https://www.keystonehardscapes.com/contact

B. Concrete grid units, including the following:
   1. Grid unit type: GrassStone I

2.02 PRODUCT SUBSTITUTIONS

A. Product substitutions shall be submitted and approved in writing 10 days prior to bid date.

2.03 BEDDING MATERIALS

A. General – Sieved per ASTM C 136. B. Bedding Sand
   1. Washed, clean, hard, durable crushed gravel or stone, free from shale, clay, friable materials, organic matter, frozen lumps, and other deleterious substances.
   2. Conforming to the grading requirements in Table 1 below.
   3. Do not use limestone screenings.

B. Washed, open-graded stone.Table 1

Grading Requirements for Bedding Sand
ASTM C 33

Sieve Size	Percent Passing
3/8 in.(9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (0.600 mm)	25 to 60
No. 50 (0.300 mm)	10 to 30
No. 100 (0.150 mm)	2 to 10
No. 200 (0.075 mm)	0 to 1

- OR-

Note: Finer gradations such as ASTM No. 89 stone may be used.

1. Conforming to the grading requirements in Table 2 below.

Table 2
ASTM No. 8 Gradation for Bedding and Joint/Opening Filler

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	85 to 100
4.75 mm (No. 4)	10 to 30
2.36 mm (No. 8)	0 to 10
1.18 mm (No. 16)	0 to 5

2.04 FILL MATERIALS FOR GRID OPENINGS
A. Open-graded aggregate.
B. Conforming the gradation requirements in Table 2. Do not use gravel.

2.05 EDGE RESTRAINTS
A. Provide edge restraints installed around the perimeter of all concrete grid paving unit areas:

PART 3 EXECUTION

3.01 EXAMINATION
A. Acceptance of site verification conditions:
1. Contractor shall inspect, accept and verify in writing to the grid installation subcontractor that site conditions meet specifications for the following items prior to installation of bedding materials and concrete grid units:
a. Verify that drainage and subgrade preparation, compacted density and elevations conform to specified requirements.
b. Verify that geotextiles, if applicable, have been placed according to drawing and specifications.
c. Verify that base materials, thickness, surface tolerances and elevations conform to specified requirements.
d. Provide written density test results for the soil subgrade, base materials to the
Owner, Contractor, and grid installation subcontractor.
2. Do not proceed with installation of bedding materials and concrete grids until [subgrade soil and] base conditions are corrected by the Contractor or

designated subcontractor.

3.03 PREPARATION

A. Verify that base is dry, certified by Contractor as meeting material, installation and grade specifications are ready to support grids and imposed loads.

B. Edge Restraint Preparation:

1. Install edge restraints per the manufacturer's recommendations.
2. Mount directly to finished base. Do not install on bedding sand.
3. The minimum distance from the outside edge of the base to the spikes shall be equal to the thickness of the base.

3.04 INSTALLATION

A. Spread the No. 8 stone evenly over the compacted, dense-graded base course and screed uniformly to 1/2 to 1 in. Place sufficient stone to stay ahead of the laid grids.

B. Ensure the grid units are free from foreign materials before installation.

C. Lay the grid units. Maintain straight joint lines.

D. Joints between the grids shall not exceed [3/16 in.

E. Fill gaps at the edges of the paved area with cut grids or edge units.

F. Cut grids to be placed along the edge with a double-bladed splitter or masonry saw.

G. Sweep No. 8 aggregate into the joints and openings until full.

H. Sweep the grid surface clear prior to compacting.

I. Compact and seat the grids into the screeded No. 8 aggregate using a low-amplitude, 75-90 Hz plate compactor capable of at least 4,000 lbs. centrifugal compaction force. Use rollers or a rubber or neoprene pad between the compactor and grids to prevent cracking or chipping. Do not compact within 6 ft of the unrestrained edges of the grid units.

J. All work to within 6 ft of the laying face must be left fully compacted at the completion of each day.

K. Remove excess No. 8 aggregate on surface when the job is complete.

3.05 FIELD QUALITY CONTROL

A. After removal of excess aggregate, check final elevations for conformance to the drawings. Allow 1/8 to 1/4 in. above specified surface elevations to compensate for minor settlement.

B. The final surface tolerance from grade elevations shall not deviate more than ±3/8 in. over a 10 ft straightedge.

C. The surface elevation of grid units shall be 1/8 to 1/4 in. above adjacent drainage inlets, concrete collars or channels.

D. Lippage: No greater than 1/8 in. difference in height between adjacent grid units.

3.06 PROTECTION

A. After work in the section is complete, the Contractor shall be responsible for protecting work from damage due to subsequent construction activity on the site.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete sidewalks
   2. Driveways
   3. Barrier free ramps

1.02 REFERENCES

A. Abbreviations and Acronyms
   1. TAS – Texas Accessibility Standards
   2. TDLR – Texas Department of Licensing and Regulation

B. Reference Standards
   1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
   2. American Society for Testing and Materials (ASTM)
      a. D545, Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Non-extruding and Resilient Types)
      b. D698, Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3)

1.03 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Mix Design: submit for approval. Section 32 13 13.

B. Product Data: submit product data and sample for pre-cast detectable warning for barrier free ramp.

1.04 FIELD CONDITIONS

A. Weather Conditions: Placement of concrete shall be as specified in Section 32 13 13.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Forms: wood or metal straight, free from warp and of a depth equal to the thickness of the finished work.

B. Concrete: see Section 32 13 13.
   1. Unless otherwise shown on the Drawings or detailed specifications, the standard class for concrete sidewalks, driveways and barrier free ramps is shown in the following table:

Standard Classes of Pavement Concrete Class of Concrete[1]	Minimum Cementitious, Lb./CY	28 Day Min. Compressive Strength[2] psi	Maximum Water/ Cementitious Ratio	Course Aggregate Maximum Size, inch
A	470	3000	0.58	1-1/2

C. Reinforcement: see Section 32 13 13.
   1. Sidewalk, driveway and barrier free ramp reinforcing steel shall be #3 deformed bars at 18 inches on-center-both-ways at the center plane of all slabs, unless otherwise shown on the Drawings or detailed specifications.

D. Joint Filler
   1. Wood Filler: see Section 32 13 13.
   2. Pre-Molded Asphalt Board Filler
      a. Use only in areas where not practical for wood boards.
      b. Pre-molded asphalt board filler: ASTM D545.
      c. Install the required size and uniform thickness and as specified in Drawings.
      d. Include 2 liners of 0.016 asphalt impregnated kraft paper filled with a mastic mixture of asphalt and vegetable fiber and/or mineral filler.

E. Expansion Joint Sealant: see Section 32 13 73 where shown on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Surface Preparation
   1. Excavation: Excavation required for the construction of sidewalks, driveways and barrier free ramps shall be to the lines and grades as shown on the Drawings or as established by the OWNER.
   2. Fine Grading
      a. The Contractor shall do all necessary filling, leveling and fine grading required to bring the subgrade to the exact grades specified and compacted to at least 90 percent of maximum density as determined by ASTM D698.
      b. Moisture content shall be within minus 2 to plus 4 of optimum.
      c. Any over-excavation shall be repaired to the satisfaction of the OWNER.

B. Demolition / Removal
   1. Sidewalk, Driveway and/ or Barrier Free Ramp Removal: see Section 02 41 50.

3.02 INSTALLATION

A. General
   1. Concrete sidewalks shall have a minimum thickness of 4 inches.
   2. Sidewalks constructed in driveway approach sections shall have a minimum thickness equal to that of driveway approach or as called for by Drawings

and specifications within the limits of the driveway approach.

3. Driveways shall have a minimum thickness of 6 inches. Standard cross-slopes for walks shall be 2 percent max in accordance with current TAS/TDLR guidelines. The construction of the driveway approach shall include the variable height radius curb in accordance with the Drawings.
4. All pedestrian facilities shall comply with provisions of TAS including location, slope, width, shapes, texture and coloring. Pedestrian facilities installed by the Contractor and not meeting TAS must be removed and replaced to meet TAS (no separate pay).

B. Forms: Forms shall be securely staked to line and grade and maintained in a true position during the depositing of concrete.

C. Reinforcement: see Section 32 13 13.

D. Concrete Placement: see Section 32 13 13.

E. Finishing
1. Concrete sidewalks, driveways and barrier free ramps shall be finished to a true, even surface.
2. Trowel and then brush transversely to obtain a smooth uniform brush finish.
3. Provide exposed aggregate finish if specified.
4. Edge joints and sides shall with suitable tools.

F. Joints
1. Expansion joints for sidewalks, driveways and barrier free ramps shall be formed using redwood.
2. Expansion joints shall be placed at 40 foot intervals for 4 foot wide sidewalk and 50 foot intervals for 5 foot wide and greater sidewalk.
3. Expansion joints shall also be placed at all intersections, sidewalks with concrete driveways, curbs, formations, other sidewalks and other adjacent old concrete work. Similar material shall be placed around all obstructions protruding into or through sidewalks or driveways.
4. All expansion joints shall be 1/2 inch in thickness.
5. Edges of all construction and expansion joints and outer edges of all sidewalks shall be finished to approximately a 1/2 inch radius with a suitable finishing tool.
6. Sidewalks shall be marked at intervals equal to the width of the walk with a marking tool.
7. When sidewalk is against the curb, expansion joints shall match those in the curb.

G. Barrier Free Ramp
1. Furnish and install brick red color pre-cast detectable warning Dome-Tile, manufactured by StrongGo Industries or approved equal by the OWNER.
2. Detectable warning surface shall be a minimum of 24-inch in depth in the direction of pedestrian travel, and extend to a minimum of 48-inch along the curb ramp or landing where the pedestrian access route enters the street.
3. Locate detectable warning surface so that the edge nearest the curb line is a minimum of 6-inch and maximum of 8-inch from the extension of the face

of the curb.

4. Detectable warning Dome-Tile surface may be curved along the corner radius.
5. Install detectable warning surface according to manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY
- A. Section Includes:
  1. Concrete Curbs and Gutters
  2. Concrete Valley Gutters

1.02 FIELD CONDITIONS
- A. Weather Conditions: See Section 32 13 13.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS
- A. Forms: See Section 32 13 13.
- B. Concrete: See Section 32 13 13.
- C. Reinforcement: See Section 32 13 13.
- D. Joint Filler
  1. Wood Filler
  2. Pre-Molded Asphalt Board Filler
     a. Use only in areas where not practical for wood boards
     b. Pre-molded asphalt board filler: ASTM D545
     c. Install the required size and uniform thickness.
     d. Include two liners of 0.016 asphalt impregnated kraft paper filled with a mastic mixture of asphalt and vegetable fiber and/or mineral filler.
- E. Expansion Joint Sealant

PART 3 - EXECUTION

3.03 PREPARATION
- A. Demolition / Removal: See Section 02 41 50.

3.04 INSTALLATION
- A. Forms
  1. Extend forms the full depth of concrete.
  2. Wood forms: minimum of 1-1/2 inches in thickness
  3. Metal Forms: a gauge that shall provide equivalent rigidity and strength
  4. Use acceptable wood or metal forms for curves with a radius of less than 250 feet.
  5. All forms showing a deviation of 1/8 inch in 10 feet from a straight line shall be rejected.
- B. Reinforcing Steel
  1. Place all necessary reinforcement for OWNER approval prior to depositing concrete.
  2. All steel must be free from paint and oil and all loose scale, rust, dirt and other foreign substances.

3. Remove foreign substances from steel before placing.
4. Wire all bars at their intersections and at all laps or splices.
5. Lap all bar splices a minimum of 20 diameters of the bar or 12 inches, whichever is greater.

C. Concrete Placement
1. Deposit concrete to maintain a horizontal surface.
2. Work concrete into all spaces and around anyreinforcement to form a dense mass free from voids.
3. Work coarse aggregate away from contact with the forms
4. Hand-Laid Concrete – Curb and gutter
   a. Shape and compact subgrade to the lines, grades and cross section shown onthe Drawings.
   b. Lightly sprinkle subgrade material immediately before concrete placement.
   c. Deposit concrete into forms.
   d. Strike off with a template 1/4 to 3/8 inch less than the dimensions of the finishedcurb, unless otherwise approved.
5. Machine-Laid Concrete – Curb and Gutter
   a. Hand-tamp and sprinkle subgrade material before concrete placement.
   b. Provide clean surfaces for concrete placement.
   c. Place the concrete with approved self-propelled equipment.
      1) The forming tube of the extrusion machine or the form of the slipform machine must easily be adjustable vertically during the forward motion of the machine to provide variable heights necessary to conform to the established gradeline.
   d. Attach a pointer or gauge to the machine so that a continual comparison canbe made between the extruded or slipform work and the grade guideline.
   e. Brush finish surfaces immediately after extrusion or slipforming.
6. Hand-Laid Concrete – Concrete Valley Gutter: See Section 32 13 13.
7. Expansion joints
   a. Place expansion joints in the curb and gutter at 200-foot intervals and atintersection returns and other rigid structures.
   b. Place tooled joints at 15-foot intervals or matching abutting sidewalk jointsand pavement joints to a depth of 1-1/2 inches.
   c. Place expansion joints at all intersections with concrete driveways, curbs,buildings and other curb and gutters.
   d. Make expansion joints no less than 1/2 inch in thickness, extending the full depth of the concrete.
   e. Make expansion joints perpendicular and at right angles to the face of the curb.
   f. Neatly trim any expansion material extending above the finished to the surface of the finished work.
   g. Make expansion joints in the curb and gutter coincide with the concrete expansion joints.
   h. Longitudinal dowels across the expansion joints in the curb and gutter are required.

i. Install 3 No. 4 round, smooth bars, 24 inches in length, for dowels at each expansion joint.

j. Coat 1/2 of the dowel with a bond breaker and terminate with a dowel cap that provides a minimum of 1-inch free expansion.

k. Support dowels by an approved method.

D. Curing: see Section 32 13 13.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Galvanized coated chain link (non-security) fencing and accessories.
2. Wrought iron fencing and accessories
3. Steel tube fencing and accessories

1.02 REFERENCES

A. Reference Standards
1. Reference standards cited in this specification refer to the current reference standard published at the time of the latest revision date logged at the end of this specification, unless a date is specifically cited.
2. American Society for Testing and Materials (ASTM):
a. A 36, Standard Specification for Carbon Structural Steel
b. A 123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
c. A 392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
d. A 500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
e. F 626, Standard Specification for Fence Fittings
f. F 1043, Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
g. F 1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
h. F 1183, Specification for Aluminum Alloy Chain Link Fence Fabric

1.03 ACTION SUBMITTALS

A. Shop drawings
1. Layout of fences and gates with dimensions, details, and finishes of components, accessories and post foundations.

B. Product data
1. Manufacturer’s catalog cuts indicating material compliance and specified options.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS / MATERIALS

A. Manufacturer
1. Minimum of 5 years of experience manufacturing galvanized coated chain link fencing.
2. Approved Manufacturer or equal:
a. Allied Fence, Inc.
b. American Fence Corp.
c. Anchor Fence, Inc.
d. Master Halco, Inc.

B. Materials
1. Chain Link Fence

a. General
   1) Posts, gate frames, braces, rails, stretcher bars, truss rods and tension wire shall be of steel.
   2) Gate hinges, post caps, barbed wire supporting arms, stretcher bar bands and other parts shall be of steel, malleable iron, ductile iron or equal
   3) Post tops, rail end, ties and clips may be of aluminum.
   4) Use only new material, or salvaged/existing material if approved by OWNER or noted on Drawings.

b. Steel Fabric
   1) Fabric
      a) No. 9 gauge
      b) 2-inch mesh
         (1) Commercial: both top and bottom selvages twisted and barged
             Residential: match existing or both top and bottom selvages knuckled
         (2) Furnish 1-piece fabric widths.
   2) Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc per square foot of surface.

c. Aluminum Fabric
   1) Fabric
      a) ASTM F 1183
      b) No. 9 gauge
      c) 2-inch mesh, with both top and bottom selvages twisted and barged.
      d) Furnish 1-piece fabric widths.

d. Steel Framing
   1) Steel pipe - Type I
      a) ASTM F 1083
      b) Standard weight schedule 40
      c) Minimum yield strength: 30,000 psi
      d) Sizes as indicated
      e) Hot-dipped galvanized with minimum average 1.8 oz/ft² of coated surface area
   2) Steel pipe - Type II
      a) ASTM F 1043, Group IC
      b) Minimum yield strength: 50,000 psi
      c) Sizes as indicated on Drawings
      d) Protective coating per ASTM F 1043
         (1) External coating Type B
            (a) Zinc with organic overcoat
            (b) 0.9 oz/ft² minimum zinc coating with chromate conversion coating and verifiable polymer film
         (2) Internal coating Type B
            (a) Minimum 0.9 oz./ft² zinc or Type D, zinc pigmented, 81 percent nominal coating, minimum 3 mils
   3) Formed steel (“C”) sections:
      a) Roll formed steel shapes complying with ASTM F 1043, Group II
      b) Minimum yield strength: 45,000 psi (310 MPa)
      c) Sizes as indicated on Drawings
      d) External coating per ASTM F 1043, Type A
         (1) Minimum average 2.0 oz./ft² of zinc per ASTM A 123
   4) Steel square sections
      a) ASTM A 500, Grade B
      b) Minimum yield strength: 40,000 psi
      c) Sizes as indicated on Drawings
      d) Hot-dipped galvanized with minimum 1.8 oz/ft² of coated surface area

e. Accessories
   1) Chain link fence accessories
      a) ASTM F 626
      b) Provide items required to complete fence system.
      c) Galvanize each ferrous metal item and finish to match framing.
   2) Post caps
      a) Formed steel or cast malleable iron weather tight closure cap for tubular posts.
      b) Provide 1 cap for each post.
      c) Cap to have provision for barbed wire when necessary.
      d) "C" shaped line post without top rail or barbed wire supporting arms do not require post caps.
      e) Where top rail is used, provide tops to permit passage of top rail.
   3) Top rail and rail ends
      a) 1 5/8 inch diameter galvanized round pipe for horizontal railing
      b) Pressed steel per ASTM F626
      c) For connection of rail and brace to terminal posts
   4) Top rail sleeves
      a) 7-inch expansion sleeve with a minimum 0.137 inch wire diameter and 1.80 inch length spring, allowing for expansion and contraction of top rail
   5) Wire ties
      a) 9 gauge galvanized steel wire for attachment of fabric to line posts
      b) Double wrap 13 gauge for rails and braces.
      c) Hog ring ties of 12-1/2 gauge for attachment
   6) Brace and tension (stretcher bar) bands
      a) Pressed steel
      b) Minimum 300 degree profile curvature for secure fence post attachment
      c) At square post provide tension bar clips.
   7) Tension (stretcher) bars:
      a) 1 piece lengths equal to 2 inches less than full height of fabric
      b) Minimum cross-section of 3/16 inch x 3/4 inch
      c) Provide tension (stretcher) bars where chain link fabric meets terminal posts.
   8) Tension wire
      a) Galvanized coated steel wire, 6 gauge, [0.192 inch] diameter wire
      b) Tensile strength: 75,000 psi
   9) Truss rods & tightener
      a) Steel rods with minimum diameter of 5/16 inch
      b) Capable of withstanding a tension of minimum 2,000 pounds
   10) Nuts and bolts are galvanized.

2. Wrought Iron Fence: specified per Drawings.
3. Steel Tube Fence: specified per Drawings.
4. Setting Materials
   a. Concrete
      1) Minimum 28 day compressive strength of 3,000 psi
      2) Bagged concrete allowed.
   b. Drive Anchors
      1) Galvanized angles
      2) ASTM A 36 steel
      3) 1 inch x 1 inch x 30 inch galvanized shoe clamps to secure angles to posts.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions
   1. Verify areas to receive fencing are completed to final grades and elevations.
   2. Ensure property lines and legal boundaries of work are clearly established

3.02 INSTALLATION

A. Chain Link Fence Framing
   1. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30 degrees or more.
   2. Space line posts uniformly at 10 feet on center.
   3. Set all posts in concrete
      a. Drill holes in firm, undisturbed or compacted soil.
      b. Drill hole diameter 4 times greater than outside dimension of post.
      c. Set post bottom 24 inches below surface when in firm, undisturbed soil.
      d. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.
      e. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.
   4. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
   5. Bracing
      a. Install horizontal pipe brace at mid-height for fences 6 feet and taller, on each side of terminal posts.
      b. Firmly attach with fittings.
      c. Install diagonal truss rods at these points.
      d. Adjust truss rod, ensuring posts remain plumb.
   6. Tension wire
      a. Provide tension wire at bottom of fabric and at top, if top rail is not specified.
      b. Install tension wire before stretching fabric and attach to each post with ties.
      c. Secure tension wire to fabric with 12-1/2 gauge hog rings 24 inches on center.
   7. Top rail
      a. Install lengths, 21 feet
      b. Connect joints with sleeves for rigid connections for expansion/contraction.
   8. Center Rails for fabric height 12 feet and taller.
      a. Install mid rails between posts with fittings and accessories.
   9. Bottom Rails: Install bottom rails between posts with fittings and accessories.

B. Chain Link Fabric Installation
   1. Fabric
      a. Install fabric on security side and attach so that fabric remains in tension after pulling force is released.
      b. Leave approximately 2 inches between finish grade and bottom selvage.
      c. Attach fabric with wire ties to line posts at 15 inches on center and to rails, braces, and tension wire at 24 inches on center.
   2. Tension (stretcher) bars
      a. Pull fabric taut.
      b. Thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15 inches on center.

3. Accessories
   a. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.
   b. Fasteners: Install nuts on side of fence opposite fabric side for added security.
   c. Slats: Install slats in accordance with manufacturer's instructions.

C. Wrought Iron Installation: install per Drawings

D. Steel Tube Fence: install per Drawings

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having following characteristics:

1. pH value of between 5.5 and 8.5 (pH may have to be adjusted to promote grass growth). District may require random testing for verification of compliance at any time.
2. Liquid limit: 50 or less
3. Plasticity index: 20 or less
4. Gradation: maximum of 10 percent passing No. 200 sieve

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at minimum depth of 4 inches and has similar characteristics to that found at placement site. Do not obtain topsoil from the areas infected with growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Excavate topsoil for areas to receive grass or landscaping from areas to be further excavated. Stockpile in area approved by Owner

B. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion

3.02 TOPSOIL EXCAVATION

A. Conform to excavation and stockpiling requirements as shown on Drawings and Contract Documents.

3.03 PLACEMENT

A. 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 Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with appropriate lawn roller to consolidate topsoil.

B. Increase depth of topsoil to 12 inches when placed over sand bedding and backfill materials specified in Section 31 23 00 – EXCAVATION BEDDING AND BACKFILL FOR UTILITIES.

C. For areas to receive shrubs or trees, excavate existing material and place topsoil to depth and dimensions shown on Drawings.

D. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Section 01 74 19 - WASTE MATERIAL DISPOSAL.

E. 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 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: The Drawings, Division 0 and Division 1 apply to the Work in this Section.

1.2 SCOPE

A. Furnishing and applying hydro-seeding of native Texas grasses.

B. Site clean up.

C. Maintenance and guarantee.

1.3 RELATED WORK IN OTHER SECTIONS

A. Section 32 91 16.13 – Top Soil

1.4 QUALITY ASSURANCE

A. Source:

1. Seed: The Landscape Architect shall be furnished a signed copy of statement from vendor, certifying that each container of seed delivered is labeled in accordance with the Federal Seed Act and is at least equal to requirements previously specified. Seed analysis shall be furnished prior to commencement of planting operations. Each lot of seed may be resampled and retested in accordance with latest Rules and Regulations under the Federal Seed Act at the discretion of the Landscape Architect. If these tests reveal the seed to be below the specified pure live seed content, the Contractor shall be required to plant additional seed to compensate for the deficiency at no additional cost to the Owner. The seed retests will be conducted by the State Seed Laboratory. Allowance will be made for the actual pure live seed content of the specified grasses in determining the actual planting rate.

B. Inspections:

1. Make written request for inspection after seeding operations have been completed. Such inspection is for the purpose of establishing the Maintenance Period.

2. Submit written requests for inspections to the Landscape Architect at least seven (7) days prior to anticipated inspection date.

1.5 SUBMITTALS

Furnish required copies of manufacturer's literature, certifications, or laboratory analytical data for the following items:

1. Source. (Certification).

2. Fiber Mulch. (Laboratory Analytical Data).

1.6 FINAL ACCEPTANCE

Work under this Section will be accepted by Landscape Architect upon satisfactory completion of all work, but exclusive of re-application under the Guarantee Period. Final Acceptance of lawn establishment shall be as follows:

For Seed: Ninety five (95%) percent uniform coverage of grass in excess of one (1"0 inch height. No bare spots of greater than two (2) square feet will be accepted.

The Landscape Architect and/or Owner shall interpret the above. Upon Final Acceptance, the Owner will assume the responsibility for maintenance of the work.

1.7 CLEAN UP

Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during lawn installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Landscape Architect.

PART 2 - PRODUCTS

2.1 SEED

All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act. All seed shall be furnished in sealed standard containers unless exception is granted in writing by the Landscape Architect. Seed which has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

Seed mixes shall be provided from Native American Seed or approved equal.

Contact Information:
Native American Seed
3791 N US Hwy 377
Junction, TX 76849
800.728.4043

www.seedsource.com

The minimum percentage by weight of pure live seed in each lot of seed shall be as follows and seed shall be planted at the rate per acre indicated under pure live seed required per acre.

Dam Slope Mix – 20 lbs / Acre, containing Blue Grama 31%, Little Bluestem 12.07%, Buffalograss 11%, Sideoats Grama 10.18%, Eastern Gamagrass 4.95%, Green Sprangletop 4.95%, Sand Dropseed 4.90%, Prairie Wildrye 4.75%, Big Bluestem 4.19%, Indiangrass 3.67%, Switchgrass 3.50%, Sand Lovegrass 2%, Western Wheatgrass 1.37%, Texas Cupgrass 0.55%, Curly Mesquite 0.50%, Halls Panicum 0.20%, White Tridens 0.20%, Cane Bluestem 0.03%.

If planting occurs between September & February, all seeding areas to also receive:

Cereal Rye Grain – 100 lbs / Acre

Weed seed shall not exceed ten (10%) percent by weight of the total of pure live seed and other material in the mixture. Johnson grass, nut grass, or other noxious weed seed will not be allowed.

2.2 FIBER MULCH: Fiber mulch, for use with the hydraulic application of grass seed, shall consist of specially prepared mulch. It shall be processed in such a manner that it will not contain germination or growth inhibiting factors. It shall be dyed an appropriate color to allow visual metering of its application. The mulch shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil, the fibers shall form a blotter-like groundcover which readily absorbs water and allows infiltration to the underlying soil. Weight specifications from suppliers for all applications shall refer only to air dry weight of the fiber, a standard equivalent to eighteen (18%) percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100 pounds and be marked by the manufacturer to show the dry weight content. Suppliers shall be prepared to certify that laboratory and field-testing of their product has been accomplished and that it meets all of the foregoing requirements.

2.3 WATER: Shall be free from oil, acid, alkali, salt, and other substances harmful to growth of grass. The water source shall be subject to approval prior to use.

2.4 SLURRY MIX COMPONENTS PER ACRE

Fiber Mulch	2,000 Pounds
Grass Seed	(As Specified)

2.5 TOPDRESS MIX:

Native Topsoil

PART 3 - EXECUTION

3.1 HYDROMULCH SEEDING ON PREPARED FINISHED GRADE

A. Bed Preparation: Immediately after the finished grade has been approved, begin hydro-seeding operation to reduce excessive weed growth.

B. Special Mulching Equipment and Procedures: Hydraulic equipment used for the application of fertilizer, seed, and slurry of prepared wood fiber mulch shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry containing up to forty (40) pounds of fiber plus appropriate gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. The discharge line shall be equipped with a set of hydraulic spray nozzles which provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of eight hundred (800) gallons and shall be mounted on a traveling unit which may be either self-propelled or drawn with a separate unit which will place the slurry tank and spray nozzles within sufficient proximity to the areas to be seeded so as to provide uniform distribution without waste. The Landscape Architect may authorize equipment with smaller tank capacity provided that the equipment has the necessary agitation system and sufficient pump capacity to spray the slurry in a uniform coat.

C. Mixing: Care shall be taken that the slurry preparation takes place on the site of the work. The slurry preparation should begin by adding water to the tank when the engine is at half throttle. When the water level has reached the height of the agitator shaft, good recirculation shall be established and seed shall be added, followed by wood pulp mulch. The wood pulp mulch shall only be added to the mixture after the seed and when the tank is at least one-third filled with water. The engine throttle shall be opened to full speed when the tank is half filled with water. All the wood pulp mulch shall be added by the time the tank is two-thirds to three-fourths full. Spraying shall commence immediately when the tank is full. The operator shall spry the area with a uniform, visible coat by using the green color of the wood pulp as a guide.

D. Application:

1. Contractor shall obtain approval of hydro-seed area preparation form the Landscape Architect prior to application.

2. Operators of hydro-seed equipment shall be thoroughly experienced in this type of application. Apply specified slurry mix in a motion to form a uniform mat at specified rate.

3. Keep hydro-seed within areas designated and keep from contact with other plant material.

4. Slurry mixture which has not been applied within four (4) hours of mixing shall not be used and shall be removed from the site.

5. Native seeds must be covered with no more than ¼” depth of fiber material to achieve successful germination.

6. After application, the Contractor shall not operate any equipment over the covered area.

7. Immediately after application, thoroughly wash off any plant material, planting areas, or paved areas not intended to receive slurry mix. Keep all paved and planting areas clean during maintenance operations.

8. Refer also to the maintenance portion of this Section.

E. Unseeded Areas: If, in the opinion of the Landscape Architect, unplanted skips and areas are noted after hydro-seed, the Contractor shall be required to seed the unplanted areas with the seed mixes that were to have been planted at no additional cost to the Owner. Contractor is also responsible for hydro-seeding any areas disturbed during the construction process, even if they are outside the areas designated to receive seed.

3.2 INSPECTIONS

A. Make written request for inspection prior to seeding and after areas have been seeded and sodded.

B. Submit requests for inspections to Landscape Architect at least two (2) days prior to anticipated inspection date.

END OF SECTION

PART 1 - GENERAL

1.01 This work includes all labor, materials, and equipment for soil preparation, fertilization, planting and other requirements regarding turfgrass planting areas shown on the plans.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 31 00 00 - Earthwork.

1.03 SUBMITTALS:

A. Delivery Receipts and Invoices: All delivery receipts and copies of invoices for materials used for this work shall be subject to checking by the Owner or his representative and shall be subsequently delivered to the office of the Owner.

B. Samples and Producers' Specifications: Various samples, certificates, and specifications of seed, fertilizer and other materials shall be submitted for approval as required by subsequent sections of this specification.

PART 2 - PRODUCTS

2.01 TURFGRASS:

A. Sod: Turfgrass sod shall be Cynodon dactylon (Common Bermudagrass). Sod shall consist of stolons, leaf blades, rhizomes, and roots with a healthy, virile system of dense, thickly matted roots throughout the soil of the sod for a thickness not less than three-quarters (¾") inch. Sod shall be alive, healthy, vigorous, free of insects, disease, stones, and undesirable foreign materials and grasses. The grass shall have been mowed prior to sod cutting so that the height of the grass shall not exceed two (2") inches. Sod shall have been produced on growing beds of loam topsoil. Sod shall not be harvested or planted when its moisture condition is so excessively wet or dry that its survival will be affected. All sod is to be harvested, delivered, and planted within a twenty-four (24) hour period of time. Sod shall be protected from exposure to wind, sun, and freezing. If sod is stacked, it shall be kept moist and shall be stacked roots-to-roots and grass-to-grass.

1. Dimensions: All sod shall have been machine cut to uniform soil thickness of one (1") inch plus or minus one-quarter (¼") inch. All sod shall be of the same thickness. Rectangular sections of sod may vary in length, but all shall be of equal width and of a size that permits the sod to be lifted, handled, and rolled without breaking. Broken pads and torn, uneven ends will be unacceptable.

2.02 FERTILIZER:

A. General: Fertilizer shall be a commercial product, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer shall be

delivered to the site in fully labeled original containers. Fertilizer which has been exposed to high humidity and moisture, or has become caked or otherwise damaged making it unsuitable for use, will not be acceptable.

B. Initial Planting Application: Fertilizer for the initial planting application shall be a starter fertilizer with a N-P-K ratio of 4-5-1 (19-26-5) or approved equal. The phosphorus component must be derived from monoammonium phosphate to stimulate vigorous development of new roots, stolons, and rhizomes. This initial application must be applied and incorporated into the soil immediately prior to sodding or sprigging and applied immediately after seedlings begin to emerge on seeded areas.

1. Specification Submittal: Submit a sample label or specification of the fertilizer proposed to be used for the Owner's approval.

C. Post Planting Application: Fertilizer for the post planting application will be a complete fertilizer of chemical base containing by weight the following percentages of nutrients: 27-3-4 +2% Fe (N-P-K) or approved equal from methylene urea or the nitrogen equivalent of 33-3-10. The application rate should provide one (1) pound of nitrogen per 1,000 square feet.

1. Specification Submittal: Submit a sample label or specification of the fertilizer proposed to be used for the Owner's approval.

PART 3 - EXECUTION

3.01 GENERAL:

A. All turf operations are to be executed across the slope, parallel to finished grade contours.

3.02 SOIL PREPARATION:

A. Tillage: Tillage shall be accomplished to loosen the soil, destroy existing vegetation, and prepare an acceptable sod area. All areas shall be tilled with a heavy duty disc or a chisel-type breaking plow, chisels set not more than ten (10") inches apart. Initial tillage shall be done in a crossing pattern for double coverage then followed by a disc harrow. Depth of tillage shall be five (5") inches.

B. Cleaning: Soil shall be further prepared by the removal of debris, building materials, rubbish, weeds, and stones larger than three-quarter (¾") inches in diameter.

C. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts, depressions, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.

D. Rock Removal: During the soil preparation process, a "Rock Pick" or other approved piece of machinery shall be used to gather surface stones as small as three-quarter (¾") inch in diameter. The Contractor shall be responsible for the disposal of collected materials as waste per "Clean Up," Paragraph 3.12.

3.03 FERTILIZING:

A. Initial Planting Application: The fertilizer shall be applied at the rate of one (1) pound of phosphorus per one thousand (1000) square feet.

1. Timing: The initial planting application of fertilizer for all areas shall be applied after the soil preparation, but not more than two (2) days prior to turfgrass planting.

B. Post Planting Application: Thirty (30) days after planting, turfgrass areas shall receive the specified post planting fertilizer at the rate of one (1) pound of nitrogen per one thousand (1,000) square feet.

1. Timing: The Project Coordinator and Landscape Architect will determine if it is too late in the growing season for the post planting application. In the event that it is, the application shall be made in the spring of the next year, or the cost of the application may become a credit due to the Owner.

2. Post Planting Maintenance: See Paragraph 3.9. Areas without a uniform stand (complete coverage) that must be maintained later than thirty (30) days after the initial planting shall receive subsequent applications of fertilizer, as described above, every thirty (30) days until a uniform stand is achieved.

3.04 PLANTING:

A. Solid Sodding:

3. Prior to laying the sod, the planting bed shall be raked smooth to true grade and moistened to a depth of four (4") inches, but not to the extent causing puddling. The sod shall be laid smoothly, tightly butted edge to edge, and with staggered joints. The sod shall be pressed firmly into contact with the sod bed by rolling or by hand tamping with an approved tamper so as to eliminate all air pockets, provide a true and even surface, and insure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Following compaction, fine screened soil of good quality shall be used to fill all cracks between sods. Excess soil shall be worked into the grass with suitable equipment and shall be well watered. The quantity of fill soil shall be such that it will cause no smothering of the grass.

4. All sodded areas shall be flush with the finish grade of adjacent grassed areas.

5. All sod on slopes that exceed a 1:5 slope shall be held to the slope with wooden pegs driven through the sod and into the underlying soil.

3.05 PROTECTION:

A. No heavy equipment shall be moved over the planted turf area unless the soil is again prepared, graded, leveled, and replanted. It will be the responsibility of this Contractor to protect all paving surfaces, curbs, utilities, plant materials, and any other existing improvements from damage. Any damages shall be repaired or replaced at no cost to the Owner. This Contractor will also locate and stake all irrigation heads, valve risers, etc., prior to beginning any soil preparation work.

3.06 IRRIGATION SYSTEM:

A. The proposed irrigation system must be complete in all respects and must be completely operational before turfgrass planting may begin. After planting, any breakdowns in the irrigation system attributable to warranty items must be immediately repaired by the Contractor. Otherwise, the cost of replacing the lost turf caused by the Contractor's failure to promptly repair the irrigation system will be fully borne by the Contractor.

B. All turf areas not covered by the proposed irrigation systems must be irrigated with a temporary above-ground irrigation system. The above-ground temporary irrigation system shall remain in place until all non-irrigated turf areas have established an acceptable stand of turfgrass. Contractor shall be responsible for installation, operation and removal of the temporary system. All cost associated with the temporary system shall be borne by the Contractor.

3.07 ESTABLISHMENT AND ACCEPTANCE:

A. Regardless of unseasonable climatic conditions or other adverse conditions affecting planting operations and the growth of the turfgrass, it shall be the sole responsibility of the Contractor to establish a uniform stand of turfgrass as herein specified. When adverse conditions such as drought, cold weather, high winds, excessive precipitation, or other factors prevail to such an extent that satisfactory results are unlikely, the Owner may, at his own discretion, stop any phase of the work until conditions change to favor the establishment of turfgrass.

B. A uniform stand with complete coverage of the specified grass shall be defined as not less than 90% coverage in a ten foot square area for seeded and sprigged areas. Growing plants shall be defined as healthy grass plants at least 1 ½" inches tall.

C. Complete coverage in sodded areas is defined as no visible joints showing or felt between individual sections of sod.

3.08 POST-PLANTING MAINTENANCE:

A. Maintenance shall begin immediately after each grass area is planted. All planted areas will be protected and maintained by watering, weed control, and replanting as necessary for at least thirty (30) days after initial planting and for as long as necessary to establish a UNIFORM STAND OF THE SPECIFIED GRASS and until the entire project has been accepted by the Owner. It is anticipated that a minimum of one (1) mowing will occur before the grass areas are accepted by the Owner. All areas which are not completely covered with the specified grass at the end of thirty (30) days will continue to be replanted and maintained by the Contractor until complete coverage and acceptance are achieved.

B. Water: Apply at least one-half (½") inch of water over the entire planted area every three days. Contractor shall water thoroughly and infrequently once grass is established to encourage deep root growth.

C. Mowing: Once grass is established the planted area shall be mowed at least once a week during the growing season. Grass shall be mowed to a height of two inches. Mowing during dormant season will be done as necessary.

D. Weed Control: No sooner than 45 days after grass has germinated any weed growth shall be arrested over the entire planted area. Eliminate weed growth that continues to grow after the initial application. All weed growth during the dormant season will be controlled with spot applications of “Round-Up.” “Round-Up” will not be used until the grass is totally dormant.

E. Replanting: All areas that do not produce a UNIFORM STAND OF GRASS must be replanted until a UNIFORM STAND OF GRASS is established.

F. Edging: All turf areas adjacent to paved areas shall be edged to maintain a neat appearance.

3.09 GRADING:

A. All grading and placing of topsoil on any given area will be done prior to the turfgrass installation. It will be this Contractor's responsibility to maintain the existing grades and leave them in a true and even condition after planting turfgrass.

3.10 EROSION CONTROL:

A. Throughout the project and the maintenance period for turfgrass, it is the Contractor's responsibility to maintain the topsoil in place at specified grades. Topsoil and turfgrass losses due to erosion will be replaced by the Contractor until establishment and acceptance is achieved.

3.11 CLEAN UP:

A. This Contractor shall remove any excess material or debris brought onto the site or unearthed as a result of his turfgrass operations.

3.12 GUARANTEE:

A. This Contractor shall guarantee all materials used for this work to be the type, quality, and quantity specified.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section describes manhole testing to effectively confirm the watertight integrity of existing manholes following infiltration related repairs and inflow related repairs. Vacuum testing is also applicable to complete manhole replacements.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Procurement and Contracting Requirements
2. Division 01 – General Requirements
3. Division 33 – Utilities

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Test Conformance

1. Submit data to show conformance with the specification for all testing methods.

PART 2 - EXECUTION

2.1 EXAMINATION

A. Visual

1. The Engineer, Owner, or Owners Representative shall make a final visual inspection. Any deficiencies in the finished rehabilitation work completed shall be marked and repaired according to the manufacturer's recommendations.

B. Vacuum Testing

1. All manholes that are replaced by the contractor shall be vacuum tested by the Contractor in the presence of the Engineer for sources of infiltration. Testing will be made during high groundwater conditions, wherever possible. Prior to testing Contractor shall set up and test bypass pumping or utilize flow through plugs as necessary (no additional pay item).

2. Manholes shall be tested after installation with all connections (existing and/or proposed) in place. Drop-connections and gas sealing connections shall be installed prior to testing. The lines entering the manhole shall be temporarily plugged with the plugs braced to prevent them from being drawn into the manhole. The plugs shall be installed in the lines beyond drop-connections, gas sealing connections, etc. The test head shall be placed inside the frame at the top of the manhole and inflated in accordance with the manufacturer's recommendations. A vacuum of 10 inches of mercury shall be drawn, and the vacuum pump will be turned off. With the valve closed, the level of vacuum shall be read after the required test time. If the drop in the level is less than 1-inch of mercury (final vacuum greater than 9 inches of mercury), the manhole will have passed the vacuum test. After a successful test, the temporary plugs will be removed. The required test time is determined from Table I.

Table I

MINIMUM TIME REQUIRED FOR A VACUUM DROP OF 1" H_g (10"H_g - 9"H_g) (MIN:SEC)

DEPTH OF M.H. (DEPTH IN FT.)	48" M.H.	60" M.H.	72" M.H.
0 - 20'	:40	:50	1:00
22'	:44	:55	1:06
24'	:48	1:00	1:12
26'	:52	1:05	1:18
28'	:56	1:10	1:24
30'	1:00	1:15	1:30
ADDITIONAL 2' DEPTHS-ADD FOR EACH 2'	:04	:05	:06

3. Manhole vacuum levels observed to drop greater than 1-inch of mercury (Final vacuum less than 9 inches of mercury) will have failed the test and will require additional rehabilitation. The Contractor shall make the necessary repairs at no additional compensation for only those work items completed by the Contractor. The manhole shall then be retested as described above until a successful test is made.

C. Infiltration / Inflow Testing

1. All frame seal and pipe seal repairs shall be dyed water tested. Manholes shall be dye water tested in the presence of the Engineer. The dye test shall consist of applying a concentrated dye solution around the manhole frame, prior to backfilling and restoration. Dyed water shall be applied for at least ten (10) minutes.

2. Manholes observed to be actively leaking will have failed the test and will not be acceptable. Manholes failing the test will require additional rehabilitation by the Contractor at no additional compensation. The Contractor shall be responsible for only those work items listed in the Manhole Rehabilitation Schedule. The manhole shall then be retested as described above until a successful test is made.

D. Spark Testing (Holiday Test)

1. After the coating or lining product(s) have set in accordance with manufacturer instructions, all coated or lined structures shall be inspected for holidays with high-voltage holiday detection equipment. Reference NACE RPO 188-99 for performing holiday detection. All detected holidays as indicated by the audible or visual signal of the test apparatus shall be marked and repaired by abrading the coating or lining surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional coating or lining can be hand applied to the repair area. All touch-up/repair procedures shall follow the coating or lining manufacturer's recommendations. All surfaces shall be retested after the repairs at no additional cost to the Owner. Documentation on areas tested, results and repairs made shall be provided to Owner by Contractor.
2. Spark testing shall not be performed in any explosive environment. Prior to conducting testing in an enclosure, an inspection shall be conducted to indicate weather the enclosure is safe for entry, including testing for explosive gas.

E. Thickness Testing

1. Thickness testing of the Protective Coating Material shall be done during the application by the use of a wet film thickness gauge. During application of epoxy coatings, Contractor shall regularly perform and record thickness readings with a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, to ensure a monolithic coating and uniform thickness during application. A minimum of two readings every four vertical feet, two (2) readings on the Bench (one on each side of the invert) area and one (1) reading in the chimney area shall be recorded. Contractor will submit all documentation on thickness readings to Inspector on a daily basis when coating application occurs.
2. Due to the rapid cure of the approved polyurethane Protective Coating Material, the use of a wet film thickness gage is not practical. Therefore, thickness testing for the polyurethane Protective Coating Material will be done by cutting coupons at random locations on a minimum of (10 %), one out of every ten of the total structures coated with the PCM in each basin and or subdivision, as directed by the Owner or Engineer. Using test samples from the adhesion testing (dolly's) is acceptable. All repairs shall be made by Contractor in strict accordance with manufacturer's recommendations using the manufacturer's approved patching material to repair the structure where test coupons were taken.

F. Adhesion Testing

1. Adhesion testing shall be performed on ten percent (10%) of the coated or lined manholes and structures, at random locations for one out of every ten of the total structures coated in each basin and/or subdivision, as directed by the Owner or Engineer. Testing shall be conducted in accordance with ASTM D7234 as modified herein.

a. For each test manhole a minimum of three 20 mm dollies shall be affixed to the coated surface; One test dolly shall be affixed within 2 ft of the bench area /bottom of structure, one test dolly shall be affixed in the middle of the structures wall area and the final test dolly shall be affixed within two foot of the top of the chimney area /top of the structure.
b. For larger structures a minimum of three 20 mm dollies shall be affixed to the coated surface at random locations within each 1000 square foot area or as otherwise agreed upon.
c. The adhesive used to attach the dollies to the coating shall be rapid setting with tensile strengths in excess of at least twice the anticipated failure point (generally at least 1000 psi) and permitted to cure in accordance with manufacturer recommendations. The coating and dollies shall be adequately cleaned and prepared to receive the adhesive. Failure of the dolly adhesive shall be deemed a non-test and require retesting.
d. Prior to performing the pull test, the coating shall be scored to the substrate, or within 10 mils of the substrate surface, by mechanical means without disturbing the dolly or coating system bond within the test area.
e. Two of the three adhesion pulls in each test area shall exceed 200 psi and shall include substrate adhered to the back of the dolly or no visual signs of the coating product in the test hole. Pulls tests with results between 150 and 200 psi may be acceptable if more than 50 percent of the substrate in the test area is adhered to the dolly.
f. Should a structure, or area, fail to achieve two successful pulls as described above, additional testing shall be performed at the discretion of the Owner or Project Engineer. Any areas detected to have inadequate bond strength shall be evaluated by the Project Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Contractor.
g. All adhesion testing shall be performed by qualified personnel using calibrated equipment as specified by the applicable ASTM standard(s).
h. All adhesion testing shall be documented and submitted in a consistent format detailing location, test values, description of the failure point/mode, scoring method employed, adhesive used, cure time of coating and adhesive and other data as deemed necessary by the Owner/Engineer.

2.2 FIELD QUALITY CONTROL

A. The testing required shall be performed by the Contractor at all rehabilitated manholes and documented to the satisfaction of the Engineer.

B. Any rehabilitated manholes that are observed to be leaking by the Engineer shall be subject to additional repairs and retested by the Contractor at no additional cost to the Owner.

END OF SECTION

PART 1 — GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements and procedures for Closed Circuit Television (CCTV) Inspection of sanitary sewer or storm sewer mains

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 - Contracts
2. Division 1 - General Requirements
3. Section 33 03 10 - Bypass Pumping of Existing Sewer Systems
4. Section 33 04 50 - Cleaning of Sewer Mains
5. Section 33 31 20 - Polyvinyl Chloride (PVC) Gravity Sanitary Sewer Pipe

1.2 PRICE AND PAYMENT PROCEDURES

A. Pre-CCTV Inspection

1. Measurement
   a. Measurement for this item will be by the linear foot of line televised for CCTV Inspection performed prior to any line modification or replacement determined from the distance recorded on the video tape log.
2. Payment
   a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement" will be paid for at the unit price bid per linear foot for “Pre-CCTV Inspection”.
   i. Contractor will not be paid for unaccepted video.
3. The price bid shall include:
   a. Mobilization
   b. Cleaning
   c. Digital file

B. Post-CCTV Inspection

1. Measurement
   a. Measurement for this Item will be by the linear foot of line televised for CCTV Inspection performed following repair or installation determined from the distance recorded on the video tape log.
2. Payment
   a. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid per linear foot for “Post-CCTV Inspection".
   i. Contractor will not be paid for unaccepted video.
3. 3. The price bid shall include:
   a. Mobilization
   b. Cleaning
   c. Digital file

1.3 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Meet with Owner to confirm that the equipment, software, standard templates, detect codes and defect rankings are being used, if required.
2. IT Pipes CCTV files provide NTMWD a single data repository for inspections that integrates with GIS.
3. All new or rehabbed pipelines shall be CCTV'd with NASSCO PACP Version 6.2 and be provided to operations in IT Pipes software for import into the NTMWD database.
   a. Please request copy of the NTMWD template file from Operations NASSCOv6_2.tpl
   b. Operations are able to import file type: ITpipes Project (*.mbd)
   c. Items specific to NTMWD database are given below since NTMWD is unable to change the NASSCO PACP template headers:

- Pipe Segment Reference = WWPIXXXXX.XXXX (matches GIS numbering directly to link IT Pipes and GIS)
- Drainage Area = Pipeline name to match GIS naming convention: Example "Rowlett Crk Parallel Trunk Sewer"
- Upstream MH = WWMHXXXXX to match GIS
- Downstream MH = WWMNXXXXX to match GIS
- Include:
  - ♦ Pipeline material
  - ♦ Person and company performing inspection
  - ♦ Date inspection performed
  - ♦ Length surveyed
  - ♦ Direction of survey
  - ♦ Year laid
  - ♦ Mandatory fields for NASSCO PACP Version 6.2
  - ♦ Wastewater System – MSI Template Only
    - ◊ UEFIS
    - ◊ Forney IS
    - ◊ LEFIS
    - ◊ Muddy Creek IS
    - ◊ Parker Creek IS
    - ◊ Sabine Creek IS
    - ◊ Buffalo Creek IS
    - ◊ Buffalo Creek Parallel IS
    - ◊ McKinney IS
    - ◊ Mustang Creek IS

- ◊ Parker Creek Parallel IS

4. Confirm MXLocation ID's (WWMH, WWPI, etc.) are assigned prior to production of Conformed Drawings for CCTV and record purposes.
5. IT Pipes uses the MXLocation ID to coordinate with GIS in order to open the IT Pipes inspection from GIS.

1.5 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00,

B. The Engineer or the Owner shall approve all submittals prior to delivery.

1.6 INFORMATIONAL SUBMITTALS

A. Pre-CCTV submittals for sanitary sewer lines 24 inches and larger, if required

1. Project schedule
2. Listing of cleaning equipment and procedures
3. Listing of flow diversion procedures
4. Listing of CCTV equipment
5. Listing of backup and standby equipment
6. Listing of safety precautions and traffic control measures

1.7 CLOSEOUT SUBMITTALS

A. Post-CCTV submittals

1. 2 copies of CCTV video results on DVD
2. 2 hard copies of Inspection Report

1.8 MAINTENANCE MATERIAL SUBMITTALS [NOT USED]

1.9 QUALITY ASSURANCE [NOT USED]

1.10 DELIVERY, STORAGE, AND HANDLING [NOT USED]

1.11 FIELD [SITE] CONDITIONS [NOT USED]

1.12 WARRANTY [NOT USED]

PART 2 — PRODUCTS [NOT USED]

PART 3 — EXECUTION

3.1 INSTALLERS [NOT USED]

3.2 EXAMINATION [NOT USED]

3.3 PREPARATION

A. CCTV Equipment

1. Use equipment specifically designed and constructed for such inspection.
2. Use equipment designed to operate in 100 percent humidity conditions.
3. Use equipment with a pan (±270 degrees), tilt, and rotates (360 degrees).
4. Use camera with an accurate footage counter that displays on the monitor the distance of the camera (to the nearest 1/10 foot) from the centerline of the starting manhole.
5. Use camera with height adjustment so camera lens is always centered at 1/2 the inside diameter, or higher, in the televised pipe.
6. Provide sufficient lighting to illuminate the entire periphery of the pipe.
7. Provide color video.

B. Temporary Bypass Pumping - Conform to Section 33 03 10.

C. Cleaning - Conform to Section 33 04 50.

3.4 INSPECTION (CCTV)

A. General

1. Begin inspection immediately after cleaning of the main.
2. Move camera through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the main's condition.
3. Do not move camera at a speed greater than 30 feet per minute.
4. Use manual winches, power winches, TV cable, and power rewinds that do not obstruct the camera view, allowing for proper evaluation.
5. During investigation stop camera at each defect along the main,
   a. Record the nature, location and orientation of the defect or infiltration location as specified in the CCTV Manual.
6. Pan and tilt the camera to provide additional detail at:
   a. Manholes
   b. Service connections
   c. Joints
   d. Visible pipe defects such as cracks, broken or deformed pipe, holes, offset joints, obstructions or debris
   e. Infiltration/Inflow locations
   f. Pipe material transitions
   g. Other locations that do not appear to be typical for normal pipe conditions
7. Provide accurate distance measurement.
   a. The meter device is to be accurate to the nearest 1/10 foot.
8. CCTV inspections are to be continuous.
   a. Do not provide a single segment of main on more than 1 DVD.

B. Pre-Installation Inspection for Sewer Mains to be rehabilitated

1. Perform Pre-CCTV inspection immediately after cleaning of the main and before rehabilitation work.

2. If, during inspection, the CCTV will not pass through the entire section of main due to blockage or pipe defect, set up so the inspection can be performed from the opposite manhole.
3. Provisions for repairing or replacing the impassable location are addressed in Section 33 31 20.

C. Post-Installation Inspection

1. Complete manhole installation before inspection begins.
2. Prior to inserting the camera, flush and clean the main in accordance to Section 33 04 50.

D. Documentation of CCTV Inspection

1. Follow the CCTV Manual for the inspection video, data logging and reporting.

3.5 REPAIR / RESTORATION [NOT USED]

3.6 RE-INSTALLATION [NOT USED]

3.7 FIELD [OR] SITE QUALITY CONTROL [NOT USED]

3.8 SYSTEM STARTUP [NOT USED]

3.9 ADJUSTING [NOT USED]

3.10 CLEANING

A. See Section 33 04 50.

3.11 CLOSEOUT ACTIVITIES [NOT USED]

3.12 PROTECTION [NOT USED]

3.13 MAINTENANCE [NOT USED]

3.14 ATTACHMENTS [NOT USED]

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bypass pumping of the existing sewer system, required on all sewer lines that are open-cut point repairs or new connections unless otherwise specified in the Contract Documents.
2. Point of Entry (POE) and expected flow in existing system from NTMWD Planning Group effective 8/3/2020 is shown in the following table:

Existing Manhole MX Location	Average Dry Weather Flow (mgd)	2-hr PF (mgd)	Community Loading Pipe, Direction	Loading Pipe P2HF (mgd)	Loading Pipe Invert Elevation
WWMH03557	5.09	49.4	Heath, E	0.30	468.30’
WWMH03557			Heath, W	0.07	470.30’
WWMH03550	5.09	49.3	Heath, E	0.04	469.47’
WWMH03500	5.22	54.3	Heath, SW	0.18	463.00’
			Heath, W	5.39	462.35’
WWMH03465	5.49	54.5	Heath, E	2.34	451.18’
WWMH03450	5.55	54.3	Heath, W	0.50	454.00’
WWMH03425	5.76	55.1	Heath, N	1.05	447.50’
WWMH03365	5.91	56.5	Sonoma Verde, E	0.77	435.85’
WWMH03360	5.92	56.4	Heath, W	0.03	438.98’
WWMH03340	5.95	56.6	Heath, W	0.48	432.25’
WWMH03330	5.95	56.5	Heath, E	0.29	436.51’
WWMH03290	5.98	56.3	Heath, E	0.17	430.22’
WWMH03260	5.99	56.3	Heath, E	0.27	424.09’
WWMH03240	5.99	56.4	Heath, E	0.20	421.71’
WWMH03230	6.50	61.8	Heath, W	6.50	415.03’
WWMH03095	7.40	64.1	Devonshire, E	3.20	396.16’

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 01 – General Requirements

1.02 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00 Payment Procedures.

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. Occupational Safety and Health Organization (OSHA).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination
1. Schedule meeting with District to review sewer shutdown prior to replacing or rehabilitating any facilities.
2. District reserves the right to delay schedule due to weather conditions, or other unexpected emergency within the sewer system.
3. Review bypass pumping arrangement or layout in the field with District prior to beginning operations. Facilitate preliminary bypass pumping run with District staff present to affirm the operation is satisfactory to the District.
4. After replacement or rehabilitation of facilities, coordinate the reestablishment of sewer flow with District staff.
5. Provide onsite continuous monitoring during all bypass pumping operations using one of the following methods:
   a. Personnel on site
   b. Portable SCADA equipment

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the Engineer or the District prior to delivery.

1.06 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Submit a detailed plan and description outlining all provisions and precautions that will be taken with regard to the handling of sewer flows. Submit the plan to the District for approval a minimum of 14 days prior to commencing work. Include the following details:
1. Schedule for installation and maintenance of the bypass pumping system
2. Staging areas for pumps
3. Pump sizes, capacity, number of each size, and power requirements
4. Calculations for static lift, friction losses, and velocity
5. Pump curves showing operating range and system head curves
6. Sewer plugging methods
7. Size, length, material, joint type, and method for installation of suction and discharge piping
8. Method of noise control for each pump and/or generator, if required
9. Standby power generator size and location
10. Suction and discharge piping plan
11. Emergency action plan identifying the measures taken in the event of a pump failure or sewer spill
12. Staffing plan for responding to alarm conditions identifying multiple contacts by name and phone numbers (office, mobile)

13. A contingency plan to implement in the event the replacement or rehabilitation has unexpected delays or problems

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Pumping

1. Provide equipment that shall meet or exceed the projected peak wet-weather flow for Buffalo Creek Parallel Interceptor.
2. Provide fully automatic self-priming pumps. Foot-valves or vacuum pumps are not permitted for priming the system.
3. Pumps must be constructed to allow dry running for periods of time to account for the cyclical nature of sewer flow.
4. Provide 1 stand-by pump for each size to be maintained on site. Place backup pumps on line, isolated from the primary system by valve.
5. If multiple pumps are required to meet the flow requirements, provide the necessary fittings and connections to incorporate multiple discharges.
6. Noise levels of the pumping system must follow the requirements per each City's noise ordinance.

B. Piping

1. Install pipes with joints which prevent the incident of flow spillage.

C. Plugs or Stop Logs

1. Plugs
   a. Select a plug that is made for the size and potential pressure head that will be experienced.
   b. Provide an additional anchor, support or bracing to secure plug when back pressure is present.
   c. Use accurately calibrated air pressure gauges for monitoring the inflation pressure.
   d. Place inflation gauge at location outside of confined space area. Keep the inflation gauge and valve a safe distance from the plugs.
   e. Never over inflate the plug beyond its pressure rating.
2. Stop Logs
   a. Use stop log devices designed for the manhole or sewer vault structure in use.
   b. If applicable, obtain stop logs from District that may be used on specific structures.

PART 3 - EXECUTION

3.01 PREPARATION

A. Locate the bypass pipelines in area to minimize disturbance to existing utilities and obtain approval of those locations from the District.

B. Make preparations to comply with OSHA requirements when working in the presence of sewer gases, oxygen-deficient atmospheres and confined spaces.

C. Do not begin bypass preparation and operation until District approval of the submittals requested per this Specification.

3.02 INSTALLATION

A. Install and operate pumping and piping equipment in accordance to the submittals provided per this Specification.

B. Sewer flow stoppage

1. Plugging
   a. Use confined space procedures and equipment during installation when necessary.
   b. Thoroughly clean the pipe before insertion of the plug.
   c. Insert the plug seal surface completely so it is fully supported by the pipe.
   d. Position the plug where there are not sharp edges or protrusions that may damage the plug.
   e. Use pressure gauges for measuring inflation pressures.
   f. Minimize upstream pressure head before deflating and removing.

C. Sewer flow control and monitoring

1. Take sufficient precautions to ensure sewer flow operations do not cause flooding or damage to public or private property. The Contractor is responsible for any damage resulting from bypass pumping operations.
2. Begin continual monitoring of the sewer system as soon as the sewer is plugged or blocked. Be prepared to immediately start bypass pumping if needed due to surcharge conditions.
3. Sewer discharge may be into another sewer manhole or appropriate vehicle or container only. Do not discharge sewer into an open environment such as an open channel or earthen holding facility.
4. Do not construct bypass facilities where vehicular traffic may travel over the piping.
   a. Provide details in the suction and discharge piping plan that accommodate both the bypass facilities and traffic without disrupting either service.

3.03 FIELD [OR] SITE QUALITY CONTROL

A. Field [OR] Site Tests and Inspections

1. Perform leakage and pressure tests of the bypass pumping pipe and equipment before actual operation begins. Have District staff on site during tests.

3.04 CLOSEOUT ACTIVITIES

A. Once plugging or blocking is no longer necessary, remove in such a way that permits the sewer flow to slowly return to normal – preventing surge, surcharging and major downstream disturbance.

END OF SECTION

1.00 GENERAL

1.01 RELATED REQUIREMENTS

1. Section 01 33 00 – Submittals: Shop Drawings, Product Data, and Samples

1.02 SUMMARY

1. This section includes passive system odor control:
    a. Odor control piping and accessories.

1.03 PERFORMANCE REQUIREMENTS

A. Passive Systems

a. All MH vents and ARV's shall have a 110 gallon carbon can

1. TCEQ Variance if possible to eliminate Carbon Cans on the interceptor MH vents if an Active Odor control system is pulling air from the wet well and the interceptor is not surcharged.

2. Operations uses a standard carbon specification: "Odor Control Carbon \ Specification – Final – UPDATED.docx" from NTMWD

1.04 SUBMITTALS

The following shall be submitted by contractor in accordance with Section 01 33 00 Submittal Procedures:

B. Product Data for the following:

a. Preferred Carbon Can Manufactures are:

1. Prominent Systems Inc.
2. Continental Carbon Group – Odor Control Carbon\Carbon Can spec.pdf
3. Evoqua
4. Others may be named, coordinate with Josh Forte, Lead Odor Control Operator

b. Vent is preferred on the lower side of the can, this helps with the condensation in the carbon can.

c. All vents shall be located above the 100-year flood plain,.

C. Bidders must include the following with the bid:

a. Completed Bid Form and Bid Form Exhibit A, including five (5) references for which the bidder has provided similar materials/services for in the last five (5) years.

b. Specification sheets with technical information.

c. Point of origin and manufacturer of the carbon.

d. Raw material of activated carbon.

e. Carbon media capacity test reports following ASTM D6646 protocol to verify H2S capacity.

D. Failure to provide the required information may be cause for rejection of the bid as non-compliant.

1.05 TECHNICAL REQUIREMENTS

A. Activated carbon to be furnished shall be virgin (i.e. not reactivated). Carbons regenerated onsite with hydroxides, water or other processes to meet the specified H2S Breakthrough Capacity will not be accepted. No alkali or caustic impregnated activated carbon will be accepted.

B. Activated carbon shall be derived from acceptable raw materials including lignite coal, subbituminous coal, or bituminous coal.

C. Activated carbon must be visually free of clay, dirt and deleterious material.

D. Activated carbon must be suitable for continuous removal of hydrogen sulfide (H2S) and other odor causing compounds such as mercaptans, indoles, and skatoles found in gases emitted during wastewater conveyance and treatment.

E. Carbon pressure drop must not exceed 1.7” w.c. per foot of bed depth at a media bed face velocity of 50 fpm.

F. The activated carbon shall be one of the following:

1. Evoqua Midas® OCM
2. ECS Sulfadsorb HC
3. PureAir Filtration Sulphasorb XL
4. Purafil Odorcarb Ultra Media
5. Jacobi Sulfox HC
6. Haycarb Rias 2010

G. Even if included in the list in Article III.F, the activated carbon to be furnished shall meet the requirements throughout the specification and have adsorptive and physical characteristics as provided in Table 1:

TABLE 1 – Carbon Adsorptive and Physical Characteristics

Parameter	Value	Test Procedure
H2S Breakthrough Capacity, g H2S/cc	0.3 min	ASTM D6646
Carbon Tetrachloride Activity, %	60 min	ATSM D3467
Ash, weight %	5 max	ASTM D2866
Moisture, weight/weight %	15 max	ASTM D2867
Hardness No.	95 min	ASTM D3802
Apparent Density, g/ml	0.40 - 0.50	ASTM D2854
Mean Particle Diameter, mm	3.7 – 4.1	ASTM D2862
Sieve Size Greater than 4 Mesh (4.75 mm), % Less than 8 Mesh (2.38 mm), %	 10 max 5 max	ASTM D2862

H. Carbon Testing

1. NTMWD retains the right to have the media tested by its own lab and/or a certified laboratory of its choosing to verify the supplied media meets all specifications.

2. If this test fails to meet the stated specifications it shall be the responsibility of the successful bidder to replace the defective media, reimburse NTMWD for all test expenses, and reimburse NTMWD for all costs associated with disposal of the defective media and replacement if not promptly replaced by the manufacturer.

3. The second shipment will then be reanalyzed at the supplier's cost and if the carbon media fails again the successful bidder shall once again reimburse the NTMWD for all costs for shipping product back to supplier and all costs associated for a new shipment of carbon media.

4. If at any point NTMWD believes the successful bidder cannot supply the carbon media as specified, NTMWD may cancel its purchase order and may purchase the carbon media from a different supplier at no cost to NTMWD.

1.06 DELIVERY, STORAGE, AND HANDLING

A. All cans, pipes, carbon and fittings shall be delivered to the site and unloaded with handling that conforms to the manufacturer's instructions for reasonable care. Pipe shall not be rolled or dragged over gravel or rock during handling.

2.00 PRODUCTS – NOT USED

3.00 EXECUTION – NOT USED

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. General

1. Before any television inspection, any sewer main shall be cleaned to remove all debris, solids, sand, grease, grit, etc. from the sewer and manholes.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Contracts
2. Division 1 – General Requirements
3. Section 33 01 31 – Closed Circuit Television (CCTV) Inspection

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement
   a. Measurement for this item will be by the linear foot of line cleaned.
2. Payment
   a. The work performed conforming to this section is subsidiary to closed circuit TV inspection of sewer lines, Section 33 01 30.16.

2.00 PRODUCTS

2.01 PRODUCT TYPES

A. Use only the type of cleaning material which will not create hazards to health or property or affect treatment plant processes.

3.00 EXECUTION

3.01 CLEANING

A. General

1. All materials, equipment, and personnel necessary to complete the cleaning of the sanitary sewer main and manholes must be present on the jobsite prior to isolating the sewer manhole or line segment and beginning the cleaning process.
2. Maintain clean work and surrounding premises within the work limits so as to comply with Federal, State, and local environmental and anti-pollution laws, ordinances, codes, and regulations when cleaning and disposing of waste materials, debris, and rubbish.
3. Keep the work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris, and rubbish.
4. Suitable containers for storage of waste materials, debris, and rubbish shall be provided until time of disposal.
   a. It is the sole responsibility of the Contractor to secure a licensed legal dump site for the disposal of this material.
   b. Under no circumstances shall sewage or solids removed from the main or manhole be dumped onto streets or into ditches, catch basins, storm drains, or sanitary sewers.
5. The cleaning process shall remove all grease, sand, silts, solids, rags, debris, etc. from each sewer segment, including the manhole(s).
6. Selection of cleaning equipment and the method for cleaning shall be based on the

condition of the sanitary sewer mains at the time work commences and will be subject to approval by the Owner.

7. All cleaning equipment and devices shall be operated by experienced personnel.
8. Satisfactory precautions shall be taken to protect the sanitary sewer mains and manholes from damage that might be inflicted by the improper use of the cleaning process or equipment.
9. Any damages done to a sewer main and/or structure by the Contractor shall be repaired by the Contractor at no additional cost and to the satisfaction of the Owner.
10. Cleaning shall also include the manhole wall washing by high pressure water jet.
11. The Contractor may be required to demonstrate the performance capabilities of the cleaning equipment proposed for use on the project.
    a. If the results obtained by the proposed sanitary sewer cleaning equipment are not satisfactory, the Contractor shall use different equipment and/or attachments, as required, to meet Owner satisfaction.
    b. More than 1 type of equipment/attachments may be required at a location.
12. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, dam, or suction shall be constructed in the downstream manhole in such a manner that all the solids and debris are trapped for removal.
13. Whenever hydraulically-propelled cleaning tools which depend upon water pressure to provide their cleaning force, or any tool which retard the flow of water in the sanitary sewer lines are used, precautions shall be taken to insure that the water pressure created does not cause any damage or flooding to public or private property being served by the manhole section involved.
14. Any damage of property, as a result of flooding, shall be the liability and responsibility of the Contractor.
15. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.
16. When additional quantities of water from fire hydrants are necessary to avoid delay in normal working procedures, the water shall be conserved and not used unnecessarily.
    a. No fire hydrant shall be obstructed or used when there is a fire in the area.
    b. It is the responsibility of the Contractor to obtain the fire hydrant, water meter and all related charges for the set-up, including the water usage bills from respective water purveyor agency.
    c. All expenses shall be considered incidental to the cleaning of the existing sanitary sewer mains.

B. Methods

1. Hydraulic Cleaning
    a. Hydraulic-propelled devices which require a head of water to operate must utilize a collapsible dam.
    b. The dam must be easily collapsible to prevent damage to the sewer main, property, etc.
    c. When using hydraulically-propelled devices, precautions shall be taken to insure that the water pressure created does not cause damage or flood public or private property.

d. Do not increase the hydraulic gradient of the sanitary sewers beyond the elevation that could cause overflow of sewage into area waterways or laterals.

e. The flow of wastewater present in the sanitary sewer main shall be utilized to provide necessary fluid for hydraulic cleaning devices whenever possible.

2. High-Velocity Cleaning

a. Cleaning equipment that uses a high velocity water jet for removing debris shall be capable of producing a minimum volume of 50 gpm, with a pressure of 1,500 psi, for the sanitary sewer line and 3,500 psi for the (manhole) structure at the pump.

i. Any variations to this pumping rate must be approved, in advance, by the Owner.

ii. To prevent damage to older sewer mains and property, a pressure less than 1500 psi can be used.

iii. A working pressure gauge shall be used on the discharge of all high pressure water pumps.

iv. For sewers 18 inches and larger in diameter, in addition to conventional nozzles, use a nozzle which directs the cleaning force to the bottom of the pipe.

v. Operate the equipment so that the pressurized nozzle continues to move at all times.

vi. The pressurized nozzle shall be turned off or reduced anytime the hose is on hold or delayed in order to prevent damage to the line.

3. Mechanical Cleaning

a. Mechanical cleaning, in addition to normal cleaning when required, shall be with approved equipment and accessories driven by power winching devices.

b. Submit the equipment manufacturer's operational manual and guidelines to the Owner, which shall be followed strictly unless modified by the Owner.

c. All equipment and devices shall be operated by experienced operators so that they do not damage the pipe in the process of cleaning.

d. Buckets, scrapers, scooters, porcupines, kites, heavy duty brushes, and other debris removing equipment/accessories shall be used as appropriate and necessary in the field, in conjunction with the approved power machines.

e. The use of cleaning devices such as rods, metal pigs, porcupines, root saws, snakes, scooters, sewer balls, kites, and other approved equipment, in conjunction with hand winching device, and/or gas, electric rod propelled devices, shall be considered normal cleaning equipment.

END OF SECTION

33 05 10 UTILITY TRENCH EXCAVATION, EMBEDMENT, AND BACKFILL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, Embedment and Backfill for:
      a. Pressure Applications
         1) Wastewater Force Main
      b. Gravity Applications
         1) Wastewater Gravity Mains
   2. Including:
      a. Excavation of all material encountered, including rock and unsuitable materials
      b. Disposal of excess unsuitable material
      c. Site specific trench safety
      d. Pumping and dewatering
      e. Embedment
      f. Concrete encasement for utility lines
      g. Backfill
      h. Compaction

B. Related Specification Sections include, but are not necessarily limited to:
   1. Division 00 – Procurement and Contracting Requirements
   2. Division 01 – General Requirements
   3. Section 02 16 10 – Excavation Safety
   4. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete
   5. Section 03 34 13 – Controlled Low Strength Material (CLSM)
   6. Section 31 25 00 – Erosion and Sediment Control
   7. Section 31 41 33 – Trench Safety Requirements
   8. Appendix A - FINAL REPORT_94175317 Geo Report - Buffalo Creek Interceptor Sewer_S
   9. Appendix B - GeoReport for Country Club Pond Wall 94195009_S

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Utility Company Notification
      a. Notify area utility companies at least 48 hours in advance, excluding weekends and holidays, before starting excavation.
      b. Request the location of buried lines and cables in the vicinity of the proposed work.

B. Sequencing
   1. Sequence work for each section of the pipe installed to complete the embedment and backfill placement on the day the pipe foundation is complete.
   2. Sequence work such that proctors are complete in accordance with ASTM D698 prior to commencement of construction activities.

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.5 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Provide detailed drawings and explanation for ground water and surface water control, if required.
2. Trench Safety Plan in accordance with Occupational Safety and Health Administration CFR 29, Part 1926-Safety Regulations for Construction, Subpart P - Excavations
3. Stockpiled excavation and/or backfill material
    a. Provide a description of the storage of the excavated material only if the Contract Documents do not allow storage of materials in the right-of-way of the easement.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Storage

1. Within Existing Rights-of-Way (ROW)
    a. Spoil, imported embedment and backfill materials may be stored within existing ROW, easements or temporary construction easements, unless specifically disallowed in the Contract Documents.
    b. Do not block drainage ways, inlets or driveways.
    c. Provide erosion control in accordance with Section 31 25 00.
    d. Store materials only in areas barricaded as provided in the traffic control plans.
    e. In non-paved areas, do not store material on the root zone of any trees or in landscaped areas.
2. Designated Storage Areas
    a. If the Contract Documents do not allow the storage of spoils, embedment or backfill materials within the ROW, easement or temporary construction easement, then secure and maintain an adequate storage location.
    b. Provide an affidavit that rights have been secured to store the materials on private property.
    c. Provide erosion control in accordance with Section 31 25 00.
    d. Do not block drainage ways.
    e. Only materials used for 1 working day will be allowed to be stored in the work zone.

B. Deliveries and haul-off - Coordinate all deliveries and haul-off.

1.7 FIELD [SITE] CONDITIONS

A. Existing Conditions

1. Any data which has been or may be provided on subsurface conditions is not intended as a representation or warranty of accuracy or continuity between soils. It is expressly understood that neither District nor the Engineer will be responsible for interpretations or conclusions drawn there from by the Contractor.

2. Data is made available for the convenience of the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials

1. Utility Sand
   a. Granular and free flowing
   b. Generally meets or exceeds the limits on deleterious substances per Table 1 for fine aggregate according to ASTM C 33
   c. Reasonably free of organic material
   d. Gradation:

Sieve Size	Percent Retained
1 inch	0
3/8 inch	0-10
#40	20-60
#100	95

2. Crushed Rock
   a. Durable crushed rock or recycled concrete
   b. Meets the gradation of ASTM D448 size numbers 56, 57 or 67
   c. May be unwashed
   d. Free from significant silt clay or unsuitable materials
   e. Percentage of wear not more than 40 percent per ASTM C131 or C535
   f. Not more than a 12 percent maximum loss when subjective to 5 cycles of sodium sulfate soundness per ASTM C88
3. Fine Crushed Rock
   a. Durable crushed rock
   b. Meets the gradation of ASTM D448 size numbers 8 or 89
   c. May be unwashed
   d. Free from significant silt clay or unsuitable materials.
   e. Have a percentage of wear not more than 40 percent per ASTM C131 or C535
   f. Not more than a 12 percent maximum loss when subjective to 5 cycles of sodium sulfate soundness per ASTM C88
4. Ballast Stone
   a. Stone ranging from 3 inches to 6 inches in greatest dimension.
   b. May be unwashed
   c. Free from significant silt clay or unsuitable materials
   d. Percentage of wear not more than 40 percent per ASTM C131 or C535
   e. Not more than a 12 percent maximum loss when subjected to 5 cycles of sodium sulfate soundness per ASTM C88
5. Acceptable Backfill Material
   a. In-situ or imported soils classified as CL, CH, SC or GC in accordance with ASTM D2487
   b. Free from deleterious materials, boulders over 6 inches in size and organics
   c. Can be placed free from voids
   d. Must have 20 percent passing the number 200 sieve

6. Blended Backfill Material
   a. In-situ soils classified as SP, SM, GP or GM in accordance with ASTM D2487
   b. Blended with in-situ or imported acceptable backfill material to meet the requirements of an Acceptable Backfill Material
   c. Free from deleterious materials, boulders over 6 inches in size and organics
   d. Must have 20 percent passing the number 200 sieve
7. Unacceptable Backfill Material
   a. In-situ soils classified as ML, MH, PT, OL or OH in accordance with ASTM D2487
8. Select Fill
   a. Classified as SC or CL in accordance with ASTM D2487
   b. Liquid limit less than 35
   c. Plasticity index between 8 and 20
9. Cement Stabilized Sand (CSS)
   a. Sand
      1) Shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33 and the following requirements:
         a) Classified as SW, SP, or SM by the United Soil Classification System of ASTM D2487
         b) Deleterious materials
            (1) Clay lumps, ASTM C142, less than 0.5 percent
            (2) Lightweight pieces, ASTM C123, less than 5.0 percent
            (3) Organic impurities, ASTM C40, color no darker than standard color
            (4) Plasticity index of 4 or less when tested in accordance with ASTM D4318.
   b. Minimum of 4 percent cement content of Type I/II portland cement
      1) Potable water, free of soils, acids, alkalis, organic matter or other deleterious substances, meeting requirements of ASTM C94
   c. Mix in a stationary pug mill, weigh-batch or continuous mixing plant.
   d. Strength
      1) 50 to 150 psi compressive strength at 2 days in accordance with ASTM D1633, Method A
      2) 200 to 250 psi compressive strength at 28 days in accordance with ASTM D1633, Method A
      3) The maximum compressive strength in 7 days shall be 400 psi. Backfill that exceeds the maximum compressive strength shall be removed by the Contractor for no additional compensation.
   e. Random samples of delivered product will be taken in the field at point of delivery for each day of placement in the work area. Specimens will be prepared in accordance with ASTM D1632.
10. Controlled Low Strength Material (CLSM)
    a. Conform to Section 03 34 13
11. Trench Geotextile Fabric
    a. Soils other than ML or OH in accordance with ASTM D2487
       1) Needle punch, nonwoven geotextile composed of polypropylene fibers
       2) Fibers shall retain their relative position
       3) Inert to biological degradation
       4) Resist naturally occurring chemicals
       5) UV Resistant

6) Mirafi 140N by Tencate, or approved equal
b. Soils Classified as ML or OH in accordance with ASTM D2487
1) High-tenacity monofilament polypropylene woven yarn
2) Percent open area of 8 percent to10 percent
3) Fibers shall retain their relative position
4) Inert to biological degradation
5) Resist naturally occurring chemicals
6) UV Resistant
7) Mirafi FW402 by Tencate, or approved equal

12. Concrete Encasement
a. Conform to Section 03 30 53, if applicable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

1. Review all known, identified or marked utilities, whether public or private, prior to excavation.
2. Locate and protect all known, identified and marked utilities or underground facilities as excavation progresses.
3. Notify all utility owners within the project limits 48 hours prior to beginning excavation.
4. The information and data shown in the Drawings with respect to utilities is approximate and based on record information or on physical appurtenances observed within the project limits.
5. Coordinate with the owner(s) of underground facilities.
6. Immediately notify any utility owner of damages to underground facilities resulting from construction activities.
7. Repair any damages resulting from the construction activities.

B. Notify District and/or Engineer immediately of any changed condition that impacts excavation and installation of the proposed utility.

3.2 PREPARATION

A. Protection of In-Place Conditions

1. Pavement
a. Conduct activities in such a way that does not damage existing pavement that is designated to remain.
1) Where desired to move equipment not licensed for operation on public roads or across pavement, provide means to protect the pavement from all damage.
b. Repair or replace any pavement damaged due to the negligence of the contractor outside the limits designated for pavement removal at no additional cost to District.
2. Drainage
a. Maintain positive drainage during construction and re-establish drainage for all swales and culverts affected by construction.

3. Trees
    a. When operating outside of existing ROW, stake permanent and temporary construction easements.
    b. Restrict all construction activities to the designated easements and ROW.
    c. Flag and protect all trees designated to remain in accordance with plans and specifications.
    d. Conduct excavation, embedment and backfill in a manner such that there is no damage to the tree canopy.
    e. Prune or trim tree limbs as specifically allowed by the Drawings or as directed by the inspector.
        1) Pruning or trimming may only be accomplished with equipments specifically designed for tree pruning or trimming.
    f. Remove trees specifically designated to be removed in the Drawings as directed by the inspector.
4. Above ground Structures
    a. Protect all above ground structures adjacent to the construction.
5. Traffic
    a. Maintain existing traffic, except as modified by the traffic control plan.
    b. Do not block access to driveways or alleys for extended periods of time unless:
        1) Alternative access has been provided
        2) Proper notification has been provided to the property owner or resident
        3) It is specifically allowed in the traffic control plan
    c. Use traffic rated plates to maintain access until access is restored.
6. Traffic Signal – Poles, Mast Arms, Pull boxes, Detector loops
    a. Notify the City's Traffic Services Division that has jurisdiction over the construction location a minimum of 48 hours prior to any excavation that could impact the operations of an existing traffic signal.
    b. Protect all traffic signal poles, mast arms, pull boxes, traffic cabinets, conduit and detector loops.
    c. Immediately notify the City's Traffic Services Division that has jurisdiction over the construction location if any damage occurs to any component of the traffic signal due to the contractors activities.
    d. Repair any damage to the traffic signal poles, mast arms, pull boxes, traffic cabinets, conduit and detector loops as a result of the construction activities.
7. Fences
    a. Protect all fences designated to remain.
    b. Leave fence in the equal or better condition as prior to construction.

3.3 INSTALLATION

A. Excavation

1. Excavate to a depth indicated on the Drawings.
2. Trench excavations are defined as unclassified. No additional payment shall be granted for rock or other in-situ materials encountered in the trench.
3. Excavate to a width sufficient for laying the pipe in accordance with the Drawings and bracing in accordance with the Excavation Safety Plan.
4. The bottom of the excavation shall be firm and free from standing water.

a. Notify Engineer immediately if the water and/or the in-situ soils do not provide for a firm trench bottom.
b. District/Engineer will determine if any changes are required in the pipe foundation or bedding.

5. Unless otherwise permitted by the Drawings or by District/Engineer, the limits of the excavation shall not advance beyond the pipe placement so that the trench may be backfilled in the same day.
6. Over Excavation
   a. Fill over excavated areas with the specified bedding material as specified for the specific pipe to be installed.
   b. No additional payment will be made for over excavation or additional bedding material.
7. Unacceptable Backfill Materials
   a. In-situ soils classified as unacceptable backfill material shall be separated from acceptable backfill materials.
   b. If the unacceptable backfill material is to be blended in accordance with this Specification, then store material in a suitable location until the material is blended.
   c. Remove all unacceptable material from the project site that is not intended to be blended or modified.
8. Rock – No additional compensation will be paid for rock excavation or other changed field conditions.

B. Shoring, Sheeting and Bracing
1. Engage a Licensed Professional Engineer in the State of Texas to design a site specific excavation safety system in accordance with Federal and State requirements.
2. Excavation protection systems shall be designed according to the space limitations as indicated in the Drawings.
3. Furnish, put in place and maintain a trench safety system in accordance with the Excavation Safety Plan and required by Federal, State or local safety requirements.
4. If soil or water conditions are encountered that are not addressed by the current Excavation Safety Plan, engage a Licensed Professional Engineer in the State of Texas to modify the Excavation Safety Plan and provide a revised submittal to District
5. Do not allow soil, or water containing soil, to migrate through the Excavation Safety System in sufficient quantities to adversely affect the suitability of the Excavation Protection System. Movable bracing, shoring plates or trench boxes used to support the sides of the trench excavation shall not:
   a. Disturb the embedment located in the pipe zone or lower
   b. Alter the pipe's line and grade after the Excavation Protection System is removed
   c. Compromise the compaction of the embedment located below the spring line of the pipe and in the haunching

C. Water Control
1. Surface Water
   a. Furnish all materials and equipment and perform all incidental work required to direct surface water away from the excavation.

2. Ground Water
   a. Furnish all materials and equipment to dewater ground water by a method which preserves the undisturbed state of the subgrade soils.
   b. Do not allow the pipe to be submerged within 24 hours after placement.
   c. Do not allow water to flow over concrete until it has sufficiently cured.
   d. Engage a Licensed Engineer in the State of Texas to prepare a Ground Water Control Plan if any of the following conditions are encountered:
      1) A Ground Water Control Plan is specifically required by the Contract Documents
      2) If in the sole judgment of District, ground water is so severe that an Engineered Ground Water Control Plan is required to protect the trench or the installation of the pipe which may include:
         a) Ground water levels in the trench are unable to be maintained below the top of the bedding
         b) A firm trench bottom cannot be maintained due to ground water
         c) Ground water entering the excavation undermines the stability of the excavation.
         d) Ground water entering the excavation is transporting unacceptable quantities of soils through the Excavation Safety System.
   e. Control of ground water shall be considered subsidiary to the excavation when:
      1) No Ground Water Control Plan is specifically identified and required in the Contract Documents
   f. Ground Water Control Plan installation, operation and maintenance
      1) Furnish all materials and equipment necessary to implement, operate and maintain the Ground Water Control Plan.
      2) Once the excavation is complete, remove all ground water control equipment not called to be incorporated into the work.
   g. Water Disposal
      1) Dispose of ground water in accordance with applicable local ordinances.
      2) Do not discharge ground water onto or across private property without written permission.
      3) Permission from District is required prior to disposal into the Sanitary Sewer.
      4) Disposal shall not violate any Federal, State or local regulations.

D. Embedment and Pipe Placement
   1. Sanitary Sewer Lines and Storm Sewer Lines (Flexible Pipe, e.g.: HDPE)
      a. The entire embedment zone shall be of uniform material.
      b. Crushed rock shall be used for embedment.
      c. Place evenly spread bedding material on a firm trench bottom.
      d. Spread bedding so that lines and grades are maintained and that there are no sags in the sanitary sewer pipe line.
      e. Provide firm, uniform bedding.
         1) Additional bedding may be required if ground water is present in the trench.
         2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
      f. Place pipe on the bedding according to the alignment shown in the Drawings.
      g. The pipe line shall be within ±0.1 inches of the elevation, and be consistent with the grade shown on the Drawings.

h. Place and compact embedment material to adequately support haunches in accordance with the pipe manufacturer's recommendations.
i. For sewer lines greater than 30 inches in diameter, the embedment lift shall not exceed the spring line prior to compaction.
j. Place remaining embedment including initial backfill to a minimum of 6 inches, but not more than 12 inches, above the pipe.
k. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
l. Density test shall be performed by Contractor to verify that the compaction of embedment meets requirements and provided to the District.
m. Place trench geotextile fabric on top of the initial backfill.
n. Place marker tape on top of the trench geotextile fabric, as directed.

2. Storm Sewer (RCP)
   a. The bedding and the pipe zone up to the spring line shall be of uniform material.
   b. Crushed rock shall be used for embedment up to the spring line.
   c. The specified backfill material may be used above the spring line.
   d. Place evenly spread bedding material on a firm trench bottom.
   e. Spread bedding so that lines and grades are maintained and that there are no sags in the storm sewer pipe line.
   f. Provide firm, uniform bedding.
      1) Additional bedding may be required if ground water is present in the trench.
      2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
   g. Place pipe on the bedding according to the alignment of the Drawings.
   h. The pipe line shall be within ±0.1 inches of the elevation, and be consistent with the grade, shown on the Drawings.
   i. Place embedment material up to the spring line.
      1) Place embedment to ensure that adequate support is obtained in the haunch.
   j. Compact the embedment and initial backfill to 95 percent Standard Proctor ASTM D 698.
   k. Density test shall be performed by Contractor to verify that the compaction of embedment meets requirements and provided to the District.
   l. Place trench geotextile fabric on top of pipe and crushed rock.

3. Sanitary Sewer Reinforced Concrete Junction Box
   a. Crushed rock shall be used for bedding.
   b. The pipe zone and the initial backfill shall be:
      1) Crushed rock, or
      2) Acceptable backfill material compacted to 95 percent Standard Proctor density
   c. Place evenly spread compacted bedding material on a firm trench bottom.
   d. Spread bedding so that lines and grades are maintained and that there are no sags in the storm sewer pipe line.
   e. Provide firm, uniform bedding.
      1) Additional bedding may be required if ground water is present in the trench.
      2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
   f. Fill the annular space between multiple boxes with crushed rock, CLSM according to 03 34 13.

g. Place pipe on the bedding according to the alignment of the Drawings.
h. The pipe shall be within ±0.1 inches of the elevation, and be consistent with the grade, shown on the Drawings.
i. Compact the embedment initial backfill to 95 percent Standard Proctor ASTM D698.

4. Water Services (Less than 2 Inches in Diameter) **(NOT APPLICABLE)**
5. Sanitary Sewer Services
   a. The entire embedment zone shall be of uniform material.
   b. Crushed rock shall be used for embedment.
   c. Place evenly spread bedding material on a firm trench bottom.
   d. Spread bedding so that lines and grades are maintained and that there are no sags in the sanitary sewer pipe line.
   e. Provide firm, uniform bedding.
      1) Additional bedding may be required if ground water is present in the trench.
      2) If additional crushed rock is required which is not specifically identified in the Contract Documents, then crushed rock shall be paid by the pre-bid unit price.
   f. Place pipe on the bedding according to the alignment of the Drawings.
   g. Place remaining embedment, including initial backfill, to a minimum of 6 inches, but not more than 12 inches, above the pipe.
   h. Compact the initial backfill to 95 percent Standard Proctor ASTM D698.
   i. Density test may be required to verify that the compaction meets the density requirements.

E. Trench Backfill

1. Pipe Embedment shall be Class “H” – Compacted Crushed Stone – Standard Gradation.
2. At a minimum, place backfill in such a manner that the required in-place density and moisture content is obtained, and so that there will be no damage to the surface, pavement or structures due to any trench settlement or trench movement.
   a. Meeting the requirement herein does not relieve the responsibility to damages associated with the Work.
3. Backfill Material
   a. Final backfill depth less than 15 feet
      1) Backfill with:
         a) Acceptable backfill material
         b) Blended backfill material, or
         c) Select backfill material, CSS, or CLSM when specifically required
   b. Final backfill depth 15 feet or greater: (under pavement or future pavement)
      1) Backfill depth from 0 to15 feet deep
         a) Backfill with:
            (1) Acceptable backfill material
            (2) Blended backfill material, or
            (3) Select backfill material, CSS, or CLSM when specifically required
      2) Backfill depth from 15 feet and greater
         a) Backfill with:
            (1) Select Fill
            (2) CSS, or
            (3) CLSM when specifically required

c. Final backfill depth 15 feet or greater: (not under pavement or future pavement)
   1) Backfill with:
      a) Acceptable backfill (select material, CLSM, (CSS – approved alternate to CLSM in upper lifts) or
      b) Blended backfill material
d. Backfill for service lines:
   1) Backfill for sewer service lines shall be the same as the requirement of the main that the service is connected to.

4. Required Compaction and Density
   a. Final backfill (depths less than 15 feet)
      1) Compact acceptable backfill material, blended backfill material or select backfill to a minimum of 95 percent Standard Proctor per ASTM D698 at moisture content within -2 to +5 percent of the optimum moisture.
      2) CSS or CLSM requires no compaction.
   b. Final backfill (depths 15 feet and greater/under existing or future pavement)
      1) Compact select backfill to a minimum of 98 percent Standard Proctor per ASTM D 698 at moisture content within -2 to +5 percent of the optimum moisture.
      2) CSS or CLSM requires no compaction.
   c. Final backfill (depths 15 feet and greater/not under existing or future pavement)
      1) Compact acceptable backfill material blended backfill material, or select backfill to a minimum of 95 percent Standard Proctor per ASTM D 698 at moisture content within -2 to +5 percent of the optimum moisture.
5. Saturated Soils
   a. If in-situ soils consistently demonstrate that they are greater than 5 percent over optimum moisture content, the soils are considered saturated.
   b. Flooding the trench or water jetting is strictly prohibited.
   c. If saturated soils are identified in the Drawings or Geotechnical Report in the Appendix, Contractor shall proceed with Work following all backfill procedures outlined in the Drawings for areas of soil saturation greater than 5 percent.
   d. If saturated soils are encountered during Work but not identified in Drawings or Geotechnical Report in the Appendix:
      1) The Contractor shall:
         a) Immediately notify District.
      2) District shall:
         a) Investigate soils and determine if Work can proceed in the identified location.
         b) Direct the Contractor of changed backfill procedures associated with the saturated soils that may include:
            (1) Imported backfill
            (2) A site specific backfill design
6. Placement of Backfill
   a. Use only compaction equipment specifically designed for compaction of a particular soil type and within the space and depth limitation experienced in the trench.
   b. Flooding the trench or water jetting is strictly prohibited.
   c. Place in loose lifts not to exceed 12 inches.

d. Compact to specified densities.
e. Compact only on top of initial backfill, undisturbed trench or previously compacted backfill.
f. Remove any loose materials due to the movement of any trench box or shoring or due to sloughing of the trench wall.

7. Backfill Means and Methods Demonstration
   a. Notify District in writing with sufficient time for to obtain samples and perform standard proctor test in accordance with ASTM D698.
   b. The results of the standard proctor test must be received prior to beginning excavation.
   c. Upon commencing of backfill placement for the project the Contractor shall demonstrate means and methods to obtain the required densities.
   d. Demonstrate Means and Methods for compaction including:
      1) Depth of lifts for backfill which shall not exceed 12 inches
      2) Method of moisture control for excessively dry or wet backfill
      3) Placement and moving trench box, if used
      4) Compaction techniques in an open trench
      5) Compaction techniques around structure
   e. Provide a testing trench box to provide access to the recently backfilled material.
   f. Contractor shall provide a qualified testing lab full time during this period to randomly test density and moisture continent.
      1) The testing lab will provide results as available on the job site.
8. Varying Ground Conditions
   a. Notify District of varying ground conditions and the need for additional proctors.
   b. Request additional proctors when soil conditions change.
   c. District may acquire additional proctors at its discretion.
   d. Significant changes in soil conditions will require an additional Means and Methods demonstration.

3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections

1. Proctors
   a. Contractor will perform Proctors in accordance with ASTM D698.
   b. Test results will generally be available to within 4 calendar days and distributed to:
      1) Contractor
      2) District Project Manager
      3) District Inspector
      4) Engineer
   c. Notify District if the characteristic of the soil changes.
   d. Contractor will perform new proctors for varying soils:
      1) When indicated in the geotechnical investigation in the Appendix
      2) If notified by the Contractor
      3) At the convenience of the District
   e. Trenches where different soil types are present at different depths, the proctors shall be based on the mixture of those soils.
2. Density Testing of Backfill

a. Density Tests shall be in conformance with ASTM D2922.
b. Provide a testing trench protection for trench depths in excess of 5 feet.
c. Place, move and remove testing trench protection as necessary to facilitate all test conducted by Contractor.
d. For final backfill depths less than 15 feet and trenches of any depth not under existing or future pavement:
   1) Contractor will perform density testing twice per working day when backfilling operations are being conducted.
   2) The testing lab shall take a minimum of 3 density tests of the current lift in the available trench.
e. For final backfill depths 15 feet and greater deep and under existing or future pavement:
   1) Contractor will perform density testing twice per working day when backfilling operations are being conducted.
   2) The testing lab shall take a minimum of 3 density tests of the current lift in the available trench.
   3) The testing lab will remain onsite sufficient time to test 2 additional lifts.
f. Make the excavation available for testing.
g. District will determine the location of the test.
h. Contractor's testing lab will provide results to Engineer and District's Inspector upon completion of the testing.
i. A formal report will be provided to District and Engineer within 48 hours.
j. Test reports shall include:
   1) Location of test by station number
   2) Time and date of test
   3) Depth of testing
k. Field moisture
   1) Dry density
   2) Proctor identifier
   3) Percent Proctor Density

3. Density of Embedment
   a. Storm sewer boxes that are embedded with acceptable backfill material, blended backfill material, cement modified backfill material or select material will follow the same testing procedure as backfill.
   b. District may test fine crushed rock or crushed rock embedment in accordance with ASTM D2922 or ASTM 1556.

B. Non-Conforming Work

1. All non-conforming work shall be removed and replaced.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
1. Frame, cover and grade rings used as access ports into water, sanitary sewer and storm drain structures such as manholes or vaults

1.02 REFERENCES

A. Reference Standards
1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM International (ASTM)
a. ASTM A48 – Standard Specification for Gray Iron Castings
b. ASTM A536 - Standard Specification for Ductile Iron Castings
c. ASTM C478 - Specification for Precast Reinforced Concrete Manhole Sections
3. American Association of State Highways and Transportation Officials (AASHTO)
a. AASHTO M306 – Standard Specification for Drainage, Sewer, Utility and Related Castings

1.03 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
1. All castings shall be cast with:
a. Approved foundry's name
b. Part number
c. Country of origin
2. Provide manufacturer's:
a. Specifications
b. Load tables
c. Dimension diagrams
d. Anchor details
e. Installation instructions

B. Certificates
1. Manufacturer shall certify that all castings conform to the ASTM and AASHTO designations.

PART 2 - PRODUCTS

2.01 EQUIPMENT, PRODUCT TYPES, MATERIALS

A. Castings
1. Use castings for frames that conform to ASTM A48, Class 35B or better.
2. Use castings for covers that conform to ASTM A536, Grade 65-45-12 or better.
3. Use clean casting capable of withstanding application of AASHTO HS-20 vehicle loading with permanent deformation.
4. Covers
a. Size to set flush with the frame with no larger than a 1/8 inch gap between the frame and cover
b. Provide with 2-inch wide pick slots in lieu of pick holes.
c. Provide gasket in frame and cover.

d. Standard Dimensions
   1) Sanitary Sewer
      a) Provide a clear opening of 30 inches for all sanitary sewer frames and cover assemblies unless otherwise specified in the Contract Documents.
   2) Storm Drain
      a) Provide a clear opening of 22 1/2 inches for all storm drain frames, inlets and cover assemblies unless otherwise specified in the Contract Documents.
      b) Provide a minimum clear opening of 30 inches for all storm sewer manholes and junction structures.
e. Standard Labels
   1) Water
      a) Cast lid with the word “WATER” in 2-inch letters across the lid.
   2) Sanitary Sewer
      a) Cast lid with the word “SANITARY SEWER” in 2-inch letters across the lid.
   3) Storm Drain
      a) Cast lid with the word “STORM DRAIN” in 2-inch letters across the lid.
f. Hinge Covers
   1) Provide watertight gasket on all hinged covers.
   2) Water
      a) Provide hinged covers for all water structures.
   3) Sanitary Sewer
      a) Provide hinged covers for all manholes or structures constructed over 24-inch sewer lines and larger and for manholes where rim elevations are greater than 12 inches above the surface.

B. Grade Rings
   1. Provide grade rings in sizes from 2-inch up to 8-inch.
   2. Use HDPE in traffic loading areas.
   3. In non-traffic areas, HDPE can be used.

C. Joint Sealant
   1. Provide a pre-formed or trowelable bitumastic sealant in an extrudable or flat tape form.
   2. Provide sealant that is not dependent on a chemical action for its adhesive properties or cohesive strength.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Grade Rings
   1. Place as shown in the water and sanitary sewer Drawings.
   2. Clean surfaces of dirt, sand, mud or other foreign matter before placing sealant.
   3. Seal each grade ring with sealant specified in this Specification and as shown on the Drawings.

B. Frame and Cover
   1. Water
      a. For water structures install frame, cover and grade rings in accordance with applicable Drawings.
   2. Sanitary Sewer
      a. For sanitary sewer structures install frame, cover and grade rings in accordance with applicable Drawings.
   3. Storm Drain
      a. For storm drain structures install frame, cover and grade rings in accordance with

applicable Drawings.

4. Hinge Cover
   a. Provide hinge cover on elevated manholes, junction boxes, in the flood plain and where specified on the Drawings.

C. Joint Sealing
   1. Seal frame, grade rings and structure with specified sealant.

D. Concrete Collar
   1. Provide concrete collar around all frame and cover assemblies.

END OF SECTION

SECTION 33 05 20 COMPLETE AND PARTIAL REPLACEMENT OF MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section describes replacement of manhole frames and covers. Manholes designated for replacement of frames and covers are listed on the Manhole Rehabilitation Schedule.

B. Related Specification Sections include, but are not necessarily limited to:
   1. Division 00 – Procurement and Contracting Requirements
   2. Division 01 – General Requirements
   3. Section 02 16 10 – Excavation Safety
   4. Section 33 05 20.02 - Replacement of Grade Adjustment Rings and Flattop Sections
   5. Section 33 05 20.03 – Sealing of Manhole Frame and Grade Adjustments
   6. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete
   7. Section 33 05 20.01 – Replacement of Manhole Frames and Covers
   8. Section 33 05 10 – Utility Trench Excavation, Embedment and Backfill

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Submit product data, including manhole covers, component construction, features, configurations and dimension, from pre-approved manufacturer for all materials to be installed.
   2. Shop Drawings

1.5 FIELD [SITE] CONDITIONS

A. Existing Conditions
   1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes, the Contractor shall notify the Engineer in writing.

PART 2 - PRODUCTSMATERIALS

A. Cast in place manholes shall be as specified in Section 03 30 53.

B. Frames and covers shall be as specified in Section 33 05 20.01.

C. Exterior surfaces of manhole sections shall be coated with two mop coats of coal tar epoxy paint, Kop Coat "Bitumastic Super Service Black", Tnemec, "46-465 Heavy Tnemecol", or equal. Dry film thickness shall be a minimum of 14.0 mils per coat. Recoating shall be done in accordance with manufacturer's recommendations.

D. Opening for each connecting pipe shall be circular with a compression type flexible rubber gasket cast integrally into the manhole wall. Flexible gaskets shall be manufactured in accordance with rubber joint specification ASTM C 443 and shall meet the performance and test requirements of ASTM C 425 for compression joints. Flexible gaskets shall include a coupling with O-Ring Gasket, A-Lok, Presswedge, or equal.

E. Preformed and trowelable bitumastic joint sealants shall be EZ-STIK, or equal. The minimum dimension of preformed material shall be one-half (1/2) inch square.

F. Backfill shall be in accordance with Section 33 05 10.

G. Rubber couplings shall be Non-Shear as manufactured by Mission Rubber Co., Fernco, DFW, or equivalent. Rubber couplings shall be fastened using two type C-305 stainless steel adjustable clamps to provide a leakproof seal. Encase the joint with Controlled Low Strength Material (CLSM) with greater than or equal to 2,000 psi compressive strength a minimum distance of 12" each side of the coupling. Replacement pipe shall be of the same size as existing pipe. Pipe shall be Schedule 35 PVC meeting ASTM D-3034 for 4-inch pipe, SDR 26 PVC, meeting the requirements of ASTM D-3034 for pipes 6 inches through 15 inches in diameter, and of ASTM F-794 or ASTM F-679 for pipes 18 inches or larger in diameter.

H. Precast concrete manholes will be allowed for complete manhole replacements and precast concrete sections will be allowed for partial replacement of manholes. Manholes and sections shall conform to the requirements of ASTM C-478.

I. Precast Concrete Manhole Sections

1. Manholes shall conform to ASTM C478 and as specified herein.
2. Wall thickness shall be minimum six (6) inches for all precast sections.
3. Concentric cones shall be utilized when manhole depth exceeds six feet. The clear opening of the cone shall be thirty two (32) inches.
4. Reinforced concrete flat top sections shall have a minimum thirty two (32) inch diameter opening and be a minimum eight (8) inches thick in non-traffic areas and a minimum ten (10) inches thick in traffic areas (designed for H 20 loading). Reinforce flat top sections with #4 bars at twelve (12) inch centers each way. Tie and place reinforcing steel below the mid-point. The minimum cover over the reinforcement shall be two (2) inches. The top or bottom of the flattop shall be clearly labeled or marked.
5. Openings for each connecting pipe shall be circular with a compression type flexible rubber gasket cast integrally into the manhole wall. Flexible gaskets shall be manufactured in accordance with rubber joint specification ASTM C443 and shall meet the performance and test requirements of ASTM C425 for compression joints. Flexible gaskets shall include a coupling with O Ring Gasket, A Lok, Presswedge, or equal.
6. Preformed and trowelable bitumastic joint sealants shall be Kent seal, Ram Nek, EZ STIK, or equal. The minimum dimension of preformed material shall be one half (1/2) inch square.
7. Do not deliver precast concrete sections to the job until representative concrete cylinders have attained a strength of at least 80 percent of the specified minimum. Inspect precast concrete sections when delivered. Cracked or otherwise visibly defective units will be rejected.

8. The maximum depth of lifting holes shall be no more than one-half the manhole wall thickness. After placement of the manhole, the lifting holes shall be sealed with a non-shrink grout.
9. Contractor is responsible for verifying all manhole depths, sewer pipe flowlines, and angle of sewer lines entering and exiting manhole prior to delivery of precast manholes. The contractor will be responsible for removing and replacing any manhole that is not properly fitted to the sewer grades at the existing site.

PART 3 - EXECUTION

A. Complete Manhole Replacement

1. Manholes designated for complete replacement shall be completely reconstructed using cast-in-place or new precast concrete sections. The existing manhole structure shall be completely removed prior to installation of the new structure.
2. The Contractor shall remove all debris and prevent any material from entering the sewer line. Debris shall be taken to an approved TCEQ landfill or dump site approved by the District.
3. All sanitary and storm pipe damaged during excavation shall be replaced at no additional compensation unless otherwise noted.
4. Any incoming pipes, not including service laterals, which are 2 feet or more above the outgoing invert elevation, shall be equipped with internal drop connections.
5. Complete manhole replacement shall also include replacement of frame, cover, bench/trough, sealing of frame, replacement of sewer line within five (5) linear feet outside of the manhole, frame and grade adjustments, and surface restoration.
6. Where determined by the Engineer that a good connection can not be made, the contractor will be paid for additional footage outside of the five (5) linear feet covered by the complete manhole replacement bid item and be paid for at the unit price per linear foot for additional pipe.
7. By-pass Pumping shall be performed per Section 33 03 10. Payment for bypass pumping shall be subsidiary to the complete manhole replacement items.

B. Shallow manholes shall be constructed at locations in the sanitary sewer system where depths are less than four feet, or as directed by the Engineer. Shallow manholes shall be constructed from 4000 psi concrete, formed in place as detailed in relevant section on the Manhole Rehabilitation Details.

C. Testing of Reconstructed Manholes shall be done in accordance with Section 33 01 30.02.

PART 4 - MEASUREMENT AND PAYMENT

A. Standard Manhole

1. The manhole depth shall be determined by measuring from top of casting to the invert at the center of the manhole. Payment will be made at the contract unit price for the applicable type, size and depth for each manhole. Such payment and price shall constitute full compensation for all labor, materials, equipment and for the performance of all work necessary to complete the manholes, including removal of existing manhole, excavation, concrete base, manhole frame and cover, frame and cover grade adjustment and sealing, waterproofing, concrete masonry, reinforced concrete, backfilling, replacement of any sewers, conduits, disposal of excess material and restoration, testing
2. Payment for a standard manhole will be in accordance with the contract prices as follows:
    1) A unit price to cover the construction of one standard manhole of the diameter and type indicated; 0 to 6 feet in depth.
    2) A unit price which shall cover the entire cost of each additional foot of vertical manhole depth in excess of 6 feet, measured to the nearest 0.1 foot.

B. Shallow Manhole

1. Payment for shallow manholes will be made at the contract unit price for each manhole constructed.

C. Such payment and price shall constitute full compensation for all labor, materials, equipment and for the performance of all work necessary to complete the manholes, including removal of existing manhole, excavation, concrete base, manhole frame and cover, frame and cover grade adjustment and sealing, waterproofing, concrete masonry, reinforced concrete, backfilling, replacement of any sewers, conduits, disposal of excess material and restoration

D. Additional Pipe - Where determined by the Engineer that a good connection cannot be made, the Contractor will be paid for additional footage outside of the five (5) linear feet covered by the complete manhole replacement bid item and shall be paid at the unit price per linear foot for additional pipe

E. The Unit Price for complete manhole replacement shall be eligible for 60 percent of the bid price after the repair is made, an additional 10 percent is eligible after testing is complete and an additional 30 percent is eligible after restoration is complete.

END OF SECTION

SECTION 33 05 20.01 REPLACEMENT OF MANHOLE FRAMES AND COVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section describes replacement of manhole frames and covers. Manholes designated for replacement of frames and covers are listed on the Manhole Rehabilitation Schedule.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Procurement and Contracting Requirements
2. Division 01 – General Requirements
3. Section 02 16 10 – Excavation Safety
4. Section 33 05 20.02 Replacement of Grade Adjustment Rings and Flattop Sections
5. Section 33 05 20.03 – Sealing of Manhole Frame and Grade Adjustments
6. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Submit product data, including manhole covers, component construction, features, configurations and dimension, from pre-approved manufacturer for all materials to be installed.
2. Shop Drawings

1.5 FIELD [SITE] CONDITIONS

A. Existing Conditions

1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes, the Contractor shall notify the Engineer in writing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials

1. Frames
   a. Frame material shall be EJ Group, Inc. 1480APT V1420, ductile iron conforming to ASTM A 48 83, Class 35 or better, Bass & Hays that meet EJ Group Standards or District approved equal. The DI frame shall exhibit a tensile strength of not less than 35,000 psi. Shall include ZPEX coating. ***-OR-***

b. Frame material shall be CAP ONE, composite material conforming to the below requirements, or District approved equal.

- All composite moldings shall consist of a thermosetting resin matrix blended and/or combined with reinforcing fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structure(s). The thermosetting resin matrix shall be a polyester, vinylester, or a blend of these. The moldings shall be true to pattern in form and dimension and free from cracks, pores, knit-lines, or other defects in locations affecting their strength and value for the service intended.

- Before the moldings are removed from the molding operation, they shall be thoroughly deflashed and cleaned at the parting lines, holes, notches and all exposed edges.

- Composite frames must have a wall thickness of at least 0.75 inches in sections exposed to traffic and potential traffic wheel impact.

- Testing and Performance Requirements

  i. Testing shall be performed in accordance with the following inspection criteria. 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. The manufacturer/supplier shall maintain complete records of all such tests and inspections. All testing shall be paid for by the manufacturer/supplier.
  ii. Frame and Covers shall be test “Proof Load” in accordance with AASHTO M306.
  iii. Heavy Duty: A load of 40,000lbs shall be concentrated on a 9"x 9" block with rubber or fiber backing pad for one minute. During the load testing process, visible cracks or delamination will be cause for rejection (popping noises during this test are normal for composites and do not indicate failure). When load is removed, Permanent Set (Deflection) of more than 1/8"(.125") measured at center of load area will be cause for rejection. Al l testing shall be conducted on a NIST calibrated and Certified load test machine.
  iv. Ultraviolet resistance: ASTM G 154 Cycle I for 1000hrs. Specimens shall be tested for ultimate flexural strength (ASTM D790), retaining at least 75% of control values for load and deflection at failure.
  v. Coefficient of Friction: Shall be greater than 0.6 when tested in accordance to ASTM C 1028.
  vi. Notched Izod Impact: Composite raw material impact results shall be greater than 5 ft.-lbs/inch when tested in accordance to ASTM D256.
  vii. Components for locking systems below the cover exposed to the sewer environment shall be made of noncorrosive materials such as nonmagnetic, 316 stainless steel or a polymer.

c. Bearing surfaces between the ring and cover shall be machine finished or ground to assure nonrocking fit in any position, and interchangeability.
d. Bolt down frames shall be anchored mechanically to the manhole corbel.

2. Covers
   a. The replacement cover shall form a water resistant seal between the frame and manhole cover surface. The cover shall have concealed pick holes and a machined bearing surface on the bottom of the casting. The cover shall conform to ASTM A 48 83, Class 35 or better for ductile iron, EJ Group, CAP ONE Composite material, conforming with the time requirements as described under “Frames” of this section, or District approved equal.
   b. A typical standard manhole cover design shall be EJ Group Inc., Ductile Iron or District approved equal.
   c. Covers shall set flush with the rim of the frame and shall have no larger than a 1/8 inch gap between the frame and cover.
   d. Bearing surfaces shall be machine finished.
   e. Combined weights of manhole ring and cover shall not weigh less than 260 pounds. Minimum cover opening shall be 30 inches for all frame and cover assemblies, with minimum cover size of 32 inches. All frame and cover assemblies that are smaller than these dimensions as designated on Manhole Rehabilitation Schedule or as directed by the Engineer, shall be replaced as per conditions of this section. The words “NTMWD SANITARY SEWER” shall be cast into the lid.
   f. Covers shall be H-20 load rated.
   g. CAP ONE cover shall have a magnet placed on the underside to allow location by metal detector.

3. Bolts for Bolt Down Covers
   a. Materials and Design
      1) The bolts for bolt down covers shall be ASTM F3125/F3125M-15a or better. They shall meet the manufacturer's recommendations as replacement bolts for the existing frame and cover and shall be 304 stainless steel.
   b. Installation
      1) The bolts shall be installed as per the manufacturer's recommendations for the required ft/lbs of torque for tightening.
      2) All existing female bolt threads shall be thoroughly cleaned and those deemed as deteriorated and unusable by the Engineer shall be re threaded.
      3) All gaskets encountered on bolt down covers shall be replaced. There will be no separate pay item for gaskets.

      4) The payment for replacement of bolts for bolt down covers shall include materials, labor and equipment for complete installation and be paid for per each cover. If the existing bolt down frame and cover is determined to be insufficient and cannot be reused, the Contractor shall notify the Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

1. Review all known, identified or marked utilities, whether public or private, prior to excavation.

2. Locate and protect all known, identified and marked utilities or underground facilities as excavation progresses.
3. Notify all utility owners within the project limits 48 hours prior to beginning excavation.
4. Coordinate with the owner(s) of underground facilities.
5. Immediately notify any utility owner of damages to underground facilities resulting from construction activities.
6. Repair any damages resulting from the construction activities.

B. Notify District and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

C. The replacement manhole frame shall be compatible with the replacement manhole cover specified insuring a water resistant seal between frame and cover.

3.2 PREPARATION

A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.

B. Remove existing frame, cover, and deliver to the District.

3.3 INSTALLATION

A. Seal replacement frames to the existing manhole in accordance with Section 33 05 20.02 and Section 33 05 20.03.

B. Manhole frames that are observed to be cracked, broken, pitted, or contain gaps in the bearing surface preventing a water resistant seal shall be replaced.

C. Remove scrap frames and covers from site.

3.4 FIELD QUALITY CONTROL

A. Manhole cover bolts found to be missing but not indicated on the Manhole Rehabilitation Schedule shall be replaced in accordance with this Section.

B. Manhole frames or covers that are observed to be defective or contain defective threads preventing a water resistant seal shall be replaced in accordance with this Section, or Section 33 05 20.02 and Section 33 05 20.03.

C. Contractor shall make the manhole lid gasket available to the Resident Engineer for inspection, and if found to be defective by the Engineer, the gasket shall be replaced by the Contractor.

END OF SECTION

SECTION 33 05 20.02
REPLACEMENT OF MANHOLE GRADE ADJUSTMENTS AND FLATTOP SECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section describes replacement of existing defective manhole, frame grade adjustments and the installation of new adjustments where existing manholes must be raised. Manholes designated for replacement of frames are listed on the Manhole Rehabilitation Schedule. Installation of new adjustments where existing manholes must be raised will be designated by the Engineer.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Procurement and Contracting Requirements
2. Division 01 – General Requirements
3. Section 02 16 10 – Excavation Safety
4. Section 33 05 20.01 Replacement of Manhole Frames and Covers
5. Section 33 05 20.03 – Sealing of Manhole Frame and Grade Adjustments
6. Section 03 30 - Miscellaneous Cast-in-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Submit product data, including manhole grade adjustment rings, component construction, features, configurations and dimension, from pre-approved manufacturer for all materials to be installed.
2. Shop Drawings

1.5 FIELD [SITE] CONDITIONS

A. Existing Conditions

1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes, the Contractor shall notify the Engineer in writing.
2. Not all manhole identified for frame and cover replacement are defective, the Contractor should be aware that select manholes may have been identified for frame and cover replacement in order to improvement manned-entry access by upsizing the clear opening of the frame from 24-inches to 32-inches.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials

1. Grade Adjustment Rings
   a. HDPE Design Requirements – The grade adjustment rings shall be designed to allow final adjustment of the frame and cover or grate to the grade established by the ENGINEER on the project drawings. The rings shall also be designed to accommodate flat or sloping surfaces to within approximately ¼" (one-quarter inch) to ½" (one half inch) of the specified final elevation. The maximum allowable chimney and grade ring raise shall be no greater than 24-inches. The grade adjustment system shall have a minimum 50 (fifty) year design life and shall be bolted to the manhole. Precast grade rings are not allowed

   b. Performance Requirements – The grade adjustment rings shall be capable of supporting the minimum requirements of AASHTO M-306, H-25 and HS-25, be UV stable and be resistant to chemicals and corrosion commonly associated with the sanitary and storm sewer environments. The replacement or installed grade adjustments shall provide a structural capacity equal to or greater than the existing or specified manhole frame and shall not affect the opening size or surface appearance.

   c. Acceptable Manufacture – HDPE grade rings shall be Ladtech or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions

1. Review all known, identified or marked utilities, whether public or private, prior to excavation.
2. Locate and protect all known, identified and marked utilities or underground facilities as excavation progresses.
3. Notify all utility owners within the project limits 48 hours prior to beginning excavation work.
4. Coordinate with the owner(s) of underground facilities.
5. Immediately notify any utility owner of damages to underground facilities resulting from construction activities.
6. Repair any damages resulting from the construction activities.

B. Notify District and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

C. The replacement manhole frame shall be compatible with the replacement manhole cover specified insuring a water resistant seal between frame and cover.

3.2 PREPARATION

A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.

3.3 INSTALLATION

A. Replacement of damaged grade adjustments
   1. Existing frame grade adjustments that are constructed of brick, block, or materials other than precast concrete grade rings or those identified in this specification shall be replaced
   2. Grade rings damaged during the installation of replacement frame and cover shall be replaced in accordance with this Section. Under this circumstance, existing grade adjustment rings constructed of precast concrete may be reused provided that they are not cracked, are in otherwise good condition, and approved by the District inspector prior to use.
   3. The maximum height adjustment to be provided by grade adjustment rings shall be 24-inches or less including existing grade rings.
   4. Grade Rings must be bolted to Manhole Structure

B. Installation of new adjustments where existing manholes must be raised
   1. Required for manhole in which frame and cover must in replaced in accordance with Section 33 05 20.01 by upsizing the existing frame and cover from 24-inches to 32-inches. Saw-cut the structure as required at the cone in such a manor that will allow for the installation of 32-inch diameter grade rings in accordance with this Section.
   2. The maximum height adjustment to be provided by grade adjustment rings shall be 24-inches or less.
   3. Grade Rings must be bolted to Manhole Structure

C. Replacement of manhole flattop
   1. Saw-cut the structure flattop 6-inches below observed flattop defect or wall defect if within 4-feet of the top of the structure as identified on the Manhole Rehabilitation Schedule.
   2. Dowell 8” into the existing concrete manhole with 16-inch #4 dowel bars at 24-inch centers (minimum). Install 4 stainless steel straps and bolts around the exterior of the manhole. Install new flattop for the manhole as detailed below and in accordance with Section 03 30 53. If requested by the Engineer, structural engineering calculations shall be provided by the Contractor sealed by a licensed engineer in the State of Texas for the wall and flat top replacement concrete and reinforcement.
   3. Flattop shall have a 32-inch diameter opening and the follow minimum thickness or match the existing thickness, whichever it greater:
      a. 18-inch in nontraffic areas for 48-inch diameter manhole
      b. 10-inch in non-traffic areas for 60-inch diameter
      c. 10-inch in traffic areas/design for H-20 loading
   4. Install Frame and Cover in accordance with Section 33 02 20.01 and 33 05 20.03

3.4 FIELD QUALITY CONTROL

A. Grade adjustments that are observed to be defective preventing a water-resistant seal shall be replaced in accordance with this Section or Section 33 05 20.03.

B. Cracked or broken grade adjustment rings will not be accepted.

END OF SECTION

SECTION 33 05 20.03 SEALING OF MANHOLE FRAME AND GRADE ADJUSTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section governs the materials required and construction procedures for sealing of new and rehabilitated manhole frames and grade adjustments. Manholes designated for replacement of frames are listed on the Manhole Rehabilitation Schedule. Related Specification Sections include, but are not necessarily limited to:
2. Division 00 – Procurement and Contracting Requirements
3. Division 01 – General Requirements
4. Section 02 16 10 – Excavation Safety
5. Section 33 05 20.01 Replacement of Manhole Frames and Covers
6. Section 33 05 20.02 – Replacement of Grade Adjustment Rings and Flattop Sections
7. Section 03 30 53 – Miscellaneous Cast-in-Place Concrete

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Submit product data, including manhole grade adjustment rings, component construction, features, configurations and dimension, from pre-approved manufacturer for all materials to be installed.
2. Shop Drawings

1.5 FIELD [SITE] CONDITIONS

A. Existing Conditions

1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes, the Contractor shall notify the Engineer in writing.
2. Not all manhole identified for frame and cover replacement are defective, the Contractor should be aware that select manholes may have been identified for frame and cover replacement in order to improvement manned-entry access by upsizing the clear opening of the frame from 24-inches to 32-inches.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials

1. Bitumastic Gasket Material

a. Bitumastic gasket material shall meet or exceed Federal Specification SS S 210A. The material shall show no signs of deterioration for a period of 30 days when immersed in solutions of acid, alkali or saturated hydrogen sulfide. Joints shall show no sagging when tested at 135F for a period of five days. Bitumastic Gasket Material shall be EZ STIK or approved equal. Trowelable bitumastic material shall be GS 702 compound or equal.

2. Grade Adjustments and Flattops shall be as specified in 33 05 20.02
3. Polyethylene
   a. Minimum thickness of 4 mils
4. Adhesive
   a. As recommended by the grade adjustment ring manufacture and approved by the Engineer
   b. Adhesive or sealant used for watertight installation of grade adjustment rings shall be M-1 Structural Adhesive/Sealant or equal meeting the following specifications:
      1) ASTM C-920, Type S, Grade NS, Class 25, Uses NT, T, M, G, A and O
      2) Federal Specification TT-S-00230-C Type II, Class A
      3) Corps of Engineers CRD-C-541, Type II, Class A
   c. Adhesives and sealants shall not contain VOCs.
5. Cast-in-Place Concrete
   a. In accordance with Section 03 30 53

PART 3 - EXECUTION

3.1 EXAMINATION

A. Notify District and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

B. The replacement manhole frame shall be compatible with the replacement manhole cover specified insuring a water-resistant seal between frame and cover.

3.2 PREPARATION

A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.

3.3 INSTALLATION

A. Excavation

1. Nonpaved Areas
   a. Excavate adjacent to the manhole to expose the entire frame to a minimum depth of 6 inches below the top of the structurally sound structure. Excavation shall not extend more than 2 feet greater than manhole diameter. The sides of the trench shall not deviate from the vertical for more than 1/2 inch for each foot of depth.
2. Paved Areas

a. Make a square or rectangular full depth sawcut and remove the pavement by breaking out from the sawcut toward the manhole to avoid breaking the frame. Do not use pavement-breaking equipment in the sawcut. Frames broken during excavation shall be replaced at the Contractor's expense. Excavate the work area to expose the entire frame to a minimum depth of 6 inches below the top of the structurally sound structure.

B. Sealing Procedure

a. Remove manhole frame from the manhole structure. Separate and observe the condition of the grade adjustments. If the grade adjustments are loose, deteriorated, broken, or show structural defects replace them in accordance with these Specifications. Replace adjustments that are constructed of brick, block, or materials other than precast concrete rings with precast concrete rings, or where necessary, and approved by the Owner's Representative, a precast flattop section. Precast concrete and rubber rings, or a precast concrete flattop sections will be the only adjustments allowed.

b. In brick or block manholes where it is difficult to determine where grade adjustments and walls meet, replace the upper portion of the manhole to a point 24 inches below the frame. If the walls or cone section below this level are structurally unsound, notify the Owner's Representative prior to replacement of the grade adjustments or manhole frame. Existing brickwork, which is structurally satisfactory, if damaged by the Contractor shall be replaced at the Contractor's expense.

c. Wire brush manhole frame and exposed manhole surfaces to remove dirt and loose debris. Coat exposed manhole surfaces with an approved bonding agent followed with an application of a quick setting hydraulic cement to provide a smooth working surface as thin as possible.

d. If the inside diameter of the manhole is too large to safely support new adjustments or frame, then a flattop section shall be installed.

e. Joint surfaces between the frame, adjustments, and cone section shall be free of dirt, stones, debris, and voids to ensure a watertight seal. Place a flexible gasket joint material, minimum 1/2-inch-thick, in two concentric rings along the inside and outside edge of each joint. Position the butt joint for each length of joint material on opposite sides of the manhole. No steel shims, wood, stones, or any material not specifically accepted by the Owner's Representative may be used to obtain final surface elevation of the manhole frame.

f. Seal the rubber manhole-adjusting ring to the precast concrete adjusting ring and the manhole frame as shown on the drawings.

g. In paved areas or future paved areas, castings shall be installed by using a straight edge not less than ten (10) feet long so that the top of casting will conform to the slope and finish elevation of the paved surface. The top of the casting shall be 1/8 inch below the finished elevation. Allowances for the compression of the joint material shall be made to assure a proper final grade elevation.

h. Manhole rims in parkways, lawns and other improved lands shall be at an elevation not more than one (1) nor less than one half (1/2) inch above the surrounding ground. Backfill shall provide a uniform slope from the top of manhole casting for not less than three (3) feet each direction to existing finish grade of the ground. The grade of all surfaces shall be checked for proper slope and grade by string lining the entire area regraded near the manhole or as shown in construction plans. Discrepancies between plans and specification requirements shall be submitted to Engineer for resolution.

i. Manholes in open fields, unimproved land, or drainage courses shall be set 6-inches above grade, to the existing manhole cover elevation or as shown in construction plans. Discrepancies between plans and specification requirements shall be submitted to Engineer for resolution.
j. On non-paved manholes, exterior surfaces of all exposed grade adjustments and four inches below sound structure shall be cleaned with a wire brush and then waterproofed with trowelable bitumastic gasket material in accordance with the manufacturer's specifications. A protective polyethylene cover shall be placed over the waterproofing material when backfilling, following sealing of the frame and grade adjustment.

2. Backfill
   a. Non-paved
      1) Excavated material subject to review of the Engineer shall be used for backfill and mechanically compacted following sealing of the frame and grade adjustments. Bentonite may be added to backfill at the Contractor's discretion. The level of the backfill shall be to one inch above the frame bottom with the removed topsoil being placed on top of the compacted impervious backfill prior to seeding.
   b. Paved
      1) Portland Cement Concrete (in accordance with Division 03 and 32) shall be used for backfill following sealing and testing of the frame and grade adjustments to prevent compaction of the joint material and extend to 6 inches below the top of structurally sound structure.
3. Restoration
   a. Restore surfaces in accordance with Division 32. Grassed areas shall be seeded to match existing conditions. Pavement replacement shall match existing pavement material. Restoration of all surfaces will not be paid for separately.

3.4 FIELD QUALITY CONTROL

A. The final sealing system shall remain flexible with time to account for surface loading variations.

B. Testing of frame and grade adjustment seals for water tightness in accordance with Section 33 01 30.02.

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Minimum requirements for auger boring using 48-inch and smaller casing pipe with lengths less than 300 feet at the locations shown on the Drawings

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 31 23 33 – Trenching, Backfilling and Compaction
4. Section 33 05 22 – Steel Casing Pipe

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. The work performed and materials furnished in accordance with this Item are considered subsidiary the unit price bid per linear foot by Other than Open Cut installation of sewer in Tunnel Liner plate or Steel Casing to be completed in place, and no other compensation will be allowed.

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. Occupational Safety and Health Administration (OSHA)
   a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation

1. Provide written notice to the Owner at least 3 workings days in advance of the planned launch of auger boring operations.

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23.

B. All submittals shall be approved by the Engineer or the Owner prior to delivery.

1.06 QUALITY ASSURANCE

A. Qualifications

1. Contractor
   a. All boring work shall be performed by an experienced subcontractor or Contractor who has at least 5 years of experience in performing guided auger boring work and has completed at least 5 boring projects of similar diameter and ground conditions.
      1. At least 1 of the projects shall have an individual boring length equal to or greater

in length than the longest boring on this project.

2. Submit details of referenced projects including owner's name and contact information, project superintendent and machine operators.

b. The project superintendent shall have at least 5 years of experience supervising boring construction.

1. The Contractor may be required to submit details of referenced project including owner's name, contact information and project superintendent.

c. The site safety representative and personnel responsible for air quality monitoring shall be experienced in tunnel construction and shall have current certification by OSHA.

2.00 PRODUCTS

2.01 MATERIALS

A. Description

1. Steel Casing Pipe shall be in accordance with Section 33 05 22 and shall be a minimum 0.6875" wall thickness, with a carrier pipe diameter of 36" and casing diameter of 48".

2. Tunnel Liner Plate is not permitted for use with Auger Boring.

B. Design Criteria

1. Design excavation methods and spoil conveyance system for the full range of ground conditions described in the Geotechnical Report.

2. Tolerance

a. Lateral variation in the final position of the pipe casing from the line and grade established by the Drawings shall be permitted only to the extent of 0.5 inch in 10 feet provided that such variation shall be regular and only in the direction that will not detrimentally affect the function of the carrier pipe and clearances from other underground utilities or structures.

b. Grades shown on Drawings must be maintained vertically.

3. Use methods and equipment that control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities and improvements.

a. Limit any ground movements (settlement/heave) to values that shall not cause damage to adjacent utilities or surface features (i.e. pavement, structures, railroad tracks, etc.)

b. Repair any damage caused by ground movements at no cost to the Owner.

C. Casing Spacers: Casing Spacers shall conform to Section 33 05 24 of these Specifications.

D. Grout: Grout shall conform to Section 33 05 24 of these Specifications for filling the void between the casing pipe and the carrier pipe.

E. Carrier Pipe: Carrier pipes shall meet requirements as specified in Section 33 30 00 of these Specifications.

F. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

3.00 EXECUTION

3.01 PREPARATION

A. Auger boring shall not begin until the following have been completed:

1. Review of available utility drawings and location of conduits and underground utilities in all areas where excavation is to be performed.
    a. Notify the applicable one-call system prior to any excavation to avoid interference with the existing conduits and utilities in accordance with Division
        i. Repair damage to existing utilities resulting from excavation at no additional cost to the Owner.
    b. Follow notification requirements of permit provider where applicable.
2. Complete pit excavations and support systems for each drive in accordance with the requirements of the Specifications.

3.02 INSTALLATION

A. General

1. Immediately notify the Owner if any problems are encountered with equipment or materials or if the Contractor believes the conditions encountered are materially and significantly different from those represented within the Contract Documents.
2. Where pipe is required to be installed under highways, streets or other facilities, construction shall be performed in such a manner so as to not interfere with the operation of the railroad, street, highway or other facility, and so as not to weaken or damage any embankment or structure.
3. During construction operations, furnish and maintain barricades and lights to safeguard traffic and pedestrians until the backfill has been completed and equipment remove from the site.
4. Properly manage and dispose of groundwater inflows to the shafts in accordance with requirements of specifications and all permit conditions.
    a. Discharge of groundwater inflow into sanitary sewers is not allowed without proper approval and permits.
5. Furnish all necessary equipment, power, water and utilities for auger boring, spoil removal and disposal, grouting and other associated work required for the methods of construction.
6. Promptly clean up, remove and dispose of any spoil or slurry spillage.
7. Do not disturb roadways, railroads, canal channels, adjacent structures, landscaped areas or existing utilities.
    a. Any damage shall be immediately repaired to original or better condition and to the satisfaction of the Engineer or permit grantor at no additional cost to the Owner.
8. Whenever there is a condition that is likely to endanger the stability of the excavation or adjacent structures, operate with a full crew 24 hours a day, including weekends and holidays, without interruption, until those conditions no longer jeopardize the stability of the Work.
9. Notify the Texas One Call system (800-245-4545) to request marking of utilities by utility owners / operators that subscribe to One Call, and shall individually notify all other known or suspected utilities to request marking of these utilities.
    a. Confirm that all requested locates are made prior to commencing boring operations.
    b. Visually confirm and stake necessary existing lines, cables, or other underground facilities including exposing necessary crossing utilities and utilities within 10 feet laterally of the designed tunnel.

c. Control drilling and grouting practices to prevent damage to existing utilities.

B. Boring Methods

1. Tunnel liner plate shall not be used for auger boring.
2. The Contractor shall be fully responsible for insuring the methods used are adequate for the protection of workers, pipe, property and the public and to provide a finished product as required.
3. Blasting is not allowed.

C. Pits and Trenches

1. Suitable pits or trenches shall be excavated for the purpose of conducting the jacking operations and for placing end joints of the pipe.
2. Wherever end trenches are cut in the sides of the embankment or beyond it, such work shall be sheeted securely and braced in a manner to prevent earth from caving in.
3. The location of the pit shall meet the approval of the Owner.
4. The pits of trenches excavated to facilitate these operations shall be backfilled in accordance with Section 31 23 33 immediately after the casing and carrier pipe installation has been completed.

D. Boring

1. Install steel casing pipe by boring hole with the earth auger and simultaneously jacking pipe into place.
2. The boring shall proceed from a pit provided for the boring equipment and workers.
3. Pilot Hole, required for 20-inch and larger casings
   a. By this method an approximate 2-inch hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit.
   b. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.
   c. Other methods of maintaining line and grade on the casing may be approved if acceptable to the Engineer.
   d. Placed excavated material near the top of the working pit and disposed of as required.
      i. If no room is available, immediate haul off is required.
4. The use of water or other fluids in connection with the boring operation will be permitted only to the extent required to lubricate cuttings.
   a. Jetting or sluicing will not be permitted.
5. In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10 percent of high grade carefully processed bentonite may be used to:
   a. Consolidate cuttings of the bit
   b. Seal the walls of the hole
   c. Furnish lubrication for subsequent removal of cuttings and installation of the pipe immediately thereafter
6. Allowable variation from the line and grade shall be as specified in this Specification.

E. Casing Design

1. Design of the bore pit and required bearing to resist jacking forces are the responsibility of the Contractor. The excavation method selected shall be compatible with expected ground conditions. The lengths of the casing shown on the Drawings are the minimum lengths required. The length of the casing may be extended for the convenience of the Contractor, at no additional cost to the Owner. Due to restrictive right-of-way and construction easements, boring and jacking casing lengths less than the nominal 20-foot length may be necessary.

F. Highway Crossings

1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
2. Work along or across the highway department rights-of-way shall be subject to inspection by such highway department.
3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
4. No excavated material or equipment shall be placed on the pavement or shoulders of the roadway without the express approval of the highway department.
5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the roadway.
6. The Contractor shall be responsible for providing the Owner sufficient information to obtain a blasting permit in a timely manner.

G. Groundwater Control

1. The Contractor shall control the groundwater throughout the construction of the casing.
2. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.
3. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24-hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in Section 31 23 19.16 of these Specifications.

H. Safety

1. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. Observe all applicable requirements of the regulations of the authorities having jurisdiction over this site. Conduct the operations in such a manner that all work will be performed below the level of the roadbed.
2. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, “Safety Requirements for Construction of Tunnel Shafts and Caissons”.

I. Surface Settlement Monitoring

1. Provide surface settlement markers, placed as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20-foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to benchmarks and indices sufficiently removed as not to be affected by the casing operations.
2. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.
3. Take readings and permanently record surface elevations prior to start of dewatering recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.
4. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.
5. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

J. Contact Grouting

1. Contact grout any voids caused by or encountered during the boring per Section 03 60 00 of these Specifications.
    a. Modify equipment and procedures as required to avoid recurrence of excessive settlements or damage.

K. Control of Line and Grade

1. Monitor line and grade a minimum of every 20 feet during boring operations.
    a. Record deviation with respect to design line and grade once at each casing joint.
2. If the pipe installation does not meet the specified tolerances. Owner shall require the Contractor to reinstall bore at the Contractor’s expense if the pipe does not meet the tolerances listed in 2.01.B.2. Contractor shall be responsible for any costs associated with any redesign necessary.

L. Installation of Carrier Pipe

1. Installation of Carrier Pipe shall conform to Section 33 05 24 of these Specifications.

3.03 CLEANUP AND RESTORATION

A. After completion of the boring, all construction debris, spoils, oil, grease and other materials shall be removed from the pipe, pits and all work areas.

B. Restoration shall follow construction as the Work progresses and shall be completed as soon as reasonably possible.

1. Restore and repair any damage resulting from surface settlement caused by shaft excavation or boring.

2. Any property damaged or destroyed shall be restored to a condition equal to or better than existing prior to construction.

3. Restoration shall be completed no later than 30 days after boring is complete, or earlier if required as part of a permit or easement agreement.

4. This provision for restoration shall include all property affected by the construction Operations.

C. Sheeting Removal

1. Remove sheeting used for shoring from the shaft and off the job site. The removal of damage either new or existing structures, private or public properties and to avoid cave-ins or sliding in the banks.

3.04 SITE QUALITY CONTROL

A. Field Tests and Inspections

1. Allow access to the Owner and furnish necessary assistance and cooperation to aid in the observations, measurements, data and sample collection, including, but not limited to the following:

a. The Owner shall have access to the boring system prior to, during and following all boring operations.

b. The Owner shall have access to the pits shafts prior to, during and following all boring operations.

1. This shall include, but not be limited to, visual inspection of installed pipe and verification of line and grade.

2. The Contractor shall provide safe access in accordance with all safety regulations.

c. The Owner shall have access to spoils removed from the boring excavation prior to, during and following all boring operations.

1. The Owner shall be allowed to collect soil samples from the muck buckets or spoil piles a minimum of once every 10 feet and at any time when changes in soil conditions or obstructions are apparent or suspected.

B. Safety

1. The Contractor is responsible for safety on the job site.

a. Perform all Work in accordance with the current applicable regulations of the Federal, State and local agencies.

b. In the event of conflict, comply with the more restrictive applicable requirement.

2. No gasoline-powered equipment shall be permitted in receiving shafts/pits.

a. Diesel, electrical, hydraulic, and air-powered equipment are acceptable, subject to

applicable local, State and Federal regulations.

3. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
   a. Perform all required air and gas monitoring.
   b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground work areas.
4. Perform all work in accordance with all current applicable regulations and safety requirements of the Federal, State and Local agencies.
5. Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
   a. In the event of conflict, comply with the more stringent requirements.
6. If personnel will enter the pipe during construction, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
   a. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the minimum requirements for manufacturing, furnishing and transporting Steel Casing Pipe to be installed by Open Cut or By Other than Open Cut at the locations shown in the Drawings

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – BIDDING REQUIREMENTS, CONTRACT FORMS, AND CONDITIONS OF THE CONTRACT.
2. Division 01 – GENERAL REQUIREMENTS.
3. Section 31 23 00 – EXCAVATION BEDDING AND BACKFILL FOR UTILITIES.
4. Section 33 05 21 – GUIDED AUGER BORING.

1.02 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM International (ASTM):
   a. A139, Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS Sizes 4 and Over).
3. American Water Works Association (AWWA):
   a. C203, Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
   b. C206 Standard for Field Welding Steel Water Pipe

1.03 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00- SUBMITTALS.

B. All submittals shall be approved by the Engineer or the District prior to delivery.

1.04 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Exterior Coating
   a. Material data
   b. Field touch-up procedures
2. Interior Coating
   a. Material data
   b. Field touch-up procedures

B. Shop Drawings

1. No shop drawings required for Auger Boring
2. For Tunneling, provide the following:
   a. Furnish details for Steel Casing Pipe outlining the following:
      1) Grout/lubrication ports
      2) Joint details
      3) Other miscellaneous items for furnishing and fabricating pipe

b. Submit calculations in a neat, legible format that is sealed by a Licensed Professional Engineer in Texas, consistent with the information provided in the geotechnical report, and includes:

1) Calculations confirming that pipe jacking capacity is adequate to resist the anticipated jacking loads for each crossing with a minimum factor of safety of 2
2) Calculations confirming that pipe capacity is adequate to safely support all other anticipated loads, including earth and groundwater pressures, surcharge loads, and handling loads
3) Calculations confirming that jointing method will support all loading conditions

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery, Handling, and Storage

1. Prior to delivery of the pipe, end/internal bracing shall be furnished and installed, as recommended by the manufacturer, for protection during shipping and storage.

2. Deliver, handle and store pipe in accordance with the Manufacturer's recommendations to protect coating systems.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Design Criteria

1. The Contractor is fully responsible for the design of Steel Casing Pipe that meets or exceeds the design requirements of this Specification and that is specifically designed for installation by the intended trenchless method.

2. For Steel Casing Pipe utilized for tunneling projects, consider the following:

a. Design of the casing pipe shall account for all installation and service loads including:

1) Jacking loads
2) External groundwater and earth loads
3) Traffic loads
4) Railroad Loads
5) Practical consideration for handling, shipping and other construction operations
6) Any other live or dead loads reasonably anticipated

b. Design shall be sealed and signed by a registered Professional Engineer licensed in the State of Texas.

c. The allowable jacking capacity shall not exceed 50 percent of the minimum steel yield stress.

d. Steel Casing Pipe shall have a minimum wall thickness as specified on the Drawings.

e. Steel Casing Pipe under railroads shall have the minimum wall thickness as defined in the AREMA Standards and as required by DART.

3. Steel Casing Pipe shall be provided with inside diameter sufficient to efficiently install the required carrier pipe with casing spacers as required in Section 33 05 20 Auger Boring.

a. Allowable casing diameters are shown on the Drawings for each crossing.

4. Furnish in lengths that are compatible with Contractor’s shaft sizes and allowable work areas.

5. Random segments of pipe will not be permitted for straight runs of casing.

a. Closing piece segments, however, shall be acceptable.

6. When required by installation method, provide grout/lubricant ports along the pipe at intervals of 10 feet or less.
    a. Ports and fittings shall be attached to the pipe in a manner that will not materially affect the strength of the pipe nor interfere with installation of carrier pipe.
    b. Plugs for sealing the fittings shall be provided by the Contractor and shall be capable of withstanding all external and internal pressures and loads without leaking.

B. Materials

1. Provide new, smooth-wall, carbon steel pipe conforming to ASTM A139, Grade B.
2. Dimensional Tolerances
    a. Furnishing and installing Steel Casing Pipe with dimensional tolerances that are compatible with performance requirements and proposed installation methods that meet or exceed the specific requirements below:
        1) Minimum wall thickness at any point shall be at least 87.5 percent of the nominal wall thickness.
        2) Outside circumference within 1.0 percent or 3/4 inch of the nominal circumference, whichever is less.
        3) Outside diameter of the pipe shall be within 1/8 inch of the nominal outside diameter.
        4) Roundness such that the difference between the major and minor outside diameters shall not exceed 0.5 percent of the specified nominal outside diameter or 1/4 inch, whichever is less.
        5) Maximum allowable straightness deviation of 1/8 inch in any 10-foot length.
3. All steel pipe shall have square ends.
    a. The ends of pipe sections shall not vary by more than 1/8 inch at any point from a true plane perpendicular to the axis of the pipe and passing through the center of the pipe at the end.
    b. When pipe ends have to be beveled for welding, the ends shall be beveled on the outside to an angle of 35 degrees with a tolerance of ± 2½ degrees and with a width of root face 1/16 inch ± 1/32 inch.
4. Steel Casing Pipe shall be fabricated with longitudinal weld seams.
    a. All girth weld seams shall be ground flush.

C. Finishes

1. Provide outside of Steel Casing Pipe with a coal-tar protective coating in accordance with the requirements of AWWA C203.
    a. Touch up after field welds shall provide coating equivalent to those specified above.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install Steel Casing Pipe for By Other than Open Cut in accordance with Section 33 05 21 - GUIDED AUGER BORING.

1. Steel Casing Pipe connections shall be achieved by full penetration field butt-welding or an integral machine press-fit connection (Permalok or equivalent) prior to installation of the pipe, depending on the type of carrier pipe.
2. Allowable joint types for each crossing are shown on the Drawings.
3. Field butt-welding a square end piece of steel pipe to a 35-degree beveled end of steel pipe is acceptable.
4. Integral machined press-fit connections shall be installed in accordance with

the manufacturer's installation procedures and recommendations.

B. Carrier pipe shall be installed inside Steel Casing Pipe in accordance with Section 33 05 22- STEEL CASING PIPE.

C. Contact grouting of the annulus outside the casing pipe shall be performed in accordance with Section 33 05 21 - GUIDED AUGER BORING.

END OF SECTION

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Minimum requirements for Hand Tunneling using tunnel liner plate or casing pipe at the locations shown on the Drawings

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 33 05 21 – Tunnel Liner Plate
4. Section 33 05 22 – Steel Casing Pipe

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. The work performed and materials furnished in accordance with this Item are considered subsidiary the unit price bid per linear foot by Other than Open Cut installation of sewer in Tunnel Liner plate or Steel Casing to be completed in place, and no other compensation will be allowed.

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO):
   a. HB-17, Standard Specifications for Highway Bridges.
3. Occupational Safety and Health Administration (OSHA)
   a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation

1. The Contractor shall provide written notice to the Owner at least 3 working days in advance of the planned launch of tunneling operations.

1.05 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the Engineer prior to delivery.

1.06 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Shop Drawings

1. Submit the following, when required by the Contract Documents:
   a. Detailed description of the methods and equipment to be used in completing each reach of tunnel
   b. Description of the survey methods that will be used to ensure that the tunnel is advanced as shown on the Drawings and within the line and grade tolerances specified

c. Shaft layout drawings

1) Detailing dimensions and locations of all equipment, including overall work area boundaries, crane, front-end loader, forklift, spoil stockpiles, spoil hauling equipment, pumps, generator, pipe storage area, tool trailer or containers, fences, and staging area

2) Shaft layout drawings will be required for all shaft locations and shall be to scale, or show correct dimensions.

3) Layout such that all equipment and operations shall be completely contained within the allowable construction areas shown on the Drawings

d. Schedule in accordance with Division 1 to include the following activities as independent items:

1) Mobilization

2) Shaft excavation and support

3) Water control at shafts

4) Working slab construction

5) Thrust wall construction

6) Tunneling

7) Shaft backfill

8) Site restoration

9) Cleanup

10) Demobilization

2. Provide information for Contact Grouting per Section 03 60 00 of these Specifications.

B. Daily Records

1. Submit samples of the tunneling logs or records to be used at least 7 days prior to beginning Hand Tunneling.

2. Submit daily records to the Owner's Inspector by noon on the day following the shift for which the data or records were taken.

3. Daily records shall include:

a. Date

b. Time

c. Name of operator

d. Tunnel drive identification

e. Installed liner ring and corresponding tunnel length

f. Time required to tunnel each ring

g. Time required to set subsequent ring

h. Spoil volumes (muck carts per liner ring and estimated volume of spoil in each muck cart)

i. Grout volumes and pressures

j. Soil conditions, including occurrences of unstable soils and estimated groundwater inflow rates, if any

k. Line and grade offsets

l. Any movement of the guidance system

m. Problems encountered during tunneling

n. Durations and reasons for delays

o. Manually recorded observations made:

1) At intervals of not less than 2 every 5 feet

2) As conditions change

3) As directed by the Owner and/or Engineer

1.09 QUALITY ASSURANCE

A. Qualifications

1. Failure to meet the qualification requirements is failure to fulfill the Contract and the Contractor will be required to obtain a subcontractor that meets the qualification requirements.

2. Contractor

a. An experienced subcontractor or Contractor who has at least 5 years of experience in performing tunneling work and has completed at least 5 projects of similar diameter in similar ground conditions shall perform all tunneling work.

3. All Work by the Contractor shall be done in the presence of the Owner unless the Owner grants prior written approval to perform such work in Owner's absence.

4. The Contractor shall allow access to the Owner and/or Engineer and shall furnish necessary assistance and cooperation to aid in the observations, measurements, data and sample collection including, but not limited to, the following:

a. The Owner and/or Engineer shall have access to the tunneling system prior to, during and following all tunneling operations.

b. The Owner and/or Engineer shall have access to the tunneling shafts prior to, during and following all tunneling operations.

1) This shall include, but not be limited to, visual inspection of installed pipe and verification of line and grade.

2) The Contractor shall provide safe access in accordance with all safety regulations.

c. The Owner and/or Engineer shall have access to spoils removed from the tunnel excavation prior to, during and following all tunneling operations.

1) The Owner shall be allowed to collect soil samples from the muck buckets or spoil piles a minimum of once every 10 feet and at any time when changes in soil conditions or obstructions are apparent or suspected.

2.00 PRODUCTS

2.01 MATERIALS

A. Description

1. Tunnel Liner Plate shall be in accordance with Section 33 05 21.

2. Casing Pipe shall be in accordance with Section 33 05 22.

B. Design Criteria

1. Design excavation methods and spoil conveyance system for the full range of ground conditions described in the Geotechnical Reports

2. Tolerance

a. Accurately maintain the face of the excavation inside the tunnel to allow the absolute minimum of void space outside the casing/liner plate.

b. Maintain a maximum of ½-inch tolerance between the outside of the casing/liner plate and the excavation wherever possible.

c. The tunnel diameter shall not be greater than 2 inches larger than the casing/liner outer diameter (O.D.).

3. Use methods and equipment that control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities and improvements.

a. Limit any ground movements (settlement/heave) to values that shall not cause damage to adjacent utilities and facilities.

b. Repair any damage caused by ground movements at no cost to the Owner.

c. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

3.00 EXECUTION

3.01 PREPARATION

A. Tunneling shall not begin until the following have been completed:

1. All required submittals have been made and the Owner and/or Engineer has reviewed and accepted all submittals.

2. Review of available utility drawings and location of conduits and underground utilities in all areas where excavation is to be performed.

a. Notify the applicable one-call system prior to any excavation to avoid interference with the existing conduits and utilities.

1) Repair damage to existing utilities resulting from excavation at no additional cost to the Owner.

3. Shaft excavations and support systems for each drive completed in accordance with the requirements of the Specifications.

4. Site safety representative has prepared a code of safe practices in accordance with OSHA requirements.

a. Provide the Engineer and Owner with a copy of each prior to starting shaft construction or tunneling.

b. Hold safety meetings and provide safety instruction for new employees as required by OSHA.

5. All specified settlement-monitoring points have been installed, approved and baselined in accordance with the Contract Documents.

B. Verification of Stability

1. Confirm that the ground will remain stable without movement of soil or water while the entry/exit location shoring is removed and while the tunnel is launched or received into a shaft.

2. Demonstrate that all soils have been stabilized at all tunnel portal locations to:

a. Prevent the inflow of weak, running or flowing soils.

b. Prevent the inflow of loose rock.

c. Prevent and control groundwater inflows.

3.02 INSTALLATION

A. Tunnel Methods

1. Tunnel liner plate shall not be used where bore or jack methods are used, or where not allowed on the Drawings or permits.
2. The Contractor shall be fully responsible to:
    a. Ensure the methods used are adequate for the protection of workers, pipe, property and the public
    b. Provide a finished product as required.

B. General

1. The Contractor shall immediately notify the Owner, in writing, when any problems are encountered with equipment or materials, or if the Contractor believes the conditions encountered are materially and significantly different from those represented within the Contract Documents.
2. Properly manage and dispose of groundwater inflows to the shafts in accordance with requirements of Specifications and all permit conditions.
    a. Discharge of groundwater inflow into sanitary sewers is not allowed without proper approval and permits.
3. Furnish all necessary equipment, power, water and utilities for tunneling, spoil removal and disposal, grouting and other associated work required for the methods of construction.
4. Promptly clean up. Remove and dispose of any spoil or slurry spillage.
5. Whenever a condition is likely to endanger the stability of the excavation or adjacent structures, operate with a full crew 24 hours a day, including weekends and holidays, without interruption, until those conditions no longer jeopardize the stability of the Work.

C. Installation with Steel Casing Pipe

1. Shall conform to Section 33 05 24 of these Specifications.

D. Installation with Tunnel Liner Plate

1. Shall conform to Section 33 05 24 of these Specifications.

E. Contact Grouting

1. Shall conform to Section 03 60 00 of these Specifications.

F. Control of Line and Grade

1. Confirm that all established benchmarks and control points provided for the Contractor’s use are accurate.
    a. Use these benchmarks to furnish and maintain all reference lines and grades for tunneling.
    b. Use lines and grades to establish the location of the pipe using a laser or theodolite guidance system.
    c. Submit to the Owner copies of field notes used to establish all lines and grades and allow the Engineer to check guidance system setup prior to beginning each tunneling drive.
    d. Contractor shall perform survey checks of the guidance system and the line and grade of the carrier pipe on a daily basis during tunneling operations.
    e. The Contractor remains fully responsible for the accuracy of the work and the correction of it, as required.
2. The casing/tunnel liner shall be installed in accordance with the following tolerances:

a. Variations from design line or grade: ± 2 inches maximum

1) If the installation is off line or grade, make the necessary corrections and return to the design alignment and grade at a rate of not more than 1 inch per 25 feet.

3. Monitor line and grade continuously during tunneling operations.

a. Record deviation with respect to design line and grade once at each pipe joint and submit records to Engineer daily.

4. If the pipe installation does not meet the specified tolerances, correct the installation, including any necessary redesign of the pipeline or structures and acquisition of necessary easements.

G. Obstructions

1. If the tunneling operations should encounter an object or condition that impedes the forward progress of the shield, notify the Owner immediately.

2. Correct the condition and remove, clear or otherwise make it possible for the shield to advance past any objects or obstructions that impede forward progress.

3. Proceed with removal of the object or obstruction by methods submitted by the Contractor and accepted by the Owner and/or Engineer.

H. Surface Settlement Monitoring

1. Provide surface settlement markers, placed as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area, along the centerline of the casing at 20-foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement, at the centerline of the pavement and at 10 and 25 feet in each direction from the centerline of the casing. Tie settlement markers to benchmarks and indices sufficiently removed as not to be affected by the casing operations.

2. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and using a method approved by the Engineer and the authority having jurisdiction over the project site, take immediate action to restore surface elevations to that existing prior to start of casing operations.

3. Take readings and permanently record surface elevations prior to start of dewatering recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the casing heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.

4. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.

5. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action.

3.05 CLEANUP AND RESTORATION

A. After completion of the tunneling, all construction debris, spoils, oil, grease and other materials shall be removed from the tunneling pipe, shafts and all work areas.

1. Cleaning shall be incidental to the construction.

B. Restoration shall follow construction as the Work progresses and shall be completed as soon as reasonably possible.

1. Restore and repair any damage resulting from surface settlement caused by shaft

excavation or tunneling.

2. Any property damaged or destroyed, shall be restored to a condition equal to or better than that to which it existed prior to construction.
3. Restoration shall be completed no later than 30 days after tunneling is complete, or earlier if required as part of a permit or easement agreement.
4. This provision for restoration shall include all property affected by the construction operations.

3.06 SITE QUALITY CONTROL

A. Safety

1. No gasoline-powered equipment shall be permitted in receiving shafts/pits.
   a. Diesel, electrical, hydraulic and air-powered equipment are acceptable, subject to applicable local, State, and Federal regulations.
2. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
   a. Perform all required air and gas monitoring.
   b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground work areas.
3. Perform all Work in accordance with all current applicable regulations and safety requirements of the Federal, State, and Local agencies. Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
   a. In the event of conflict, comply with the more stringent requirements.
4. If personnel will enter the pipe during construction, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
   a. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the minimum requirements for manufacturing, furnishing and transporting Tunnel Liner Plate to be used for excavation support as installed By Other than Open Cut at the locations shown on the Drawings

1.02 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Association of State Highway and Transportation Officials (AASHTO)
    a. LRFD, Bridge Design Manual, Section 12.13
    b. M190, Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
3. American Society of Testing and Materials (ASTM):
    a. A123, Standard Specification for Zinc (Hot- Dip Galvanized) Coating on Iron and Steel Products.
    b. A153, Standard Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware.
    c. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Los-Alloy with Improved Formability, and Ultra-High Strength.

1.03 SUBMITTALS

A. Product Data

1. Tunnel Liner Plate and fasteners
    a. Material data
2. Exterior Coating
    a. Material data
    b. Field touch-up procedures
3. Grout Mix
    a. Material data

B. Shop Drawings

1. Submit calculations for the design of the Tunnel Liner Plate sealed by a Licensed Engineer in the State of Texas.
2. Detailed plan for grouting the void space on the exterior of the Tunnel Liner Plate
3. Grout coupling location and spacing

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle and store Tunnel Liner Plate in accordance with the Manufacturer's recommendations to protect coating systems.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers

1. Manufactured by Contech Construction Products, Inc., DSI Underground, or approved equal.

B. Design Criteria

1. Manufacturer to design Tunnel Liner Plate in accordance with the methods and criteria as specified in AASHTO LRFD, Bridge Design Manual, Section 12.13.
2. Soil parameters shall be determined by the Tunnel Liner Plate Manufacturer.
3. Allow a maximum deflection of 3 percent.
4. Thickness of the Tunnel Liner Plate specified herein is the minimum acceptable and shall be increased as necessary to obtain adequate joint strength, stiffness, buckling strength and resistance to deflection.

C. Materials

1. Tunnel Liner Plate
   a. Provide new, corrugated metal Tunnel Liner Plates made from steel sheets conforming to the requirements of ASTM A1011.
      1) Potable and Reclaimed Water carrier pipe
         a) Galvanized
            (1) Plate to be galvanized with zinc coating in accordance with ASTM A123 with the following exception:
               (a) Zinc shall be applied at a rate of 2.0 ounces per square foot on each side.
         b) Coated
            (1) Plate to be coated with a bituminous coating meeting the performance requirements of AASHTO M190
            (2) Uniformly coat pipe inside and out to minimum thickness of 0.05 inches, measured on crests of corrugations.
      2) Sanitary Sewer carrier pipe
         a) Galvanized
            (1) Plate to be galvanized with zinc coating in accordance with ASTM A123 with the following exception:
               (a) Zinc shall be applied at a rate of 2.0 ounces per square foot on each side.
   b. Tunnel Liner Plates and fasteners shall comply with the requirements of AASHTO LRFD, Bridge Design Manual, Section 12.13.
      1) Liner plates shall be punched for bolting on both longitudinal and circumferential seams and fabricated to permit complete erection from the inside of the tunnel.
      2) Bolts and nuts shall be galvanized to conform to ASTM A153.
      3) Where groundwater is encountered gasketed liner plates shall be used.
      4) Plates shall be of uniform fabrication and those intended for 1 size tunnel shall be interchangeable.
      5) Field welding of Tunnel Liner Plate, including grout couplings shall not be allowed.
      6) The material used for the construction of these plates shall be new, unused and suitable for the purpose intended.
      7) Minimum thickness of Tunnel Liner Plate shall be as shown on drawings. General minimum thickness guidelines are as follows*:

Tunnel Diameter (inches)	2-Flanged Liner Plate Thickness (gauge)	4-Flanged Liner Plate Thickness (gauge)
	Bury Depth: 8 feet – 16 feet	
36	12	12
42	12	12
48	12	12
54	12	12
64	12	11
66	12	10
72	12	8
Greater than 72	Project Specific Design	Project Specific Design

*The information in the above table is based on the following assumptions: AASHTO Section 16: “Steel Tunnel Liner Plates”, H20 loading angle of 0 and bury depth of 8 feet to 16 feet. For projects not meeting these assumptions, a specific design should be performed to determine the appropriate thickness for the liner plate.

2. Casing Insulators

   a. Casing insulators shall be used for this project in accordance with Section 33 05 24- INSTALLATION OF CARRIER PIPE IN CASING.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Tunnel Liner Plate shall be installed in accordance with appropriate portions of Section 33 05 23- HAND TUNNELING.

B. Carrier pipe shall be installed inside Tunnel Liner Plate in accordance with Section 33 05 24- INSTALLATION OF CARRIER PIPE IN CASING OR TUNNEL LINER PLATE.

C. Contact grouting of the annulus outside the Tunnel Liner Plate shall be performed in accordance with Section 03 61 15- ANNULAR BACKFILL FOR CARRIER PIPE IN TUNNELS.

END OF SECTION

33 05 25 INSTALLATION OF CARRIER PIPE IN CASING OR TUNNEL LINER PLATE

1.00 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for the installation of carrier pipe into steel casings or tunnel liner plate at locations shown on the Drawings.

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 1 – General Requirements
3. Section 33 05 20 – Guided Auger Boring
4. Section 33 05 21 – Tunnel Liner Plate
5. Section 33 05 22 – Steel Casing Pipe
6. Section 33 05 23 – Hand Tunneling

1.02 PRICE AND PAYMENT PROCEDURES

Price and Payment shall conform to Section 01 29 00.

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Society of Testing and Materials (ASTM)
   a. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   b. C109, Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or [50 mm] Cube Specimens).
   c. D638, Standard Test Method for Tensile Properties of Plastics.
3. International Organization for Standardization (ISO):
   a. 9001, Quality Management Systems - Requirements.
4. Occupational Safety and Health Administration (OSHA)
   a. OSHA Regulations and Standards for Underground Construction, 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavation.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. The Engineer or the Owner shall approve all submittals prior to delivery.

1.05 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Casing Isolators/Spacers
   a. Material Data
2. Grout Mix
   a. Material Data

B. Shop Drawings

1. Required for 21-inch and larger pipe installations
2. Submit Work Plan describing the carrier pipe installation equipment, materials and construction methods to be employed. Contractor shall submit procedure for installation of Steel Pipe; installation method shall ensure that heat shrink sleeves are not damaged.
3. Casing Spacers/Isolators
    a. Detail drawings and manufacturer's information for the casing isolators/spacers that will be used.
        1) Include dimension and component materials and documentation of manufacturer's
    b. Alternatives to casing spacers/isolators may be allowed by the Owner on a case-by case basis.
    c. For consideration of alternate method, submit a detailed description of method including details.
4. End seal or bulkhead designs and locations for casing/liners, including location of vent lines to allow for adequate ventilation during grout filling.
5. Annular Space (between carrier pipe and casing/tunnel liner plate) Grouting Work Plan and Methods including:
    a. Grouting methods
    b. Details of equipment
    c. Grouting procedures and sequences including:
        1) Injection methods
        2) Injection pressures
        3) Monitoring and recording equipment
        4) Pressure gauge calibration data
        5) Materials
    d. Grout mix details including:
        1) Proportions
        2) Admixtures including:
            a. Manufacturer's literature
            b. Laboratory test data verifying the strength of the proposed grout mix
            c. Proposed grout densities
            d. Viscosity
            e. Initial set time of grout
                i. Data for these requirements shall be derived from trial batches from an approved testing laboratory.
    e. Submit a minimum of 3 other similar projects where the proposed grout mix design was used.
    f. Submit anticipated volumes of grout to be pumped for each application and reach grouted.
    g. For pipe installations 36-inches and larger, without hold down jacks or a restrained spacer, provide buoyant force calculations during grouting and measures to prevent flotation.
        1) Calculations sealed by a licensed Engineer in the State of Texas.
    h. Description of methods and devices to prevent buckling of carrier pipe during

grouting of annular space, if required

1.06 QUALITY ASSURANCE

A. Certifications

1. Casing isolator/spacer manufacturer shall be certified against the provisions of ISO9001:2000

2.00 PRODUCTS

2.01 MATERIALS

A. Design Criteria and Materials

1. Carrier pipe shall meet the specification requirements as outlined in Section 33 05 22 of these Specifications.
2. Grout of annular space
   a. For gravity sewer carrier pipe installation:
      1) Fill all voids between the carrier pipe and the casing or liner with grout.
      2) All exterior carrier pipe surfaces and all interior casing or liner surfaces shall be in contact with the grout.
3. Grout Mixes
   a. Low Density Cellular Grout (LDCG)
      1) Annular space (between carrier pipe and casing/liner) grout shall be LDCG.
      2) The LDCG shall be Portland cement based grout mix with the addition of a foaming agent designed for this application.
      3) Develop 1 or more grout mixes designed to completely fill the annular space based on the following requirements:
         i. Provide adequate retardation to completely fill the annular space in 1 monolithic pour.
         ii. Provide less than 1 percent shrinkage by volume.
         iii. Compressive Strength
            (1) Minimum strength of 10 psi in 24 hours, 50 psi in 3 days, 300 psi in 28 days
         iv. Design grout mix with the proper density and use proper methods to prevent floating of the carrier pipe.
         v. Proportion grout to flow and to completely fill all voids between the carrier pipe and the casing or liner.
4. End Seals
   a. Provide end seals at each end of the casing or liner to contain the grout backfill or to close the casing/liner ends to prevent the inflow of water or soil.
      1) For piping less than 24-inch diameter, use hard rubber seals, Model PL Link Seal as manufactured by the Thunderline Corporation or approved equal.
      2) For piping 24-inch diameter and greater, use pull-on, 1/8 inch thick, synthetic rubber end seals, Model C, as manufactured by Pipeline Seal and Insulator, Inc. or approved equal.
   b. Design end seals to withstand the anticipated soil or grouting pressure, provide adequate ventilation, and be watertight to prevent groundwater from entering the casing.
5. Casing Spacers/Insulators

a. Provide casing spacers/insulators to support the carrier pipe during installation and grouting (where grout is used).

b. Casing Spacers/Isolators material and properties:

1) Shall be minimum 14 gage

2) For sewer pipe, utilize Coated Steel.

3) Suitable for supporting weight of carrier pipe without deformation or collapse during installation

c. Provide restrained-style casing spacers to hold all pipes stable during grouting operations and prevent floating or movement.

d. Provide dielectric strength sufficient to electrically isolate each component from one another and from the casing.

e. Design risers for appropriate loads, and, as a minimum:

1) Provide 10 gage steel risers

i. Provide stainless steel bands and risers for water installations.

f. Band material and criteria

1) Provide polyvinyl chloride inner liner with:

i. Minimum thickness of 0.09 inches

ii. Durometer “A” of 85-90 hardness

iii. Minimum dielectric strength of 58,000 volts

g. Runner material and criteria

1) Provide pressure-molded glass reinforced polymer or UHMW with:

a. Minimum of 2 inches in width and a minimum of 11 inches in length.

2) Attach to the band or riser with 3/8 inch minimum welded steel or stainless steel studs.

3) Runner studs and nuts shall be recessed well below the wearing surface of the runner

a. File recess with a corrosion inhibiting filler.

h. Riser height

1) Provide sufficient height with attached runner allow a minimum clearance of 2 inches between the outside of carrier pipe bells or couplings and the inside of the casing liner surface.

3.00 EXECUTION

3.01 INSTALLATION

A. General

1. Carrier pipe installation shall not begin until the following tasks have been completed:

a. All required submittals have been provided, reviewed and accepted.

b. All casing/liner joints are watertight and no water is entering casing or liner from any sources.

c. All contact grouting is complete.

d. Casing/liner alignment record drawings have been submitted and accepted by Owner to document deviations due to casing/liner installation.

e. Site safety representative has prepared a code of safe practices and an

emergency plan in accordance with applicable requirements.

2. The carrier pipe shall be installed within the casings or liners between the limits indicated on the Drawings, to the specified lines and grades and utilizing methods that include due regard for safety of workers, adjacent structures and improvements, utilities and the public.

B. Control of Line and Grade

1. Install Carrier pipe inside the steel casing within the following tolerances:
   a. Horizontal
      1) ± 2 inches from design line
   b. Vertical
      1) ±1 inch from design grade
2. Check line and grade set up prior to beginning carrier pipe installation.
3. Perform survey checks of line-and-grade of carrier pipe during installation operations.
4. The Contractor is fully responsible for the accuracy of the installation and the correction of it, as required.
   a. Where the carrier pipe installation does not satisfy the specified tolerances, correct the installation, including if necessary, redesign of the pipe or structures at no additional cost to Owner.

C. Installation of Carrier Pipe

1. Pipe Installation
   a. Remove all loose soil from casing or liner.
   b. Grind smooth all rough welds at casing joints.
   c. Steel pipe shall be installed so as not to damage heat shrink sleeves. Contractor shall submit proposed method for approved.
2. Installation of Casing Spacers
   a. Provide casing spacers, insulators or other approved devices to prevent flotation, movement or damage to the pipe during installation and grout backfill placement.
   b. Assemble and securely fasten casing spacers to the pipeline to be installed in casings or tunnels.
   c. Correctly assemble, evenly tighten and prevent damage during tightening of the insulators and pipe insertion.
   d. Install spacers in accordance with manufacturer’s recommendations.
   e. Install carrier pipe so that there is no metallic contact between the carrier pipe and the casing.
   f. Carrier pipe shall be installed without sliding or dragging it on the ground or in the casing/liner in a manner that could damage the pipe or coatings.

   1. If guide rails are allowed, place cement mortar on both sides of the rails.

   g. Coat the casing spacer runners with a non-corrosive/environmentally safe lubricant to minimize friction when installing the carrier pipe.
   h. The carrier pipe shall be electrically isolated from the carrier pipe and from the casing.
   i. Grade the bottom of the trench adjacent to each end of the casing to provide a firm, uniform and continuous support for the pipe. If the trench requires some backfill to establish the final trench bottom grade, place the backfill material in 6-inch lifts and compact each layer.

j. After the casing or tunnel liner has been placed, pump dry and maintain dry until the casing spacers and end seals are installed.

3. Insulator Spacing

a. Maximum distance between spacers shall be as shown in the drawing.

b. For ductile-iron pipe, flanged pipe or bell and spigot pipe, install spacers within 1 foot on each side of the bell or flange and 1 in the center of the joint where 18 foot or 20 foot long joints are used.

c. If the casing or pipe is angled or bent, reduce the spacing.

d. The end spacer must be within 6 inches of the end of the casing pipe, regardless of size of casing and pipe or type of spacer used.

e. Install spacers on PVC pipe at the insertion line to prevent over-insertion of the spigot into the bell.

4. After installation of the carrier pipe:

a. Mortar inside and outside of the joints, as applicable

b. Verify electrical discontinuity between the water carrier pipe and tunnel liner.

1) If continuity exists, remedy the short, by any means necessary including removing and reinstalling the carrier pipe, prior to applying cellular grout.

c. If hold down jacks or casing spacers are used, seal or plug the ends of the casing.

d. If steel pipe is used and not welded prior to installation in casing/liner, welding of pipe will only be allowed after grouting of annular space is complete.

D. Installation of End Seals

1. For Sewer Pipes

a. Grout annular space between carrier pipe and casing as indicated in this Specification.

E. Annular Space Grouting

1. Prepare pipe as necessary to prevent the pipe from floating during grouting operation as necessary.

2. Mixing of Grout

a. Mix material in equipment of sufficient size to provide the desired amount of grout material for each stage in a single operation.

1) The equipment shall be capable of mixing the grout at the required densities for the approved procedure and shall be capable of changing the densities as required by field conditions.

3. Backfill Annular Space with Grout

a. Verify the maximum allowable pressure with the carrier pipe manufacturer and do not exceed this pressure.

b. After the installation of the carrier pipe, the remaining space (all voids) between the casing/liner and the carrier shall be filled with LDCG.

1) All surfaces of the exterior carrier pipe wall and casing/liner interior shall be in contact with the grout.

2) Grout shall be pumped through a pipe or hose.

3) Use grout pipes, or other appropriate materials, to avoid damage to carrier pipe during grouting.

4. Injection of LDCG

a. Grout injection pressure shall not exceed the carrier pipe manufacturer's approved recommendations or 5 psi (whichever is lower).

b. Pumping equipment shall be of a size sufficient to inject grout at a volume, velocity and pressure compatible with the size/volume of the annular space.

c. Once grouting operations begin, grouting shall proceed uninterrupted, unless grouting procedures require multiple stages.

d. Grout placements shall not be terminated until the estimated annular volume of grout has been injected.

5. Block the carrier pipe during grouting to prevent flotation during grout installation.

6. Protect and preserve the interior surfaces of the casing from damage.

3.02 SITE QUALITY CONTROL

A. Following Reports and Records are required for pipe installations:

1. Maintain and submit daily logs of grouting operations.

a. Include:

1) Grouting locations

2) Pressures

3) Volumes

4) Grout mix pumped

5) Time of pumping

2. Note any problems or unusual observations on logs.

B. Grout Strength Tests

1. Contractor shall retain a testing firm to perform the following testing and provide test results to Owner without additional cost to the Owner:

a. Testing for 24-hour and 28-day compressive strength tests for the cylinder molds or grout cubes obtained during grouting operations.

b. Contractor shall perform field sampling during annular space grouting.

1) Contractor shall collect at least 1 set of 4 cylinder molds or grout cubes for each 100 cubic yards of grout injected but not less than 1 set for each grouting shift.

2) Perform 24-hour and 28-day compressive strength tests per ASTM C39 (cylindrical specimens) or ASTM C109 (cube specimens).

3) Remaining samples shall be tested as directed by Owner.

C. Safety

1. The Contractor is responsible for safety on the job site.

a. Perform all Work in accordance with the current applicable regulations of the Federal, State and local agencies.

b. In the event of conflict, comply with the more restrictive applicable requirement.

2. No gasoline-powered equipment shall be permitted in jacking shafts and receiving shafts/pits.

a. Diesel, electrical, hydraulic and air powered equipment is acceptable, subject to applicable local, State and Federal regulations.

3. Methods of construction shall be such as to ensure the safety of the Work, Contractor's and other employees on site and the public.

4. Furnish and operate a temporary ventilation system in accordance with applicable safety requirements when personnel are underground.
    a. Perform all required air and gas monitoring.
    b. Ventilation system shall provide a sufficient supply of fresh air and maintain an atmosphere free of toxic or flammable gasses in all underground work areas.
5. Perform all Work in accordance with all current applicable regulations and safety requirements of the federal, state and local agencies.
    a. Comply with all applicable provisions of OSHA 29 CFR Part 1926, Subpart S, Underground Construction and Subpart P, Excavations.
    b. In the event of conflict, comply with the more stringent requirements.
6. If personnel will enter the pipe during construction, the Contractor shall develop an emergency response plan for rescuing personnel trapped underground in a shaft excavation or pipe.
    a. Keep on-site all equipment required for emergency response in accordance with the agency having jurisdiction

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Locating and verifying the location and elevation of the existing underground utilities that may conflict with a facility proposed for construction by use of:
      a. Exploratory Excavation
      b. Vacuum Excavation

B. Work is subsidiary to the work and shall be included in the cost to install the pipeline.

1.02 REFERENCES

A. Definitions
   1. Exploratory Excavation: A method used to locate existing underground utility as shown on the plans through the use of standard excavation equipment.
   2. Vacuum Excavation: Method used to locate existing underground utility as shown on the plans through the use of geophysical prospecting equipment such as vacuum excavation.

B. Reference Standards
   1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
   2. American Society of Civil Engineers (ASCE)
      a. ASCE Publication CI/ASCE 38 (Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data)

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination
   1. Coordinate with OWNER at least 48 hours prior to commencing on site for Exploratory Excavation of Existing Utilities.
   2. Coordinate location of all other existing utilities within vicinity of excavation prior to commencing Exploratory Excavation.
   3. Coordinate staking of Exploratory Excavations with OWNER at least 1 week prior to commencement.

B. Sequencing
   1. Exploratory Excavations shall be conducted prior to the construction of the entire project.

C. Scheduling
   1. For critical utility locations, the OWNER may choose to be present during excavation.
   2. Alter schedule for Exploratory Excavation of Existing Utilities to accommodate OWNER personnel.

1.04 SUBMITTALS

A. Report of Utility Location
   1. Horizontal location of utility as surveyed
   2. Vertical elevation of utility as surveyed
      a. Top of utility
      b. Spring line of utility

c. Existing ground

3. Material type, diameter and description of the condition of existing utility

PART 2 - EXECUTION

2.01 EXAMINATION

A. Verification of Conditions

1. Verify location of existing utilities in accordance with the General Requirements, the General Notes and the Drawings.

2.02 INSTALLATION

A. Exploratory Excavation

1. Verify location of existing utility at location denoted on the Drawings, or as directed by the OWNER.
   a. Expose utility to spring line, as necessary.
   b. Excavate and Backfill Trench for the Exploratory Excavation in accordance with Section 31 23 33.

B. Vacuum Excavation

1. Verify location of existing utility at location denoted on the Drawings, or as directed by the OWNER.
2. Designate the horizontal position of the existing underground utilities that are to be located using geophysical prospecting equipment.
   a. Acquire record documentation from and coordinate with utility companies, as necessary to locate utility.
3. Perform excavation in general accordance with the recommended practices and procedures described in ASCE Publication CI/ASCE 38.

C. Upon completion of the utility locating, submit a report of the findings.

D. If location of utility is in conflict with the Drawings, notify the Owner for appropriate design modifications.

E. Place embedment and backfill in accordance with Section 31 23 33.

F. Once necessary data is obtained, immediately restore surface to existing conditions to:

1. Obtain a safe and proper driving surface, if applicable
2. Ensure the safety of the general public
3. The satisfaction of the OWNER

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Buried and surface utility markers for utility construction

B. Related Specification Sections include, but are not necessarily limited to:

1. Division 00 – Bidding Requirements, Contract Forms, and Conditions of the Contract
2. Division 01 – General Requirements

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment

1. Measurement
   a. No measurement for this Item will be made.
2. Payment
   a. The work performed and materials furnished in accordance with this Item shall be incidental to the cost of the pipe installation.
3. The price bid shall include:
   a. Furnishing and installing Utility Markers as specified by the Utility Marker Detail and Part 3 (Execution).
   b. Mobilization
   c. Pavement removal
   d. Excavation
   e. Hauling
   f. Disposal of excess material
   g. Furnishing, placement and compaction of backfill
   h. Clean-up

1.03 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. American Public Works Association (AWPA):
   a. Uniform Color Code.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the District prior to delivery.

1.05 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Surface Marker.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers

1. Carsonite International or approved equivalent.

2. Provide new Utility Markers from a manufacturer regularly engaged in the manufacturing of Utility Markers.

B. Materials

1. Surface Markers

a. Provide as follows:

1) 3.75 inch by 72 inch three rail composite pipeline marker with barb anchor for permanent anchoring.

2) Marker Wording – “CAUTION SEWER PIPELINE” with the MXLocation ID (WWMH#).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Surface Markers

1. Bury a minimum of 2 feet deep, with a minimum of 4 feet above ground

2. Where possible, place surface markers near fixed objects such as fences and structures.

3. Place Surface Markers at the following locations:

a. Buried Features

1) Place directly above a buried feature.

b. Above-Ground Features

1) Place a maximum of 2 feet away from an above ground feature.

c. For sewer lines:

1) In undeveloped areas, place marker maximum of 2 feet away from an above-ground feature such as a manhole or combination air valve vault.

2) Place at 500-foot intervals along the pipeline, direction changes and right-of-way crossings.

END OF SECTION

33 31 13 FIBERGLASS REINFORCED PIPE GRAVITY SANITARY SEWERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Fiberglass Reinforced pipe 18-inch and larger for gravity sanitary sewer applications

1.02 REFERENCES

A. Reference Standards

1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
2. ASTM International (ASTM):
   a. D3262, Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
   b. D3681, Standard Test Method for Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe in a Deflected Condition.
   c. D4161, Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
   d. D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
   e. F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
   f. D3567 - Standard Practice for Determining Dimensions of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings
   g. D3839 - Standard Guide for Underground Installation of “Fiberglass” (Glass-Fiber Reinforced Thermosetting-Resin) Pipe
3. American Water Works Association (AWWA):
   a. AWWA M45 Fiberglass Pipe Design

1.03 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data

1. Manufacturer
2. Manufacturer Number (identifies factory, location, and date manufactured.)
3. Nominal Diameter
4. Pipe Stiffness
5. Laying lengths
6. ASTM designation

B. Shop Drawings

1. Pipe details
2. Joint details, including maximum interior joint gap opening, in the deflected position and in the straight alignment.
3. Miscellaneous items to be furnished and fabricated for the pipe
4. Dimensions
5. Tolerances
6. Wall thickness
7. Properties and strengths
8. Gasket type and composition showing ability to withstand the chemicals and conditions within sanitary sewers.
9. Connections to all proposed structures including water stop.
10. Pipe calculations

a. Calculations confirming the pipe will handle anticipated loading signed and sealed by a Professional Engineer Licensed in the State of Texas

C. Certificates

1. Furnish an affidavit certifying that all Fiberglass Reinforced Pipe meets the provisions of this Section and has been tested and meets the requirements of ASTM D3262.

D. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Owner. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.

E. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.04 QUALITY ASSURANCE

A. Qualifications

1. Manufacturers
   a. Finished pipe shall be the product of a single manufacturer for each size per project.
   b. Pipe manufacturing operations shall be performed under the control of the manufacturer.
   c. All pipe furnished shall be in conformance with this specification and ASTM D3262.

1.05 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.

B. Flexible pipe, including “semi-rigid” pipe, is required to show a long-term deflection of no more than 5 percent of the original pipe diameter.

1. Test the pipes initial vertical cross-section deflection measured within the first 24 hours after completion of all backfilling and removal of dewatering systems. Deflection shall not exceed 3% of the original pipe diameter.

2. Not sooner than 30 days after backfilling of line segment but prior to final acceptance using a standard mandrel to verify that installed pipe is within specified deflection tolerances (5% of the original pipe diameter).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Provide adequate padding and restraints during transport to prevent damage to the pipe, fittings and appurtenances.

B. Storage and Handling Requirements

1. Gravity pipe shall be stored and handled in accordance with the manufacturer’s guidelines.

1.07 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.

B. Coordinate testing schedules with Owner. Perform testing under observation of Owner.

PART 2 - PRODUCTS

2.01 EQUIPMENT, PRODUCT TYPES AND MATERIALS

A. Manufacturers

1. Only the following manufacturers will be considered: Hobas Pipe USA, Inc., Flowtite Pipe.
   a. The manufacturer must comply with this Specification and related Sections.

B. Performance / Design Criteria

1. Pipe
   a. Design and test in accordance with ASTM D3262
   b. Design pipe for service loads that include:
      1) External groundwater and earth loads
      2) Jacking/pushing loads
         a) The allowable jacking/pushing capacity shall not exceed 40 percent of the ultimate compressive strength or the maximum allowable compressive strength recommended by the manufacturer, whichever is less.
      3) Traffic loads
      4) Practical considerations for handling, shipping and other construction operations
   c. Design is to be conducted under the supervision of a Professional Engineer licensed in the State of Texas, who shall seal and sign the design.
   d. Pipe shall be supplied in nominal lengths of 10 feet up to 40 feet. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.
   e. Minimum pipe stiffness when tested shall be in accordance with ASTM D2412. The minimum pipe stiffness shall not be less than SN 46 psi and recommended by the manufacturer given consideration of the field condition, applicable loading, depth, trench width, water table and 100-year flood plain elevation. Depth shall not exceed 30 feet of cover with a gravel pipe envelope to 6 inches above pipe. For depths greater than 30 feet but less than 50 feet use a pipe stiffness not less than SN 72 psi. The minimum pipe stiffness for trenchless installations shall match the pipe stiffness of the adjacent direct bury pipe.
   f. The pipe stiffness for each segment must also be approved by the OWNER.
   g. Accommodate vertical alignment changes required because of existing utility or other conflicts by an appropriate change in pipe design depth.
   h. In no case shall pipe be installed deeper than its design allows.
2. Dimensional Tolerances
   a. Inside diameter
      1) Pipe shall not vary more than 1/8 inch from the nominal inside diameter.
   b. Wall thickness
      1) Provide minimum single point thickness no less than 98 percent of stated design thickness.
   c. End Squareness
      1) Provide pipe ends square to pipe axis with maximum tolerance of 1/4 inch or 0.5% of the nominal diameter.
   d. Fittings
      1) Provide tolerance of angle of elbow and angle between main and leg of wye or tee to ±2 degrees.
      2) Provide tolerance of laying length of fitting to ±2 inches.
3. Inspection and Testing During Fabrication
   a. The Contractor, during the fabrication of the pipe, shall retain at his expense the services of a testing laboratory to make all tests of materials to be incorporated into the pipe and maintain control of the acceptance of these materials for fabrication of the pipe.
   b. At a minimum, actual test results shall be required as follows:
      1) Load bearing tests: Provide test results for the first joint manufactured of each size and class, and at least one joint per hundred joints thereafter.
      2) Material tests: Provide material test results per the ASTM and AWWA Standards.
   c. Pipe shall have an SN Test that bear the approval stamp of the testing laboratory in lots of 1/100 per ASTM D2412. The selection of the testing laboratory shall be subject to the approval of the Owner and its work subject to the Engineer's review.
   d. The Owner or other designated representative shall be entitled to inspect pipes or witness the pipe manufacturing. Such inspection shall not relieve the manufacturer of

the responsibilities to provide products that comply with the applicable standards and these Specifications.

e. Should the Owner request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.
f. Should the Owner elect not to inspect the manufacturing, testing, or finished pipes, it in no way implies approval of products or tests.
g. An inspection of the pipe after delivery to the project shall be made by a representative of the Owner. Pipe with visible defects which are indicative of poor structural condition or poor workmanship shall be rejected and replaced without cost to the Owner. Visible defects shall include cracks of any type, honeycombs, delamination, or any other defects of poor workmanship. Any pipe rejected shall not be returned under any condition to the project.

C. Materials

1. Resin Systems
   a. Only use polyester resin system with proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product. The internal liner resin shall be suitable for service as sewer pipe, and shall be highly resistant to exposure to sulfuric acid as produced by biological activity from hydrogen sulfide gases.
2. Glass Reinforcements
   a. Use reinforcing glass fibers of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnated resins to manufacture components.
3. Fillers
   a. Silica sand or other suitable materials may be used.
   b. Use 98 percent silica with maximum moisture contest of 0.2 percent.
4. Additives
   a. Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall neither detrimentally affect the performance of the product nor impair visual inspection of the finished products.
5. Internal liner resin
   a. Suitable for service as sewer pipe
   b. Highly resistant to exposure to sulfuric acid
   c. Produced by biological activity from hydrogen sulfide gases
   d. Meet or exceed requirements of ASTM D3681
6. Gaskets
   a. Supply from approved gasket manufacturer in accordance with ASTM F477 and suitable for service intended.
   b. Affix gaskets to pipe by means of suitable adhesive or install in a manner to prevent gasket from rolling out of pre-cut groove in pipe or sleeve coupling.
   c. Provide the following gaskets in potentially contaminated areas.
      1) Petroleum (diesel, gasoline) – Nitrile
      2) Other contaminants – Manufacturer recommendation
7. Couplings
   a. Field connect pipe with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as sole means to maintain joint water tightness.
8. Joints
   a. Joints must meet requirements of ASTM D4161.
   b. Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings or bell-spigot joints that utilize elastomeric sealing gaskets as the sole means to maintain joint water tightness.
9. Pipe markings shall meet the minimum requirements of ASTM D3262. Minimum pipe

markings shall be as follows:
a. Manufacturer
b. Manufacturer Number (identifies factory, location, date manufactured, shift and sequence)
c. Nominal diameter
d. Pipe Stiffness
e. Laying length
f. ASTM designation

10. Connections
    a. Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed per manufacturer recommendations (ie. branch fittings concrete encased). They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion-bonded epoxy-coated steel and stainless steel fittings may also be used.
11. Detectable Metallic Tape
    a. See Section 33 05 26.

D. Manufacture and Construction
1. Manufacture pipe by the centrifugal casting or filament wound process to result in a dense, nonporous, corrosion-resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow shall be manufactured using a resin with a 50% elongation (minimum) when tested in accordance with ASTM D638, or a glass reinforced resin liner system. The interior surface shall provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a sand and resin layer or a glass reinforced resin layer that provides UV protection to the exterior. Pipes shall be Type 1, Liner 1 or 2, Grade 1 or 3 per ASTM D3262.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General
1. Install pipe, fittings, specials and appurtenances as specified herein and in accordance with the pipe manufacturer’s recommendations.
2. Lay pipe to the lines and grades as indicated in the Drawings.
3. Excavate and backfill trenches in accordance with Section 31 23 33.
4. Embed pipe in accordance with Section 31 23 33.
5. For installation of carrier pipe within casing, see Section 33 05 25.
6. Install fiberglass pipe, fittings, specials, and appurtenances as specified and required for the proper functioning of the completed pipeline. Install pipe, fittings, and specials in accordance with the Manufacturer's recommendations, ASTM 3839, and AWWA M45. Pipe shall be laid to the lines and grades indicated. Just before each joint of pipe is lowered into the trench, it is to be inspected. All damaged areas and holidays are to be repaired per manufacturer recommendations before the pipe is lowered into the trench.
7. Lay pipe in satisfactory conditions on embedment as indicated. Pipe laying process shall be approved by the Engineer or OWNER'S representative. Carefully lower pipe to the bottom of the trench and lay with the bell upgrade, unless otherwise approved by the Engineer or Owner's representative. Chains or cables shall not be used.
8. In handling, laying, and jointing the pipe, exercise extreme care to prevent damaging the gaskets and the ends of the pipe joints. Just prior to joining, make an inspection to be certain that the pipe ends and gaskets are thoroughly clean with no foreign materials adhering to them. Coat the bell or groove slopes of the pipe with a lubricating material in

accordance with manufacturer's recommendations. Petroleum lubricants shall not be permitted. Assemble the pipe by pulling the tongue or spigot of the joint being laid into the groove or bell of the pipe with sufficient force necessary to make a tight seal on the gasket. Use of backhoe or similar equipment for a homing the joint will not be permitted. Do not exceed forced recommended by the manufacturer for coupling the pipe.

9. Check joints with a feeler gauge, if pipe does not have a homing mark on pipe outside and check for inside gaps to determine full homing of the joints. If any irregularity in the position of the gasket is detected at any point on the entire circumference of the pipe, remove the pipe and examine the gasket for cuts. If the gasket is undamaged, it may be used again, but the gasket and the joint must be lubricated. After the pipe section is joined, check the line and grade.
10. Securely place tight fitting stoppers or bulkheads in the ends of the pipelines when the work is stopped temporarily, or at the end of the day's work, to prevent trash or dirt entering the pipe.
11. The CONTRACTOR may use deflected pipe joint to make slight adjustments in line and grade however, the maximum deflection of any joint shall not exceed 75% of the manufacturer maximum recommended joint deflection.

B. Pipe Handling

1. Haul and distribute pipe and fittings at the project site.
2. Handle piping with care to avoid damage.
   a. Inspect each joint of pipe and reject or repair any damaged pipe prior to lowering into the trench.
   b. Use only nylon ropes, slings or other lifting devices that will not damage the surface of the pipe for handling pipe. Use of chains or cables is not allowed.
3. At the close of each operating day:
   a. Keep the pipe clean and free of debris, dirt, animals and trash – during and after the laying operation.
   b. Effectively seal the open end of the pipe using a gasketed nightcap.

C. Pipe Joint Installation

a. Clean dirt and foreign material from the gasketed socket and the spigot end.
b. Assemble pipe joint by sliding the lubricated spigot end into the gasketed bell end to the reference mark.
c. Install such that identification marking on each joint are oriented upward toward the trench opening.
d. When making connection to manhole, use an elastomeric seal or flexible boot to facilitate a seal.

D. Detectable Metallic Tape Installation

1. See Section 33 05 26.

3.02 QUALITY CONTROL

A. Preparation

1. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
2. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures as required.

B. Field Tests and Inspections

1. Testing Requirements
   a. Perform testing in accordance with Section 01 40 00.
   b. Hydrostatic Leak Test-Gravity Flow Sewer Lines
      1) Perform hydrostatic leak tests after backfilling.

2) The length of the pipe to be tested shall be such that the head over the crown of the upstream end is not less than 2' or 2' above the ground water level whichever is higher and the head over the downstream crown is not more than 6'.
3) Plug the pipe by pneumatic bags or mechanical plugs so that the air can be released from the pipe while it is being filled with water.
4) Continue the test for one hour and make provisions for measuring the amount of water required to maintain the water at a constant level during this period.
5) Remove the jointing material and remake the joint if any joint shows any visible leakage or infiltration.
6) Remove and replace any defective or broken pipes.
7) Determine the maximum allowable leakage or infiltration by the following formula:

$$L = \frac{C\ D\ S}{26{,}720}$$

Equation Term	Represents	Measure
L	Maximum allowable leakage	gallons per hour
S	Length of pipe tested	feet
D	Nominal diameter of the pipe	inches
C	Infiltration / exfiltration rate	
	Use 50 for C outside of 25-year floodplain.	
	Use 10 for C within 25-year floodplain.	

8) Determine the rates of infiltration by means of V-Notch weirs, pipe spigot, or plugs in the end of the pipe. Methods, times, and locations are subject to the Engineer's approval.
9) Pipe with visible leaks or infiltration or exceeds the maximum allowable leakage or infiltration is considered defective and must be corrected.

c. Low Pressure Air Test- Gravity Flow Sewer Lines
1) Use air test in lieu of the hydrostatic test if desired, or if pipeline grades do not allow filling the entire pipeline segment or manhole to the indicated depth.
2) Perform low-pressure air tests, using equipment specifically designed and manufactured for the purpose of testing sewer pipelines using low-pressure air. Test is to conform to procedure described in ASTM F-1417 except for testing times. The following test times are required:

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Long Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

a) Provide the equipment with an air regulator valve or air safety valve set to an internal air pressure in the pipeline that cannot exceed 6 psig.
b) Pass air through a single control panel.
c) Provide pneumatic plugs that have a sealing length equal to or greater than the

circumference of the pipe to be tested.
d) Provide pneumatic plugs that resist internal test pressures without requiring external bracing or blocking.
e) Provide an air compressor of adequate capacity for charging the system.

3) Perform air test only on lines less than 36" diameter. Air tests for pipes larger than 36" may be air tested at each joint.
4) Check connections for leakage with a soap solution. Release the air pressure, repair the leak, and retest with soap solution until results are satisfactory, before resuming air test if leaks are found.
5) Determine the shortest allowable time for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch by the following formula:

T = 0.0850 DK/Q

Equation Term	Represents	Measure
T	Time for the pressure to drop 1.0 pound per square inch gauge	seconds
K	Factor equal to 0.000419DL, but not less than 1.0	
D	Average inside diameter of the pipe	inches
L	Length of line of the same pipe size	feet
Q	Rate of loss. Use 0.0015 cubic feet per minute per square foot of internal surface	

2. Air Test for Individual Joints
   a. Lines 36" and larger may be tested at individual joints.
   b. The shortest allowable time for the pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge is 10 seconds for all pipe sizes.
3. Deflection Testing for Pipe
   a. Perform deflection tests on flexible and semi-rigid pipe in accordance with ASTM 3034.
      1) The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5.0% unless specified otherwise.
      2) Conduct test after the final backfill has been in place a minimum of 30 days; if deflection is tested between 30 and 60 days after backfill has been placed, the maximum allowable vertical deflection shall be 4% to help keep the long-term deflection at 5%. Deflection testing to be completed prior to final acceptance testing of line segment.
      3) Thoroughly clear the lines before testing.
   b. Measure deflection from the inside of the pipe.
   c. Excavate and repair pipe with deflections in excess of the maximum allowable deflection.
4. Closed Circuit Television (CCTV) Inspection
   a. Provide a CCTV inspection in accordance with Section 33 01 30.16.
5. Visual Inspection of Gravity Sanitary Sewers
   a. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

END OF SECTION

PART 1 GENERAL

1.01 SCOPE

A. This specification section includes all materials, equipment, labor, and incidentals required for the supply and installation of polyvinyl chloride (PVC) pipe and fittings, 4-inch diameter to 60-in diameter for use in storm sewer, sanitary sewer, or other non-pressure sewer applications.

1.02 RELATED SECTIONS

A. Section 01 33 00 Submittals
B. Section 01 45 16.16 Hydrostatic Testing of Wastewater Pipelines
C. Section 01 74 23 Final Cleaning
D. Section 31 23 33 Trench Excavation and Backfill
E. Section 33 04 50 Cleaning of Sewer Mains
F. Section 33 05 10 Utility Trench Excavation, Embedment and Backfill
G. Section 33 05 25 Installation of Carrier Pipe in Casing

1.03 REFERENCES

The Contractor and/or Pipe Manufacturer shall follow the standards listed below, except as otherwise specified herein. The latest revision or edition in effect at the time of bid opening shall be utilized.

A. American Society for Testing and Materials (ASTM)
    1. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
    2. D2321 – Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications
    3. D3034 – Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
    4. D3212 – Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
    5. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe
    6. F679 – Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
    7. F1417 – Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
B. American Water Works Association (AWWA)
    1. M23 – PVC Pipe – Design and Installation
C. Uni-Bell PVC Pipe Association
    1. UNI-B-6 – Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe
    2. UNI-PUB-6 – Installation Guide for PVC Solid-Wall Sewer Pipe (4 - 48 in.)
    3. UNI-TR-3 – Maintenance of PVC Sewer Pipe
    4. Handbook of PVC Pipe Design and Construction

1.04 QUALIFICATIONS

A. The Pipe Manufacturer shall be a member of the Uni-Bell PVC Pipe Association.
B. The pipe and fittings shall be designed, manufactured, and installed in accordance with industry standards and shall comply with the specification requirements herein.

1.05 SUBMITTALS

A. Conform to the requirements of Section 01 33 00 - Submittals

B. Submit product data on pipe, fittings, gaskets and appurtenances as required to ensure products meet the requirements of this specification.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Pipe shall be shipped so as to not bend, dent, or otherwise damage the pipe during transport.
B. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading.
C. Owner shall observe and inspect unloading of pipe to ensure proper unloading procedures are followed.
D. Under no circumstances will pipe or fittings be allowed to be rolled, pushed, or dropped off from any height for delivery, storage, or installation. Any pipe found to have been damaged due to improper handling procedures will be immediately marked for identification and removed from the jobsite at Contractor's expense.
E. Material storage shall be performed in accordance with Pipe Manufacturer's recommendations.
F. Stacking of pipe shall be performed in accordance with Pipe Manufacturer's recommendations.
G. Once pipe has been unloaded, it shall be stored as near to its point of installation as possible. Contractor shall limit moving or restacking of pipe prior to installation.
H. Where necessary, because of ground conditions, store pipe on wooden sleepers, spaced suitably and of such widths as not to allow deformation of pipe at point of contact with sleeper or between supports.
I. Pipe shall not be stored close to heat sources or hot objects such as heaters, boilers, steam lines, and engine exhaust.
J. If pipe is to be exposed to direct sunlight for extended periods (in excess of two years from the date of manufacture), then Contractor shall cover/shade pipe utilizing canvas or other opaque materials. Black plastic will not be acceptable as a shading material.
K. Gaskets shall be protected from exposure to excessive heat, prolonged direct sunlight, and oil and grease.

PART 2 PRODUCTS

2.01 PIPE

A. Pipe shall be manufactured and supplied in accordance with ASTM D3034 (4-Inch to 15-Inch) or F679 (18-Inch to 60-Inch).
B. Pipe shall have lay lengths between 14 and 22 feet unless otherwise specified by the Owner.
C. The pipe shall be made of PVC compound having a cell classification of 12454 or 12364 in accordance with ASTM D1784.
D. Pipe shall be homogenous throughout, free of voids, cracks, inclusions, and other defects.
E. Pipe shall have markings at intervals of 5ft or less including:
    1. Manufacturer's name or trademark and code
    2. Nominal pipe size
    3. PVC cell classification
    4. Legend (e.g. " SDR-41 PVC Sewer Pipe" or "PS 46 PVC Sewer Pipe")
    5. ASTM Designation
    6. Gasketed pipe shall be marked with an insertion depth mark on the spigot end
F. Pipe for non-potable water shall be white in color.
G. Pipe for wastewater uses shall be green color.

H. Pipe outside diameters shall be equal to those of cast iron unless otherwise specified by the Owner.

2.02 PIPE DESIGN

A. Pipe shall be supplied to meet the external loading requirements of the project as follows:
   1. Maximum calculated deflection of 7.5%
   2. Live loads as calculated per AWWA M23 based on the profile shown on the plans
   3. Depth of cover as shown on the plans
   4. Trench width as shown on the plans
   5. Modulus of soil reaction (E'), bedding constant (K), and soil density (γ) shall be based on design and site conditions.

2.03 FITTINGS

A. Fittings shall be manufactured and supplied in accordance with ASTM D3034 (4-Inch to 15-Inch) or ASTM F679 (18-Inch to 60-Inch). Molded and fabricated fittings may be supplied in accordance with ASTM F1336.
B. Fittings shall be made of PVC compound having a cell classification of 12454 or 13343 in accordance with ASTM D1784.
C. Pipe used in fabricated fittings shall have a wall thickness equal to or greater than the wall thickness of the pipes to which the fitting (or that part of the fitting) will be joined.
D. Molded and fabricated fittings shall have markings including:
   1. Manufacturer's name or trademark
   2. Nominal size
   3. Material designation (e.g. "PVC")
   4. ASTM Designation
E. Fittings may also be supplied as ductile iron fittings in accordance with AWWA C110 and/or C153.

2.04 PIPE JOINTS

A. Joints shall be gasketed push-on type conforming to ASTM D3212.
B. Gasket materials shall meet requirements of ASTM F477.
C. Joint lubricant shall be approved by the Pipe Manufacturer and shall have no detrimental effect on the gasket or pipe.

PART 3 EXECUTION

3.01 GENERAL

A. Install pipe, fittings, specials, and appurtenances in accordance with ASTM D2321, UNI-PUB-6 and/or in accordance with the Pipe Manufacturer's recommendations.
B. Lay pipe to the lines and grades as indicated on the Plans.

3.02 PIPE HANDLING

A. Handle pipe and piping materials with care to avoid damage.
B. Prior to installation, each pipe length shall be carefully inspected for damage.
C. All pipe, fittings, and appurtenances shall be thoroughly cleaned before installation and shall be kept clean until installation and backfilling has completed.
D. Use only nylon ropes, slings, or other lifting devices that will not damage the surface of the pipe.
E. Keep the pipe clean and free of debris, dirt, animals, and trash during and after laying operations.

F. At the close of each operating day, seal the open end of the pipe using a gasketed night cap.

3.03 PIPE INSTALLATION

A. Do not drag pipe over gravel or rock. Avoid striking rocks or hard objects when lowering pipe into the trench.
B. Placement of pipe and fittings into the trench should be done with ropes and skids, slings on a backhoe bucket, or by hand.
C. Pipe or fittings shall not be thrown into the trench and no part of the pipe shall be allowed to take an unrestrained fall onto the trench bottom.
D. Joint sockets shall be carefully cleaned before pipes are lowered into trenches.
E. Pipe trenches and excavation shall be kept free of water during pipe laying operations and other related work. If high groundwater levels are expected or encountered, Contractor is to ensure that a minimum depth of cover of 1.5 times the pipe diameter will be maintained over the pipe once it has been installed or provide other methods approved by the Owner and Pipe Manufacturer of preventing flotation of the pipe.

3.04 JOINT MAKING

A. Install push-on joints in accordance with Pipe and Fittings Manufacturer's recommendations.
B. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. In cases when gaskets are supplied separately from pipe, Contractor is to ensure that gaskets supplied are designed for the pipe in use.
C. Clean the gasket of all extraneous matter.
D. Apply a thin film of joint lubricant to the inside of the gasket and the outside of the spigot prior to entering the spigot into the bell. Lubricated spigots ends shall not come in contact with soil or backfill material.
E. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell. If two reference marks are present, the mark closest to the spigot end shall be considered the minimum insertion mark, and the second mark shall be considered the maximum insertion mark. Under no circumstances will the spigot be inserted into the bell past the reference mark or maximum insertion mark.
F. For small diameter pipe, use the bar-and-block method for joint assembly or other method approved for use by the Owner and Pipe Manufacturer.
G. For large diameter pipe, use mechanical assistance such as hydraulic pipe pullers, jacks, pulleys, come-alongs, or a backhoe bucket. Observation by a spotter will be required when assembling joints for large diameter pipe to prevent over-insertion.
H. When using a field cut plain end piece of pipe, bevel the end with a beveling tool, wood rasp, or power sander to the same angle and length as provided on the factory-finished pipe. Redraw the insertion line on the spigot using a factory-marked spigot as a guide.
I. Angular changes in pipe alignment shall be achieved by either fittings, joint deflection, or longitudinal bending of the pipe.
J. Joint deflection shall not exceed the Pipe Manufacturer's recommendation.
K. Field assembly of pipe fittings shall follow the Pipe Fittings Manufacturer's recommendations.
L. Mechanical joints shall be assembled per the Pipe and/or Fittings Manufacturer's recommendations as well as the recommendations of the mechanical joint supplier.

3.05 LONGITUDINAL PIPE BENDING

A. Controlled changes in direction may be accomplished by longitudinal bending of the pipe barrel.

B. Pipe Manufacturer shall be consulted prior to start of construction for recommendations on longitudinal bending.
C. When longitudinal bending of pipe is utilized, Contractor shall use manual force alone to achieve prescribed bending. Mechanical means shall not be utilized to achieve longitudinal bending of the pipe.
D. When the desired change of direction in the pipeline exceeds the maximum allowable deflection specified, the longitudinal bending shall be made throughout a number of pipe lengths.
E. Contractor will ensure that pipe joints will not be over-pulled or over-inserted during longitudinal bending operations.

3.06 FIELD TESTING

A. After pipe has been installed and backfilled, deflection testing shall be performed in accordance with ASTM D3034 and/or F679, PVC Pipe Handbook, and the specifications herein. Deflection testing shall utilize a “go/no-go” mandrel for measurement of pipe deflection. Where practical, Contractor should allow for stabilization of the pipe/soil system (up to 30 days) prior to testing.
    a. The maximum allowable deflection of pipe measured as the reduction in vertical inside diameter is 5.0% unless specified otherwise.
    b. Conduct test after the final backfill has been in place a minimum of 30 days; if deflection is tested between 30 and 60 days after backfill has been placed, the maximum allowable vertical deflection shall be 4% to help keep the long-term deflection at 5%. Deflection testing to be completed prior to final acceptance testing of line segment.
    c. Thoroughly clear the lines before testing.
B. All finished installations for non-pressure applications shall be tested via low-pressure air testing in accordance with ASTM F1417, UNI-B-6, and the specifications herein.
C. Isolate the section of non-pressure sewer line to be air tested by inflatable stoppers or other suitable test plugs/caps.
D. Ends of all branches, laterals, tees, wyes, and/or stubs in the test section shall be plugged or capped to prevent air leakage. One of the plugs/caps shall have an inlet tap or other method for connecting the air hose to an air control source.
E. Test ends should be restrained and/or braced during air testing.
F. Add air slowly to the test section until the pressure reaches 4.0 psi. After the test pressure is obtained, regulate the air supply so that the pressure is maintained between 3.5 and 4.0 psi for at least 2 minutes until the air temperature stabilizes and is in equilibrium with the temperature of the pipe walls.
G. After equilibrium is achieved, determine the rate of air pressure loss by either the constant pressure method or the time-pressure drop method as outlined in ASTM F1417.
H. Upon completion of the test, open the bleeder valve and allow all air to escape. Caps/plugs shall not be removed until all air pressure in the test section has been reduced to atmospheric pressure.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Precast concrete manholes or manhole sections for sanitary sewers.

B. Precast concrete sanitary sewer manholes with manhole coating where corrosion-resistant manholes are used.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 REFERENCES

A. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

B. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. ASTM C 270- Standard Specification for Mortar for Unit Masonry.

E. ASTM C 443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

G. ASTM C 923 - Standard Specifications for Resilient Connectors between Reinforced Concrete Manhole Structures and Pipes.

H. ASTM C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).

I. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3).

J. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

K. ASTM D 2996 - Standard Specification for Filament-Wound Fiberglass@(Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

L. ASTM D 2997 - Standard Specification for Centrifugally Cast Fiberglass@(Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

M. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines.

N. American Association of State Highway and Transportation Officials (AASHTO).

1.03 SUBMITTALS

A. 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 C 478 and design criteria as established in Paragraph 2.01E 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 bypassing flows and 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 State of Texas.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings that are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. 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 2.01E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide tops to support HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with cone top precast sections used to transition to 32-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Owner.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.

1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs.

2. Unit soil weight of 130 pcf located above portions of manhole, including base slab projections.

3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf.

4. Internal liquid pressure based on unit weight of 63 pcf.

5. Dead load of manhole sections fully supported by transition and base slabs.

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:

1. Design additional reinforcing steel to transfer stresses at openings.

2. Wall Loading Conditions:

a. Saturated soil pressure acting on empty manhole.

b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure.

3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater.

G. Provide joints between sections with O-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. 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.

2.02 CONCRETE

A. Conform to requirements of Section 03 01 30.05 - Concrete for Utility Construction.

B. 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 4000 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Section 31 23 23.34 - Cement Stabilized Sand.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.03 REINFORCING STEEL

A. Conform to requirements of Section 03 21 01 - Concrete Reinforcement.

2.04 MORTAR

A. Conform to requirements of Section 03 01 30.06 - Mortar.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 33 05 13 - Frames, Covers, and Grade Rings.

2.06 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.07 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers:

1. Refer to plans.

2.08 SEALANT MATERIALS

A. Approved products in accordance with Contract Documents.

B. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.

C. Provide external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

D. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.09 CORROSION RESISTANT MANHOLE MATERIALS

A. Provide new corrosion resistant manhole materials in per Section 33 39 60.01, Epoxy Liners for Sanitary Sewer Structures.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Section 31 23 00, Excavation and Backfill for Utilities.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 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.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Owner.

3.02 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.03 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. 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 03 34 13, Controlled Low Strength Material.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Owner 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 Drawings, under manhole base.

3.04 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.

E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

F. Top of manhole elevations shown on Drawings are approximate, based on pavement and natural ground conditions at the time of the topographic survey. No additional payment will be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manhole in accordance with manufacturer's instructions.

1. Where smooth exterior pipes (i.e. steel, ductile iron or PVC pipes) are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as an 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 stainless steel power sleeve, stainless steel take-up clamp and 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.

B. 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.

C. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install water stop gasket around existing pipe at center of cast-in-place wall. Join ends of split water stop material at pipe spring line using an adhesive recommended and supplied by water stop manufacturer.

D. Test connection for watertight seal before backfilling.

3.06 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of Invert Bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum.
2. Depth of Bench to Invert:
   a. Pipes smaller than 15 inches: one-half of largest pipe diameter.
   b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter.
   c. Pipes larger than 24 inches: equal to largest pipe diameter.
3. Invert Slope through Manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. 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.

3.07 DROP CONNECTIONS FOR SANITARY SEWERS

A. 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.

B. Install drop connection when sewer line enters manhole higher than 24 inches above invertof manhole.

3.08 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.09 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete and 30” new pipe sections so elevation of installed casting cover matches pavement surface. Seal between concrete riser and precast top section with non-shrink grout; do not use mortar. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on 30” new pipe section in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch high and 1/2-inch wide.

B. Wrap manhole frame and 30” new pipe riser adjustment with external sealing material,minimum 3 inches beyond joint between ring and frame and ring and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing groundline unless otherwise indicated on Drawings. In unpaved areas, 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.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes inaccordance with requirements of Section 31 23 33, Trench Excavation and Backfill. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. 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.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 32 91 16.13,Topsoil. Seed in accordance with Section 32 92 16, Hydro Mulch Seeding.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 01 40 00, Quality Requirements.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to Owner.

END OF SECTION

GENERAL

1.01 SECTION INCLUDES

A. Composite frames and covers, grade adjustment rings for application in wastewater collection system and facilities.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment to rack over existing manhole is on a unit price basis for each manhole.

2. Refer to Section 01 29 00 Payment Procedures 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. M306-10: Drainage, Sewer, Utility, and Related Castings
   a. Manufacture
   b. Proof Testing
   c. Inspection
   d. Certification
   e. Marking

2. Standard Specification for Highway Bridges

B. ASTM C501 – Standard Testing for Wear and Abrasion

C. ASTM G154: Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

D. ASTM C1028 – Standard Testing for Coefficient of Friction

E. ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness

F. TCEQ Chapter 217 Design Criteria for Waste Water Systems Section 217.55 Manhole Covers

1.04 SUBMITTALS

A. Conform to requirements of Section 01 33 00 Submittals.

B. Submit copies of manufacturer's specifications, testing data, certifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of frame and cover assemblies. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of frames and

anchorage devices.

PART 2 PRODUCTS

2.01 COMPOSITE RING AND COVER

A. Composite frames and covers shall be manufactured in the USA from fiber-reinforced polymer (FRP). It shall consist of an FRP matrix consisting of between 45% to 70% fiber reinforcement by weight. Fiber reinforcement shall consist of fiberglass, carbon, aramid, basalt and/or natural fibers. The polymer matrix shall be thermoset consisting of a polyester, vinylester, epoxy, polyurethane, and/or hybrid chemical composition.

B. Cover shall gave a gasket seal and two locking lugs made of stainless steel. The locking lugs shall be designed to lock under the seat of the frame. Lock lugs shall be actuated by a stainless-steel penta-head bolt.

C. Composite frames and covers shall be of uniform quality, with a general dimensional tolerance of 1/16-inch. The finished product will feature a strength to weight ratio of 750:1 when comparing proof load capacity to weight of the cover. There shall be no possibility of corrosion welding between the cover and the frame, preventing damage to the infrastructure when opening. Perimeter overmold gasket system shall be integral to the cover. Perimeter overmold shall be integrated to protect the laminate portion of the cover, reduce traffic shock and to abate noise and malodors. The laminate portion of the cover shall extend far enough to engage with at least 1/2-inch of the frame seat, when centered.

D. Frame shall have a polyurethane overmold to protect it from damage. The overmold shall extend at least 1.5-inches down the outside wall of the frame and shall encapsulate the seat of the frame (cover bearing surface).

E. Fabricate rings and covers to conform to shapes, dimensions, and with wording or logos shown on Drawings.

F. Covers shall be provided with a positive lock mechanism. Lock will have indicators to show when Lock is fully engaged.

2.02 TESTING AND PERFORMANCE REQUIREMENTS

A. 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 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.

B. Frames and Covers shall be tested in accordance with the following methods.

1. Proof Load Testing: Traffic service frames and covers shall have a first article

proof load test conducted and the results of that proof load shall be made available to the purchaser upon request. The proof load shall be conducted in accordance with the method and procedure that is outlined in AASHTO M 306. The product shall be tested on a suitable and calibrated load testing machine, the composite frame and cover shall hold a 50,000-pound proof load for one minute without experiencing any cracks or detrimental permanent deformation. During the load testing process audible cracking, visible cracks or delamination will be cause for rejection. When load is removed, Permanent Set (Deflection) of more than 1/8” (.125”) measured at center of load area will be cause for rejection. All testing shall be conducted on a NIST calibrated and Certified load test machine.

2. Fatigue Performance: Composite frames and covers shall be tested to a fatigue performance consisting of 2 million cycles at 16,000 pounds. There shall be no visible damage and permanent deformation must not exceed 1/8-inch. Permanent deformation shall be measured at least 15 minutes after loading. This test must be performed in a manner approximating the field installation as accurately as possible. After the product has gone through the cycle test, it must then pass the proof load requirements of AASHTO M 306 H25.

3. Ultraviolet resistance: Cover shall meet ultraviolet requirements as defined in ASTM G154 (Cycle 1 for 1600 hours). Specimens shall be tested for ultimate flexural strength, retaining at least 75% of control values for load and deflection at failure.

4. Coefficient of Friction: Static Coefficient of Friction of cover shall be 0.5 or greater, as described in ASTM C1028 Standard, in both wet and dry applications.

5. Wear and Abrasion: Shall be tested in accordance with ASTM C501, Test shall be 1000 cycles of a H22 wheel with 1000g load. Wear Index is calculated 88/Weight Loss(grams). The four test cycle average shall have a calculated wear index of >300.

C. At the request of the Project Manager, the quality process manual shall be available for review; manufacturing facility shall also be available for inspection to ensure quality standards are met along with EPA and OSHA standards.

2.03 GRADE ADJUSTMENT RINGS

A. Adjustment Risers shall consist of a minimum 80% by weight of recycle rubber and minimum 10% by volume recycled RFL coated fiber. Each riser shall be marked with the Manufactures Name, Country of Origin (Made in USA), Product Name and Identification Number.

B. Physical properties shall comply with ASTM D 2240-05 with a Shore Durometer of 77A ±5

C. Molded adjustment risers tolerance shall be ±1/16” (1.6mm) from required nominal dimensions. Adjustment Risers shall be designed for heavy-duty street traffic, and meet or exceed minimum load capacity requirements of

AASHTO M306.

D. Riser rings shall be available in ½" height increments and designed to fit NTMWD frames and covers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install materials according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set accurately at required locations to proper alignment and elevation. Keep plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in formwork until permanently set.

C. When compliance with "TCEQ 217.58 (2) Vacuum Testing" is required, frames and/or grade adjustment rings shall be affixed to the substructure with Loctite PL Premium construction adhesive. At the discretion of the Owner, onsite support will be provided by the manufacturer for guidance on the proper application and installation of the product.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite frames and covers, grade adjustment rings for application in wastewater collection system and facilities.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment to rack over existing manhole is on a unit price basis for each manhole.

2. Refer to Section 01 29 00 Payment Procedures 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. M306-10: Drainage, Sewer, Utility, and Related Castings
   a. Manufacture
   b. Proof Testing
   c. Inspection
   d. Certification
   e. Marking

2. Standard Specification for Highway Bridges

B. ASTM C501 – Standard Testing for Wear and Abrasion

C. ASTM G154: Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

D. ASTM C1028 – Standard Testing for Coefficient of Friction

E. ASTM D2240 - Standard Test Method for Rubber Property—Durometer Hardness

F. TCEQ Chapter 217 Design Criteria for Waste Water Systems Section 217.55 Manhole Covers

1.04 SUBMITTALS

A. Conform to requirements of Section 01 33 00 Submittals.

B. Submit copies of manufacturer's specifications, testing data, certifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of frame and cover assemblies. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of frames and anchorage devices.

PART 2 PRODUCTS

2.01 COMPOSITE RING AND COVER

A. All composite moldings shall consist of a thermosetting resin matrix blended and/or combined with reinforcing fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structure(s). The thermosetting resin matrix shall be a polyester, vinylester, or a blend of these. The moldings shall be true to pattern in form and dimension and free from cracks, pores, knit-lines, or other defects in locations affecting their strength and value for the service intended.

B. Before the moldings are removed from the molding operation, they shall be thoroughly deflashed and cleaned at the parting lines, holes, notches and all exposed edges.

C. Composite frames must have a wall thickness of at least 0.75 inches in sections exposed to traffic and potential traffic wheel impact.

D. If using a lock, bolt, or latch, these must be independent of the method used to open the cover to ensure the cover can be opened in the event of lock failure.

E. Composite ring and cover shall be a CAP ONE-30 as manufactured by Composite Access Products, L.P. of McAllen, TX. Cover shall be watertight (0.0 gpm passing), non-vented, bolted, and gasketed.

2.02 MOLDING PROCESS:

A. Covers and frames shall be compression molded under high pressures (>0.5 tons/sq inch of x-y surface area) and high temperatures (>200 degrees F).

B. Metal reinforcements or metal hinges molded within the composite shall not be permitted. Small non-stress bearing pieces of metal may be encapsulated.

C. Composite covers and frames shall be molded in the USA.

2.03 TESTING AND PERFORMANCE REQUIREMENTS

A. 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. The manufacturer/supplier shall maintain complete records of all such tests and inspections. All testing shall be paid for by the manufacturer/supplier.

1. Frame and Covers shall be test “Proof Load” in accordance with AASHTO M306.
2. Heavy Duty: A load of 40,000lbs shall be concentrated on a 9"x 9" block with rubber or fiber backing pad for one minute. During the load testing process, visible cracks or delamination will be cause for rejection (popping noises during this test are normal for composites and do not indicate failure). When load is removed, Permanent Set (Deflection) of more than 1/8"(.125") measured at center of load area will be cause for rejection. All testing shall be conducted on a NIST calibrated and Certified load test machine.
3. Ultraviolet resistance: ASTM G 154 Cycle I for 1000 hrs. Specimens shall be tested for ultimate flexural strength (ASTM D790), retaining at least 75% of control values for load and deflection at failure.
4. Coefficient of Friction: Shall be greater than 0.6 when tested in accordance to ASTM C 1028.
5. Notched Izod Impact: Composite raw material impact results shall be greater than 5 ft.-lbs/inch when tested in accordance to ASTM D256.

C. Components for locking systems below the cover exposed to the sewer environment shall be made of noncorrosive materials such as nonmagnetic, 316 stainless steel or a polymer.

D. Covers shall be the types and shall be imprinted as shown on the plans or standard details.

2.04 MARKINGS

Covers and Frames shall have the following molded into the substrate of the cover:

1. Name (or Abbreviation) Molder
2. Country of Origin
3. Molding Date
4. Indication that Material is Non-metallic

2.05 ADJUSTMENT RISERS

A. Adjustment Risers shall consist of a minimum 80% by weight of recycle rubber and minimum 10% by volume recycled RFL coated fiber. Each riser shall be marked with the Manufactures Name, Country of Origin (Made in USA), Product Name and Identification Number.

B. Physical properties shall comply with ASTM D 2240-05 with a Shore Durometer of 77A ±5

C. Molded adjustment risers tolerance shall be ±1/16” (1.6mm) from required nominal dimensions. Adjustment Risers shall be designed for heavy-duty street traffic, and meet or exceed minimum load capacity requirements of

AASHTO M306.

D. Riser rings shall be available in ½" height increments and designed to fit NTMWD frames and covers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install materials according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set accurately at required locations to proper alignment and elevation. Keep plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in formwork until permanently set.

C. When compliance with "TCEQ 217.58 (2) Vacuum Testing" is required, frames and/or grade adjustment rings shall be affixed to the substructure with Loctite PL Premium construction adhesive. At the discretion of the Owner, onsite support will be provided by the manufacturer for guidance on the proper application and installation of the product.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

A. This specification covers acid resistant polymer concrete manholes intended for use in sanitary sewers, storm sewers and water lines, where corrosion resistance is required.

1.2 REFERENCES

A. ASTM C 478 (most current) Standard Specification for Precast Reinforced Concrete Manhole Sections.

B. ASTM C 857 (most current) Standard Practice for Minimum Structural Design Loading for Underground Utility Structures.

C. ASTM D 648 (most current) Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position.

D. ASTM D 6783 (most current) Standard Specification for Polymer Concrete Pipe.

E. ASTM D 2584 (most current) Test Method for Ignition Loss of Cured Reinforced Resins.

F. ASTM C 923 (most current) Standard Specifications for Resilient Connectors between Concrete Manholes Structures and Pipe.

G. ASTM C 990 (most current) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections using Preformed Flexible Joint Sealants

H. ASTM C 497 (most current) Test Methods for Concrete Pipe, Manhole Sections, or Tile.

I. ACI 440.1R-15 Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars. Reference ACI 440.1R-15 in specification.

1.3 SUBMITTALS

A. Conform to bid document requirements.

B. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, 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 acid resistant polymer concrete manhole design meets or exceeds the load and strength requirements of ASTM C 478 and ASTM C 857
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. Proof of independent Chemical Resistance testing conducted in accordance with the Standard Specifications for Public Works Construction (California Greenbook) Section 211-2 or equal.

C. Submitted sealed drawings by a registered Professional Engineer in the State of Texas.

PART 2 PRODUCTS

2.1 ACID RESISTANT POLYMER CONCRETE MANHOLES

A. Provide acid resistant polymer concrete manhole sections, manhole risers and related components. ASTM C 478 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product.

B. Provide base riser section with integral inverts, unless shown otherwise.

C. Provide riser sections joined with bell and spigot / ship-lap design seamed with butyl mastic (ASTM C 990) and/or gasketed connections so that on assembly, manhole base, riser and

top section make a continuous and uniform manhole.

D. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated on drawings.

E. Use various lengths of manhole sections in combination to provide correct height with the fewest joints.

F. Design wall sections for depth and loading conditions with wall thickness as required by polymer concrete manufacturer.

G. Provide tops to support HL-93 vehicle loading and receiving cast iron frame covers, as indicated on drawings.

2.2 DESIGN CRITERIA:

A. Manhole risers, transition slabs, conical tops, and grade rings shall be designed, by manufacturer, to meet the intent of ASTM C 478 with allowable compositional and sizing differences required by a polymer product.

1. AASHTO LRFD HL-93 design live loading applied to manhole cover and transition and base slabs.
2. Polymer concrete manholes will be designed based upon live and dead load criteria in ASTM C 857.
3. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
4. Internal liquid pressure based on unit weight of 63 pcf.
5. Dead load of manhole sections fully supported by transition and base slabs.

2.3 DESIGN:

B. Manhole risers, transition slabs, conical tops, grade rings and manhole base sections shall be designed, by manufacture, to requirements of ASTM C 478 and ASTM C 857 as modified to accept polymer concrete construction in lieu of concrete as follows:

1. Polymer Mixture - the mixture shall consist solely of thermosetting resin sand and aggregate. No cementitious materials shall be allowed as part of the mix design matrix. All sand and aggregate shall be nonreactive in an acid environment.
2. Required wall thickness for all members will be that stated by polymer concrete manhole manufacturer based upon loading conditions and material properties. The wall thickness of risers and conical tops shall be not less than that prescribed by the manufacturer's design by more than 5%.
3. Thermosetting Resin - The resin shall have a minimum of deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584. Resin selection shall be suitable for applications in the corrosive conditions to which the structures will be exposed.
4. Each manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. The internal diameter of manhole components shall not vary more than 1%. Variations in height of two opposite sides of risers and conical tops shall not be more the 5/8 inch. The under run in height of a riser or conical top shall not be more than 1/4in./ft of height with a maximum of ½ inch in any one section.
5. Marketing and Identification - Each manhole shall be marked on the inside and outside with the following information - Manufacturer's name or trademark, Manufacturer's location and Production Date.
6. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic joint so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface

irregularities that would affect joint integrity.

7. Minimum clear distance between two wall penetrations shall be a minimum of 6” on 48”to 72” diameter manholes and a minimum of 8” on larger diameter manholes. A clearance of 3” is required between wall penetration and joint.
8. Construct invert channels to provide smooth flow transition waterway with no disruptionof flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts. Polymer bench and channel are to be constructed with all resin aggregate material – no alternative fill material is allowed. Extended base footer requirements for buoyancy concerns can be addressed with cementitious concrete material.
9. Provide resilient connectors conforming to requirements of ASTM C 923 or as arequired by owner. All connectors are to be watertight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer’sinstructions.
10. Exceptions to ASTM C 478- components shall be designed for the intended combinations of manufacturing materials. Component designs may be as non-reinforced members or reinforced members as recommended by the manufacturer. Steel reinforcement to follow ASTM C478, FRP reinforcement to follow ACI 440. 1R-15.

2.4 QUALITY CONTROL

A. Perform testing in accordance with Section 01 40 00.

1. Manhole Testing

a. Test manholes for leakage separately and independently of the wastewater lines by hydrostatic exfiltration testing, vacuum testing or other approved methods acceptable to TCEQ. Test manholes after installation with all connections (existing and/or proposed) in place. Plug lift holes with an approved non-shrink grout prior to testing. Install drop-connections and gas sealing connections prior to testing.

1) Hydrostatic Test - Make manhole watertight and re-test if the manhole fails the leakage test. The maximum leakage for hydrostatic testing is 0.025 gallons per foot diameter per foot of manhole depth per hour. Prepare for hydrostatic exfiltration testing by sealing all wastewater lines coming into the manhole with an internal pipe plug, then fill the manhole with water and maintain full for at least one hour. With concrete manholes, a period of 24 hours prior to testing may be used in order to allow saturation of the concrete.

2) Vacuum Test – Temporarily plug lines entering the manhole with the plugs braced to prevent them from being drawn into the manhole. Install plugs in the lines beyond drop-connections, gas sealing connections, etc. Place the test head inside the frame at the top of the manhole and inflate in accordance with the manufacturer’s recommendations. Draw a vacuum of 10 inches of mercury, then turn off the vacuum pump. Read the level of vacuum after the required test time with the valve closed. The manhole will pass the test if the drop in the level is less than 1 inch of mercury (final vacuum greater than 9 inches of mercury). The required test time for 48”, 60”, and 72” manholes with depths up to 30 feetis one minute-thirty seconds. Test times for manholes of greater size and depths will be determined by the Engineer.

3) Manhole Repairs – Manholes will be accepted in accordance with the criteria above. Repair any manhole that fails the initial test with non-shrink grout or other suitable material as determine for the material from which the manhole is constructed. Retest the manhole as described above until a successful test is achieved. Remove all temporary plugs and grout after a successful test.

B. Facility Quality Control should be maintained by adhering to ISO 9001 for manufacturing. All manufacturers will be ISO 9001Certifiied. All manufacturing will take place in an all

polymer concrete fabrication facility. At no time will the polymer concrete fabrication facility share the facility with a cementitious precast product production facility.

2.5 GROUTING

A. All materials needed for grouting and patching will be an epoxy or resin mortar compound provided by the manufacturer or an approved equal by the manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 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.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Owner.

3.02 PLACEMENT

A. Install precast polymer concrete manholes to conform to locations and dimensions shown on Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.03 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. 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 03 34 13, Controlled Low Strength Material.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Owner 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 Drawings, under manhole base.

3.04 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink epoxy or resin based grout.

D. Place at least two grade rings with thickness of 12 inches or less, under casting.

E. Top of manhole elevations shown on Drawings are approximate, based on pavement and natural ground conditions at the time of the topographic survey. No additional payment will be made if final elevation of manhole ring and cover is higher or lower due to requirements of finished grade or replaced pavement surface.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors following ASTM C923 at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

B. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enterspace 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.

C. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install water stop gasket around existing pipe at center of cast-in-place wall. Join ends of split water stop material at pipe spring line using an adhesive recommended and supplied by water stop manufacturer.

D. Test connection for watertight seal before backfilling.

3.06 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flowat pipe-manhole connections. Conform to following criteria:

1. Slope of Invert Bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum.
2. Depth of Bench to Invert:
    a. Pipes smaller than 15 inches: one-half of largest pipe diameter.
    b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter.
    c. Pipes larger than 24 inches: equal to largest pipe diameter.
3. Invert Slope through Manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. 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 betweenpipe inverts.

3.07 DROP CONNECTIONS FOR SANITARY SEWERS

A. 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.

B. Install drop connection when sewer line enters manhole higher than 24 inches above invertof manhole.

3.08 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.09 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine polymer concrete manhole and 30” new pipe sections so elevation of installed casting cover matches pavement surface. Seal between grade ring and precast top section with non-shrink grout; do not use mortar. Apply latex-based bonding agent to precast polymer concrete surfaces joined with non-shrink grout. Set cast iron frame on 30” new pipe section in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch high and 1/2-inch wide.

B. Wrap manhole frame and 30” new pipe riser adjustment with external sealing material, minimum 3 inches beyond joint between ring and frame and ring and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, 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.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 31 23 33, Trench Excavation and Backfill. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. 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.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Section 32 91 16.13, Topsoil. Seed in accordance with Section 32 92 16, Hydro Mulch Seeding.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 01 40 00, Quality Requirements.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair onsiste damage to manholes at no additional cost to Owner.

END OF SECTION

SECTION 33 39 50 MANHOLE GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This section governs all work, materials and testing required for the pressure grouting of manhole defects. Manholes designated for grouting are listed on the Manhole Rehabilitation Schedule or will be designated by the Engineer for manhole grouting.

B. Related Specification Sections include, but are not necessarily limited to:
   1. Division 00 – Procurement and Contracting Requirements
   2. Division 01 – General Requirements

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Submit product data, including each material, component construction, features, configurations and dimension, from pre-approved manufacturer for all materials to be installed.

B. Contractor Data

1.5 FIELD [SITE] CONDITIONS

A. Existing Conditions
   1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes, the Contractor shall notify the Engineer in writing.
   2. Manholes to be grouted may be of brick, block, pre-cast, or poured concrete construction.
   3. Provide confined space entry, flow diversion and/or bypass plans as necessary to perform the specified work. Perform work in accordance with OSHA Standards.

1.6 QUALITY ASSURANCE

A. Obtain all materials from a single manufacturer.

B. At a minimum, products and installers must meet all of the following criteria to be deemed commercially acceptable:
   1. For a Product to be considered commercially acceptable, the product must have a minimum of eighty thousand (80,000) vertical feet and five (5) year history of successful wastewater collection system installations in the United Stated. In addition, products must provide Third Party test Results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Owner. No product will be allowed without Independent Third Party Testing verification.

2. For an installing contractor to be considered commercially acceptable, the installer must satisfy all insurance, financial and bonding requirements for the Owner. The Contractor must have a certification from the manufacturer as a licensed and fully installer of the product. The installer must also have a minimum of eighty thousand (80,000) vertical feet of successful wastewater collection system installations and five (5) year of rehabilitation experience.

C. Personnel shall have confined space entry certification.

D. Field verification shall be completed by the contractor prior to commencement of work.

E. Contractor shall verify the finished thickness of each rehabilitation method prior to starting the next layer and upon completion of the work. The Engineer my obtain core samples at his discretion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials

1. Grouting Materials
   a. Urethane Gel Grout
      1) Urethane gel grout, such as AV-350 Multigel by Avanti International, Deneef or equal shall be a hydrophilic polymer. The chemical shall be mixed within the range of from 8 to 10 parts of water and shall contain a reinforcing agent supplied by the same manufacturer. The material shall gel and cure to a tough flexible elastomeric condition. When wet, the gel shall exhibit strength properties of at least 25 psi tensile at 150 percent elongation. The material shall not change in linear dimension more than eight percent when subjected to wet and dry cycles.

      2) The chemical grout shall be applied so as to have the grout material flow freely into the defects. To avoid any wastage of the material flowing through the defects gel control agent may be added. The following properties shall be exhibited by the grout:

         a) Documented service of satisfactory performance in similar usage.

         b) Controllable reaction times and shrinkage through the use of chemicals supplied by the same manufacturer. The minimum gel set time shall be established so that adequate grout travel is achieved.

         c) Resistance to chemicals; resistant to most organic solvents, mild acids and alkali.

         d) Compressive recovery return to original shape after repeated deformation.

         e) The chemical shall be essentially nontoxic in a cured form.

f) Sealing material shall not be rigid or brittle when subjected to dry atmosphere. The material shall be able to withstand freeze/thaw and moving load conditions.

g) Sealing material shall be noncorrosive.

3) A reinforcing agent such as AV-257 Icoset by Avanti International reinforcing agent or equivalent shall be utilized in accordance with manufacturer's recommendations. Any 257 reinforcing agent, which contains lumps, must be discarded. Care must be taken to be sure that the pH of the water in the tank is from 5 to 9. As a precaution against the possibility of the pH being outside this range, take a small amount of water from the tank to which Gel Reinforcing Agent 257 is to be added. Add a few drops of 257 to this test sample. Avanti Gel Reinforcing Agent 257 should disperse readily. If precipitation occurs, drain the tank and retest. Repeat as necessary until dispersion occurs. If dispersion does not occur, do not use the water source.

4) A filler material such as Celite 292 (diatomaceous earth) from John Mansville or equivalent shall be utilized. The addition of the filler material shall not exceed the quantity specified by the manufacturer, and continuous agitation of the water side of the mixture is required. The filler material may also be utilized as a reinforcing agent in accordance with the urethane gel grout manufacturer's recommendations.

2. Grout – Octocrete as manufactured by IPA Systems, Inc. or approved equivalent.
   1) Minimum Physical Properties
      a) ASTM C109 Compressive Strength 5,800 psi (28 days)
      b) ASTM C348 Flexural Strength 900 psi (28 days)
      c) ASTM C882 Bond Strength 1,640 psi (28 day)

3. Additives
   1) Grout additions may be utilized for catalyzing the gel reaction, inhibiting the gel reaction, buffering the solution, lowering the freezing temperature of the solution, acting as a filler, providing strength or for inhibition of root growth.

4. Root Control
   1) A root inhibiting chemical such as dichlobenil, Avanti AC-50W or equivalent shall be added to the chemical grout mixture at a safe level of concentration and shall have the ability to remain active within the grout for a minimum of 12 months, for all area we're protruding roots are found.

5. Material Identification
   1) Contractor shall completely identify the types of grout, mortar, sealant, and/or root control chemicals used and provide case histories of successful use or defend the choice of grouting materials based on chemical and physical properties, ease of application, and expected performance, to the satisfaction of the Engineer.

6. Mixing and Handling

1) Mixing and handling of chemical grout and forming constituents, which may be toxic under certain conditions shall be in accordance with the recommendations of the manufacturer and in such a manner as to minimize hazard to personnel. It is the responsibility of the Contractor to provide appropriate protective measures to ensure that chemicals or gels produced by the chemicals are under control at all times and are not available to unauthorized personnel or animals. All equipment shall be subject to the approval of the Engineer. Only personnel thoroughly familiar with the handling of the grout material and additives shall perform the grouting operations.

7. Portland Cement
   1) As specified in Section 03 31 50.

8. Oakum
   1) Activated oakum, such as Fibrotite Oakum as manufactured by Avanti International or equivalent shall be utilized as a carrier that assists in sealing grout holes while it cures.

9. Non-Shrink Grout
   1) As specified in Section 03 62 13.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Notify District and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

3.2 PREPARATION

A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.

B. Manhole grouting shall not be performed until sealing of manhole frame and grade adjustments or partial manhole replacement is complete.

3.3 INSTALLATION

A. Preliminary Repairs
   1. Seal all unsealed lifting holes, unsealed step holes, precast manhole section joints, and voids larger than approximately one half (1/2) inch in thickness with Octocrete or approved equal. All cracked or deteriorated material shall be removed from the area to be patched and replaced with Octocrete, as manufactured by IPA Systems, Inc. or equal, in accordance with manufacturer's specifications.
   2. Cut and trim all roots within the manhole.

B. Temperature
   1. Normal grouting operations including application of interior coating shall be performed at temperatures of 40F or greater. If grouting is performed below temperatures of 40F, then it must be performed in accordance with manufacturer's recommendations.

C. Grouting Materials Usage

1. Grouting of the manhole may include frame seal, frame and grade adjustments, corbel, wall, pipe seals, and/or bench/trough. Areas of the manhole designated to be grouted will be directed by the Engineer. If entire manhole is scheduled for grouting, grouting shall include the entire manhole including corbel, wall, pipe seals and bench/trough.

D. Drilling and Injection

1. Injection holes shall be drilled through the manhole at 120-degree angles from each other at the same plane of elevation. Rows shall be separated no more than three vertical feet, and the holes shall be staggered with the holes in the rows above and below. Provide additional injection holes near observed defects, bench and trough, and at pipe seals. A minimum of 6 injection holes shall be provided in the walls/corbel and three injection holes at each pipe seal and at the bench/trough. Manholes shall be grouted from the top of the corbel or bottom of flattop to the pipe invert.
2. Grout shall be injected through the holes under pressure with a suitable probe. Injection pressure shall not cause damage to the manhole structure or surrounding surface features. Grout shall be injected through the lowest holes first. The procedure shall be repeated until the manhole is externally sealed with grout.
3. Grouting from the ground surface shall not be allowed.
4. Grout travel shall be verified by observation of grout to defects or adjacent injection holes. Provide additional injection holes, if necessary, to ensure grout travel.
5. Injection holes shall be cleaned with a drill and patched with a waterproof quick setting mortar.
6. All grout shall be removed from interior surfaces of the manhole. After the grouting is completed, the interior of the manhole shall be coated with ½"thick quick setting mortar such as Hyperform as manufactured by Quadex (A Vortex Company), or equal. The coating shall cover at least 6" past the joint each side.

3.4 FIELD QUALITY CONTROL

A. Testing of rehabilitated manholes for water tightness shall be performed by the Contractor in the presence of the Engineer in accordance with the requirement of Section 33 01 30.02.

END OF SECTION

SECTION 33 39 60 EPOXY & POLYMER LINERS FOR SANITARY SEWER STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Application of a high-build epoxy and or Polymer coating system to concrete utility structures such as manholes, lift station wet wells, junction boxes or other concrete facilities that may need protection from corrosive materials. Manholes designated for interior coating shall be first coated with a cementitious coating as detailed in Section 33 39 61.

B. Related Specification Sections include, but are not necessarily limited to:
   1. Division 00 – Procurement and Contracting Requirements
   2. Division 01 – General Requirements
   3. Section 33 01 30.02 –Manhole Testing
   4. Section 33 39 61 – Cementitious Manhole Coating

1.2 PRICE AND PAYMENT PROCEDURES

Will be in accordance with Section 01 29 00.

1.3 REFERENCES

A. Reference Standards
   1. Reference standards cited in this Specification refer to the current reference standard published at the time of the latest revision date logged at the end of this Specification, unless a date is specifically cited.
   2. ASTM International (ASTM).
   3. Environmental Protection Agency (EPA).
   4. NACE International (NACE).
   5. Occupational Safety and Health Administration (OSHA).
   6. Resource Conservation and Recovery Act, (RCRA).
   7. The Society for Protective Coatings/NACE International (SSPC/NACE):
      a. sp 13/NACE No. 6, Surface Preparation of Concrete.

1.4 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by the District prior to delivery.

1.5 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Technical data sheet on each product used
   2. Material Safety Data Sheet (MSDS) for each product used
   3. Copies of independent testing performed on the coating product indicating the product meets the requirements as specified herein

4. Technical data sheet and project specific data for repair materials to be top-coated with the coating product including application, cure time and surface preparation procedures

B. Contractor Data
   1. Current documentation from coating product manufacturer certifying Contractor's training and equipment complies with the Quality Assurance requirements specified herein
   2. 5 recent references of Contractor indicating successful application of coating product(s) of the same material type as specified herein, applied by spray application within the municipal wastewater environment

1.6 QUALITY ASSURANCE

A. Obtain all materials from a single manufacturer.

B. At a minimum, products and installers must meet all of the following criteria to be deemed commercially acceptable:
   1. For a Product to be considered commercially acceptable, the product must have a minimum of eighty thousand (80,000) vertical feet and five (5) year history of successful wastewater collection system installations on manholes in the United Stated. In addition, products must provide Third Party test Results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Owner. No product will be allowed without Independent Third Party Testing verification.
   2. For an installing contractor to be considered commercially acceptable, the installer must satisfy all insurance, financial and bonding requirements for the Owner. The Contractor must have a certification from the manufacturer as a licensed and fully installer of the product. The installer must also have a minimum of eighty thousand (80,000) vertical feet of successful wastewater collection system installations and five (5) year of rehabilitation experience on manholes.

C. Personnel shall have confined space entry certification.

D. Field verification shall be completed by the contractor prior to commencement of work.

E. Contractor shall verify the finished thickness of each rehabilitation method prior to starting the next layer and upon completion of the work. The Engineer my obtain core samples at his discretion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Keep materials dry, protected from weather and stored under cover.

B. Store coating materials between 50 degrees F and 90 degrees F.

C. Do not store near flame, heat or strong oxidants.

D. Handle coating materials according to their material safety data sheets.

1.8 FIELD [SITE] CONDITIONS

A. Provide confined space entry, flow diversion and/or bypass plans as necessary to perform the specified work.

1.9 WARRANTY

A. Contractor Warranty
   1. Contractor's Warranty shall be 5 years for labor and materials.

PART 2 - PRODUCTS

2.1 EQUIPMENT, PRODUCT TYPES, MATERIALS

A. Repair and Resurfacing Products
   1. Compatible with the specified coating product(s) in order to bond effectively, thus forming a composite system
   2. Used and applied in accordance with the manufacturer's recommendations
   3. The repair and resurfacing products must meet the following:
      a. 100 percent solids, solvent-free epoxy grout specifically formulated for epoxy top-coating compatibility
      b. Factory blended, rapid setting, high early strength, fiber reinforced, non-shrink repair mortar that can be toweled or pneumatically spray applied and specifically formulated to be suitable for top-coating with the specified coating product used

B. Coating Product
   1. Manufacturers: Only the following manufacturers will be considered for lining:
      a. Raven Lining Systems (Primer-Raven 405 & Top Coat-Raven 405 Trowel)
      b. CCI Spectrum, Inc (Spectrashield Total Lining System)
      c. Warren Epoxy (Primer-S301-14 & Top Coat-301-18)
   2. Capable of being installed and curing properly within a wet manhole or concrete utility environment
   3. Resistant to all forms of chemical or bacteriological attack found in municipal sanitary sewer systems; and, capable of adhering to typical manhole structure substrates
   4. 100 percent solids system, specially compounded to protect concrete surfaces from corrosion:
      a. Application Temperature – 50 degrees F, minimum
      b. Thickness – 125 mils **minimum** (Epoxy) - CCI Spectrum should be applied per manufactures guidelines for thickness.
      c. Color – Per manufacturer
      d. Compressive Strength (per ASTM C579) – 9,000 psi minimum
      e. Bond Strength: Min 400psi
      f. Cured Density: 117lb/cf
      g. Tensile Strength (per ASTM C307) – 2,500 psi minimum
      h. Abrasion Resistance (per ASTM D4060): Less than 148 mg loss (H18;250 gm load)
      i. Modulus of Elasticity (ASTM C580): 1x86x106 PSI
      j. Flexural Strength (per ASTM C580) – 5,000 psi minimum
      k. Adhesion to Concrete, mode of failure (ASTM D4541): Substrate (concrete) failure
      l. Thermal Coeff of Linear Expansion: 1.5x10-5 in/in/deg F (ASTM D531)
      m. Chemical Resistance (ASTM D543/G20) all types of service for:

1) Municipal sanitary sewer environment
2) Sulfuric acid, 30 percent
3) Sodium hydroxide, 5 percent

C. Coating Application Equipment
1. Manufacturer approved equipment
2. Hard to reach areas, primer application and touch-up may be performed using hand tools.

2.2 SOURCE QUALITY CONTROL

1. Testing
a. Take wet film thickness gauge per ASTM D4414 at 3 locations within the manhole, 2 spaced equally apart along the wall and 1 on the bench.
1) Document and attest measurements and provide to the District.
b. After coating has set, repair all visible pinholes by lightly abrading the surface and brushing the lining material over the area.
c. Repair all blisters and evidence of uneven cover according to the manufacturer's recommendations.
d. Test manhole for final acceptance according to Section 33 01 30.02.

PART 3 - EXECUTION

3.1 INSTALLERS

A. All installers shall be certified applicators approved by the manufacturers.

3.2 PREPARATION

A. Manhole Preparation
1. Stop I/I prior to coating.
2. Stop active flows via damming, plugging or diverting as required to ensure all liquids are maintained below or away from the surfaces to be coated.
3. Maintain temperature of the surface to be coated between 50 and 120 degrees F.
4. Shield specified surfaces to avoid exposure of direct sunlight or other intense heat source.
a. Where varying surface temperatures do exist, coating installation should be scheduled when the temperature is falling versus rising.

B. Surface Preparation
1. Remove oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts or other contaminants, which may affect the performance and adhesion of the coating to the substrate.
2. Remove concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation so that only sound substrate remains.
3. Surface preparation method, or combination of methods, that may be used include high pressure water cleaning, high pressure water jetting, abrasive blasting, shot blasting, grinding, scarifying, detergent water cleaning, hot water blasting and others as described in SSPC SP 13/NACE No. 6.

4. All methods used shall be performed in a manner that provides a uniform, sound, clean, neutralized, surface suitable for the specified coating product.
5. Install cementitious coating as detailed in Section 33 39 61 and cure prior to the application of epoxy coating.

3.3 BYPASS PUMPING

A. Utilize flow through plugs to maintain sewage flow as needed and to prevent backup or overflow as specified.

B. In the event of accidental spill or overflow, immediately stop the overflow and take action to clean up and disinfect spillage. Promptly notify the Engineer so that required reporting can be made to the Texas Commission on Environmental Quality and U. S. Environmental Protection Agency.

3.4 INSTALLATION

A. General
1. Perform coating after the sewer line replacement/repairs, grade adjustments and grouting are complete (See 33 39 61 Cementitious Manhole Coating Specification).
2. Perform application procedures per recommendations of the coating product manufacturer, including environmental controls, product handling, mixing and application.

B. Temperature
1. Only perform application if surface temperature is between 50 and 120 degrees F.
2. Make no application if freezing is expected to occur inside the manhole within 24 hours after application.

C. Coating
1. Apply per manufacturer’s recommendation at a minimum film thickness per manufacture.
2. Approved manufactures are as follow:
   a. CCI Spectrum (Spectrashield),
   b. Raven Lining Systems
   c. Warren Environmental
3. Coating shall begin at the bottom of LADTECH grade adjustment rings and extend below the normal depth of water in the manhole channel. Contractor shall cut 1/ 4" wide and 1/ 4" deep coating termination groove into concrete channel at least 4" below normal water depth as termination point of manhole coating. Coating shall be completed during dry-weather, low-flow periods.
4. Apply any topcoat or additional coats within the product’s recoat window.
   a. Additional surface preparation is required if the recoat window is exceeded.
5. Allow a minimum of 3 hours of cure time or be set hard to touch before reactivating flow.

3.5 FIELD [OR] SITE QUALITY CONTROL

A. Each structure will be visually inspected by the District the same day following the application.

B. The inspector will check for deficiencies, pinholes and thin spots.

C. If leaks are detected, they will be chipped back, plugged and coated immediately with protective epoxy resin coating.
   1. Make repair 24 hours after leak detection.

D. Any and all defects in coating observed by the District or District's Representative during Final Walkthrough will be remedied by Contractor prior to District's acceptance.

3.6 CLOSEOUT ACTIVITIES

A. Upon final completion of the work, the manufacturer will provide a written certification of proper application to the District.

B. The certification will confirm that the deficient areas were repaired in accordance with the procedure set forth in this Specification.

END OF SECTION

SECTION 33 39 61 CEMENTITIOUS MANHOLE COATING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This section governs all work, materials and testing required for the cementitious coating of Manholes. Manholes designated for interior coating are listed on the Manhole Rehabilitation Schedule. Manholes designated for interior coating shall be first coated with a cementitious coating follow up an epoxy coating as detailed in Section 33 39 60.

B. Related Specification Sections include, but are not necessarily limited to:
   1. Division 00 – Procurement and Contracting Requirements
   2. Division 01 – General Requirements
   3. Section 33 39 60 – Epoxy Coating

1.2 PRICE AND PAYMENT PROCEDURES

Measurement and Payment shall be in accordance with Section 01 29 00.

1.3 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 00.

B. All submittals shall be approved by District prior to construction.

1.4 ACTION SUBMITTALS/INFORMATIONAL SUBMITTALS

A. Product Data
   1. Submit product data, including each material, component construction, features, configurations and dimension, from pre-approved manufacturer for all materials to be installed.

B. Contractor Data

1.5 FIELD [SITE] CONDITIONS

A. Existing Conditions
   1. Contractor is responsible for locating and uncovering all manholes. If the contractor is unable to locate manholes, the Contractor shall notify the Engineer in writing.
   2. Manholes to be interior coated may be of brick, block, pre-cast, or poured concrete construction. Some may have a previously applied interior mortar coating.
   3. Provide confined space entry, flow diversion and/or bypass plans as necessary to perform the specified work. Perform work in accordance with OSHA Standards.

1.6 QUALITY ASSURANCE

A. Obtain all materials from a single manufacturer.

B. At a minimum, products and installers must meet all of the following criteria to be deemed commercially acceptable:

1. For a Product to be considered commercially acceptable, the product must have a minimum of eighty thousand (80,000) vertical feet and five (5) year history of successful wastewater collection system installations on manholes in the United Stated. In addition, products must provide Third Party test Results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Owner. No product will be allowed without Independent Third Party Testing verification.
2. For an installing contractor to be considered commercially acceptable, the installer must satisfy all insurance, financial and bonding requirements for the Owner. The Contractor must have a certification from the manufacturer as a licensed and fully installer of the product. The installer must also have a minimum of eighty thousand (80,000) vertical feet of successful wastewater collection system installations and five (5) year of rehabilitation experience on manholes.

C. Personnel shall have confined space entry certification.

D. Field verification shall be completed by the contractor prior to commencement of work.

E. Contractor shall verify the finished thickness of each rehabilitation method prior to starting the next layer and upon completion of the work. The Engineer my obtain core samples at his discretion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials

1. Cementitious Interior Coating
   a. Quadex QM-1s Restore proprietary pre-blended cement based synthetic granite (Donnafill) enhanced polypropylene fiber reinforced coatings as manufactured by Quadex, LLC (A Vortex Company). Or approved equal shall be used on this project. No material (other than clean potable water) shall be used with or added to the coating material without prior approval or recommendation from the coating material manufacturer.
2. Material Identification
   a. Contractor shall completely identify the types of grout, mortar, patching compounds, sealant, and/or root control chemicals used and provide case histories of successful use or defend the choice of grouting materials based on chemical and physical properties, ease of application, and expected performance, to the satisfaction of the Owner's Representative.
3. Mixing and Handling
   a. Mixing and handling of interior coating, which may be toxic under certain conditions shall be in accordance with the recommendations of the manufacturer and in such a manner as to minimize hazard to personnel. It is the responsibility of the Contractor to provide appropriate protective measures to ensure that materials are under control at all times and are not available to unauthorized personnel or animals. All equipment shall be subject to the approval of the Owner's Representative. Only personnel thoroughly familiar with the handling of the coating material shall perform the coating operations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Notify District and/or Engineer immediately of any changed condition that impacts installation of the proposed frame and cover replacement.

3.2 PREPARATION

A. The contractor shall be responsible for supplying the required material for the replacement of manhole frames and covers, including the unloading, temporary storage, and transporting of the materials.

B. Manhole coating shall not be performed until sealing of manhole frame and grade adjustments and/or pressure grouting or replacement is complete.

3.3 INSTALLATION

A. Preliminary Repairs

1. All foreign materials shall be removed from the manhole interior using high-pressure water spray (minimum 3500 psi). Loose and protruding brick, mortar and concrete shall be removed using a masonry hammer and chisel and/or scrapers. Existing roots and manhole steps shall be removed by cutting them flush with the wall of the manhole.
   a. All unsealed lifting holes, unsealed step holes, voids larger than approximately one-half (1/2) inch in thickness shall be filled with patching compound at least one hour (1) prior to spray application of the first coat.
   b. Active leaks shall be grouted in accordance with Section 33 39 50.
   c. After all repairs have been completed, remove all loose material.
2. Temperature
   a. Normal interior coating operation shall be performed at temperatures of 40°F or greater. No application shall be made when freezing is expected within 24 hours. If ambient temperatures are in excess of 90°F, precautions shall be taken to keep mixing water below 85°F, using ice if necessary.
3. Interior Manhole Coating
   a. Manholes scheduled for interior coating are shown on the Manhole Rehabilitation Schedule. The interior coating shall be applied to the manhole from the bench and trough (including the bench/trough) to the bottom of the frame of the first grade adjustment ring.
   b. The interior coating shall be applied in accordance with the manufacturer's recommendations and the following procedure.
      1) The surface shall be thoroughly cleaned of all foreign materials and matter. Cleaning shall be accomplished by using high-pressure water spray (minimum 3500 psi.)
      2) Place covers over invert to prevent extraneous material from entering the sewer.
      3) The surface prior to application shall be damp without noticeable free water droplets or running water. Coating material shall be spray applied to a minimum uniform thickness of ½-inch minimum. Troweling shall begin immediately following the spray application. The troweled surface shall be smooth with no evidence of previous void areas.

4) After the walls are coated, the invert/bench covers shall be removed and the bench sprayed with epoxy material in such a manner as to produce a bench having a gradual slope from the walls to the invert with the wall/bench intersection built up and rounded to a uniform radius for the full circumference of the intersection. The thickness of the bench shall be no less than 1/2 inch at the invert and shall increase in the direction of the wall so as to provide the required slope. Trough area shall be coated as required to seal all cracks and to provide a smooth surface.
5) The material shall have a minimum of four (4) hours cure time before being subjected to active flow. Ambient conditions in the manhole are adequate for curing as long as the manhole is covered.
6) Traffic shall not be allowed over manholes for 12 hours after reconstruction is complete.
7) Caution should be taken to minimize exposure of applied product to sunlight and air movement. At no time should the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover. In extremely hot and arid climates manhole should be shaded while reconstruction is in process.
8) No application shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95 degrees F, precautions shall be taken to keep the mix temperature at time of application below 90 degrees F. Mix water temperature shall not exceed 85 degrees F. Chill with ice if necessary.

3.4 FIELD QUALITY CONTROL

A. Testing of rehabilitated manholes for water tightness shall be performed by the Contractor in the presence of the Engineer in accordance with the requirement of Section 33 01 30.02.

B. At least two 2-inch cubes shall be taken from each day's work with the date, location and job recorded on each. The cubes shall be sent to a certified testing laboratory for testing. A compression test will be made per ASTM C109, and the results will be furnished to the Owner. Test results shall equal or exceed the manufacturer's published values.

C. Vacuum testing of rehabilitated manholes for water tightness shall be performed by the Contractor after operations are complete in accordance with the Manhole Testing Section 33 01 30.02.

END OF SECTION

TS-1 TECHNICAL REQUIREMENTS AND SPECIFICATIONS
FIBERGLASS MANHOLE

PART 1 GENERAL

1. The Contractor shall furnish and install fiberglass manholes per the Drawings.
2. Contractor shall submit shop drawings and laying diagrams of all pipe, joints, bends, special fittings, and piping appurtenances.
3. Each completed manhole shall be examined for dimensional requirements, hardness, and workmanship. All required A.S.T.M. 3753 testing shall be completed and records of all testing shall be kept and copies of test records shall be presented to customer upon formal written request within a reasonable time period.
4. As a basis of acceptance the manufacturer shall provide an independent certification which consists of a copy of the manufacturer's test report and accompanied by a copy of the test results stating the manhole has been sampled, tested, and inspected in accordance with the provisions of this specification and meets all requirements.
5. Do not drop or impact the fiberglass manhole. Fiberglass manhole may be lifted by inserting a 4"x 4" x 30" timber into the top of manhole with cable attached or by a sling or "choker" connection around center of manhole, lift as required. Use of chains or cables in contact with the manhole surface is prohibited.
6. Each manhole shall be marked on the inside and outside with the following information:
    a. Manufacturer’s name or trademark
    b. Manufacturer’s factory location
    c. Manufacturer’s serial number
    d. Total length

PART 2 MATERIALS

1. Manufacturer shall be L.F. Manufacturing or approved equivalent.
2. Fiberglass reinforced polyester manhole shall be manufactured from commercial grade polyester resin or other suitable polyester or vinyl ester resins with fiberglass reinforcements. Manhole shall be a one piece unit manufactured to meet or exceed all specifications of ASTM D3753.
3. The resins used shall be a commercial grade unsaturated polyester resin or other suitable polyester or vinyl ester resin.
4. The reinforcing materials shall be commercial Grade “E” type glass in the form of continuous roving and chop roving, having a coupling agent that will provide a suitable bond between the glass reinforcement and the resin.
5. The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inch thick. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5 inch (13 mm) to maximum length of 2.0 inch (50.8 mm) and shall be applied uniformly to an equivalent weight of 3 oz/ft. Each pass of chopped roving shall be well-rolled prior to the application of additional reinforcement. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inch (2.5 mm). The interior surface shall be resin rich with no exposed fibers. The surface shall be free of crazing, delamination, blisters larger than 0.5 inch in diameter and wrinkles of 0.125 inch or greater in depth. Surface pits shall be permitted if they are less than 0.75 inch in diameter and less than 0.0625 inch deep. Voids that cannot be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 0.5 inch in diameter and less than 0.0625 inch thick.

6. After inner layer has been applied the manhole wall shall be constructed with chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. The cone section, if produced separately, shall be affixed to the barrel section at the factory with resin-glass reinforced joint resulting in a one-piece unit. Seams shall be fiberglassed on the inside and the outside using the same glass-resin jointing procedure. The cone and barrel sections shall not be joined in the field except by the manufacturer.
7. For a UV inhibitor the resin on the exterior surface of the manhole shall have gray pigment added for a minimum thickness of 0.125 inches. The exterior surface shall be relatively smooth with no sharp projections. Hand-work finish is acceptable if enough resin is present to eliminate fiber show. The exterior surface shall be free of blisters larger than 0.5 inch in diameter, delamination or fiber show.
8. Upon request stub outs may be installed. Installation of SDR PVC sewer pipe must be performed by sanding, priming, and using resin fiber-reinforced hand layup. The resin and fiberglass shall be same type and grade as used in the fabrication of the fiberglass manhole. Inserta-Tee fittings may be requested and installed per manufacturer's instructions. Kor-N-Seal boots may be installed by the manhole manufacturer using fiberglass reinforced pipe stub out for Kor-N-Seal boot sealing surface.
9. Fiberglass manholes will be required to have resin fiber-reinforced bottom. Deeper manholes may require a minimum of two fiberglass channel stiffening supports. All fiberglass manholes manufactured with a fiberglass bottom will have a minimum 3-inch wide anti-floatation ring. The manhole bottom shall be a minimum of ½ inch thick.
10. A fiberglass enclosed invert and bench area shall be installed in the manhole by the manufacturer. The invert will be formed using a non-corrosive material and completely enclosed in a minimum ¼-inch layer of fiberglass chop.
11. Fiberglass manholes must have the ability to be height adjustable with the use of a height adjustment ring. Height adjustment can be made as a field operation without the use of uncured resins or fiberglass layups. Fiberglass manholes must maintain all load and soundness characteristics required by A.S.T.M. D3753 after height adjustment has occurred.
12. Fillers, when used, shall be inert to the environment and manhole construction. Sand shall not be accepted as an approved filler. Additives, such as thixotropic agents, catalysts, promoters, etc., may be added as required by the specific manufacturing process to be used to meet the requirements of this standard. The resulting reinforced-plastic material must meet the requirements of this specification.
13. All manholes shall be designed so that a ladder or step system can be supported by the installed manhole.
14. Manway reducers will be concentric with respect to the larger portion of the manhole diameters through 60 inches. Larger manholes may have concentric or eccentric manway reducer openings.
15. The manhole shall provide an area from which a grade ring or brick can be installed to accept a typical metal ring and cover and have the strength to support a traffic load without damage to the manhole. The grade ring should be extended past the perimeter of the manhole at least 1" in order to transfer as much load as practical to the exterior wall of the manhole.
16. Tolerance of inside diameter shall be +/- 1% of required manhole diameter.
17. The complete manhole shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with A.S.T.M. 3753 8.4 (note 1). To establish this rating

the complete manhole shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 inch at the point of load application when loaded to 24,000 lbs.

18. In order to determine soundness, apply an air or water pressure test to the manhole test sample. Test pressure shall not be less than 3 psig or greater than 5 psig. While holding at the established pressure, inspect the entire manhole for leaks. Any leakage through the laminate is cause for failure of the test.

19. The fiberglass manhole and all related components shall be fabricated from corrosion proof material suitable for atmospheres containing hydrogen sulfide and dilute sulfuric acid as well as other gases associated with the wastewater collection system.

PART 3 MEASUREMENT AND PAYMENT

1. Payment shall be measured by per each for 0 to 13 feet in the depth and paid for at the per-each bid price. Additional foot of vertical manhole depth in excess of 13 feet shall be measured to the nearest 0.1 foot and paid per vertical foot price. This includes all materials, equipment and labor for a complete installation of a fiberglass manhole, including excavation, backfill and restoration.

END OF SECTION

Item 247
Flexible Base

1. DESCRIPTION

Construct a foundation course composed of flexible base.

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer may sample and test project materials at any time before compaction throughout the duration of the project to assure specification compliance. Use Tex-100-E material definitions.

2.1. **Aggregate**. Furnish aggregate of the type and grade shown on the plans and meeting the requirements of Table 1. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives, such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1 unless shown on the plans.

Table 1
Material Requirements

Property	Test Method	Grade 1–2	Grade 3	Grade 4[2]	Grade 5
Sampling	Tex-400-A				
Master gradation sieve size (cumulative % retained)	Tex-110-E				
2-1/2"		0	0	As shown on the plans	0
1-3/4"		0–10	0–10		0–5
7/8"		10–35	–		10–35
3/8"		30–65	–		35–65
#4		45–75	45–75		45–75
#40		65–90	50–85		70–90
Liquid Limit, % Max	Tex-104-E	40	40	As shown on the plans	35
Plasticity Index, Max[1]	Tex-106-E	10	12	As shown on the plans	10
Plasticity index, Min[1]		As shown on the plans	As shown on the plans	As shown on the plans	As shown on the plans
Wet ball mill, % Max	Tex-116-E	40	–	As shown on the plans	40
Wet ball mill, % Max increase passing the #40 sieve		20	–	As shown on the plans	20
Min compressive strength, psi	Tex-117-E			As shown on the plans	
lateral pressure 0 psi		35	–		–
lateral pressure 3 psi		–	–		90
lateral pressure 15 psi		175	–		175

1. Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
2. Grade 4 may be further designated as Grade 4A, Grade 4B, etc.

2.1.1. **Material Tolerances**. The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation.

When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4.

The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

2.1.2. **Material Types**. Do not use fillers or binders unless approved. Furnish the type specified on the plans in accordance with the following:

2.1.2.1. **Type A**. Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.

2.1.2.2. **Type B**. Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.

2.1.2.3. **Type C**. Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I. Blending of 2 or more sources is allowed.

2.1.2.4. **Type D**. Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in Section 247.2.1.3.2., "Recycled Material (Including Crushed Concrete) Requirements," and be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.

2.1.2.5. **Type E**. Caliche, iron ore or as otherwise shown on the plans.

2.1.3. **Recycled Material**. Reclaimed asphalt pavement (RAP) and other recycled materials may be used when shown on the plans. Request approval to blend 2 or more sources of recycled materials.

2.1.3.1. **Limits on Percentage**. Do not exceed 20% RAP by weight, when RAP is allowed, unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.

2.1.3.2. **Recycled Material (Including Crushed Concrete) Requirements**.

2.1.3.2.1. **Contractor-Furnished Recycled Materials**. Provide recycled materials, other than RAP, that have a maximum sulfate content of 3,000 ppm when tested in accordance with Tex-145-E. When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of Table 1 for the grade specified. Certify compliance with DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines," for Contractor furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with Tex-413-A. For RAP, do not exceed a maximum percent loss from decantation of 5.0% when tested in accordance with Tex-406-A. Test RAP without removing the asphalt.

2.1.3.2.2. **Department-Furnished Required Recycled Materials**. When the Department furnishes and requires the use of recycled materials, unless otherwise shown on the plans:

- Department-required recycled material will not be subject to the requirements in Table 1,
- Contractor-furnished materials are subject to the requirements in Table 1 and this Item,
- the final product, blended, will be subject to the requirements in Table 1, and
- for final product, unblended (100% Department-furnished required recycled material), the liquid limit, plasticity index, wet ball mill, and compressive strength is waived.

Crush Department-furnished RAP so that 100% passes the 2 in. sieve. The Contractor is responsible for uniformly blending to meet the percentage required.

2.1.3.2.3. **Department-Furnished and Allowed Recycled Materials**. When the Department furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of Table 1 and the plans.

2.1.3.3. **Recycled Material Sources**. Department-owned recycled material is available to the Contractor only when shown on the plans. Return unused Department-owned recycled materials to the Department stockpile location designated by the Engineer unless otherwise shown on the plans.

The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of them in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with Department-owned recycled material unless approved.

2.2. **Water**. Furnish water free of industrial wastes and other objectionable matter.

2.3. **Material Sources**. Expose the vertical faces of all strata of material proposed for use when non-commercial sources are used. Secure and process the material by successive vertical cuts extending through all exposed strata, when directed.

3. EQUIPMENT

Provide machinery, tools, and equipment necessary for proper execution of the work.

3.1. Provide rollers in accordance with Item 210, “Rolling.” Provide proof rollers in accordance with Item 216, “Proof Rolling,” when required.

3.2. When ride quality measurement is required, provide a high speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute. Provide equipment certification documentation. Display a current decal on the equipment indicating the certification expiration date.

4. CONSTRUCTION

Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 ft. thick. Stockpiles must have a total height between 10 and 16 ft. unless otherwise approved. After construction and acceptance of the stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

Do not add or remove material from temporary stockpiles that require sampling and testing before delivery unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted from the Contractor’s estimates.

Haul approved flexible base in clean trucks. Deliver the required quantity to each 100-ft. station or designated stockpile site as shown on the plans. Prepare stockpile sites as directed. When delivery is to the 100-ft. station, manipulate in accordance with the applicable Items.

Item 247

Flexible Base

4.1. **Preparation of Subgrade or Existing Base**. Remove or scarify existing asphalt concrete pavement in accordance with Item 105, "Removing Treated and Untreated Base and Asphalt Pavement," when shown on the plans or as directed. Shape the subgrade or existing base to conform to the typical sections shown on the plans or as directed.

When new base is required to be mixed with existing base, deliver, place, and spread the new flexible base in the required amount per station. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

Proof roll the roadbed in accordance with Item 216, "Proof Rolling," before pulverizing or scarifying when shown on the plans or directed. Correct soft spots as directed.

4.2. **Placing**. Spread and shape flexible base into a uniform layer with an approved spreader the same day as delivered unless otherwise approved. Construct layers to the thickness shown on the plans. Maintain the shape of the course. Control dust by sprinkling, as directed. Correct or replace segregated areas as directed, at no additional expense to the Department.

Place successive base courses and finish courses using the same construction methods required for the first course.

4.3. **Compaction**. Compact using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. When necessary, sprinkle the material in accordance with Item 204, "Sprinkling."

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. Begin rolling at the low side and progress toward the high side on superelevated curves. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed.

Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish requirements before the next course is placed or the project is accepted. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

Before final acceptance, the Engineer will select the locations of tests and measure the flexible base depth in accordance with Tex-140-E. Correct areas deficient by more than 1/2 in. in thickness by scarifying, adding material as required, reshaping, recompacting, and refinishing at the Contractor's expense.

4.3.1. **Ordinary Compaction**. Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.

4.3.2. **Density Control**. Compact to at least 100% of the maximum dry density determined by Tex-113-E, unless otherwise shown on the plans. Maintain moisture during compaction within ±2 percentage points of the optimum moisture content as determined by Tex-113-E. Measure the moisture content of the material in accordance with Tex-115-E or Tex-103-E during compaction daily and report the results the same day to the Engineer, unless otherwise shown on the plans or directed. Do not achieve density by drying the material after compaction.

The Engineer will determine roadway density and moisture content of completed sections in accordance with Tex-115-E. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

4.4. **Finishing**. After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the plans or as directed.

Correct grade deviations greater than 1/4 in. in 16 feet measured longitudinally or greater than 1/4 in. over the entire width of the cross-section in areas where surfacing is to be placed. Correct by loosening and adding, or removing material. Reshape and re-compact in accordance with Section 247.4.3., "Compaction."

4.5. **Curing**. Cure the finished section until the moisture content is at least 2 percentage points below optimum or as directed before applying the next successive course or prime coat.

4.6. **Ride Quality**. This section applies to the final travel lanes that receive a 1 or 2 course surface treatment for the final surface, unless otherwise shown on the plans. Measure ride quality of the base course after placement of the prime coat and before placement of the surface treatment, unless otherwise approved. Use a certified profiler operator from the Department's MPL. When requested, furnish the Engineer documentation for the person certified to operate the profiler.

Provide all profile measurements to the Engineer in electronic data files within 3 days after placement of the prime coat using the format specified in Tex-1001-S. The Engineer will use Department software to evaluate longitudinal profiles to determine areas requiring corrective action. Correct 0.1-mi.sections having an average international roughness index (IRI) value greater than 100.0 in. per mile to an IRI value of 100.0 in. per mile or less for each wheel path, unless otherwise shown on the plans.

Re-profile and correct sections that fail to maintain ride quality until placement of the next course, as directed. Correct re-profiled sections until specification requirements are met, as approved. Perform this work at no additional expense to the Department.

5. MEASUREMENT

Flexible base will be measured as follows:

- **Flexible Base (Complete In Place)**. The ton, square yard, or any cubic yard method.
- **Flexible Base (Roadway Delivery)**. The ton or any cubic yard method.
- **Flexible Base (Stockpile Delivery)**. The ton, cubic yard in vehicle, or cubic yard in stockpile.

Measurement by the cubic yard in final position and square yard is a plans quantity measurement. The quantity to be paid for is the quantity shown in the proposal unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Measurement is further defined for payment as follows.

5.1. **Cubic Yard in Vehicle**. By the cubic yard in vehicles of uniform capacity at the point of delivery.

5.2. **Cubic Yard in Stockpile**. By the cubic yard in the final stockpile position by the method of average end areas.

5.3. **Cubic Yard in Final Position**. By the cubic yard in the completed and accepted final position. The volume of base course is computed in place by the method of average end areas between the original subgrade or existing base surfaces and the lines, grades, and slopes of the accepted base course as shown on the plans.

5.4. **Square Yard**. By the square yard of surface area in the completed and accepted final position. The surface area of the base course is based on the width of flexible base as shown on the plans.

5.5. **Ton**. By the ton of dry weight in vehicles as delivered. The dry weight is determined by deducting the weight of the moisture in the material at the time of weighing from the gross weight of the material. The Engineer will determine the moisture content in the material in accordance with Tex-103-E from samples taken at the time of weighing.

When material is measured in trucks, the weight of the material will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the types of work shown below. No additional payment will be made for thickness or width exceeding that shown on the typical section or provided on the plans for cubic yard in the final position or square yard measurement.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans. When proof rolling is shown on the plans or directed, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade will be paid in accordance with pertinent Items or Article 4.4., "Changes in the Work."

6.1. **Flexible Base (Complete In Place)**. Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. For square yard measurement, a depth will be specified. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, spreading, blading, mixing, shaping, placing, compacting, reworking, finishing, correcting locations where thickness is deficient, curing, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

6.2. **Flexible Base (Roadway Delivery)**. Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

6.3. **Flexible Base (Stockpile Delivery)**. Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle" or "In Stockpile" will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing and disposing of materials, preparing the stockpile area, temporary or permanent stockpiling, assistance provided in stockpile sampling and operations to level

stockpiles for measurement, loading, hauling, delivery of materials to the stockpile, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

Item 441
Steel Structures

1. DESCRIPTION

Fabricate and erect structural steel and other metals used for steel structures or for steel portions of structures.

MATERIALS

Base Metal. Use metal that meets Item 442, "Metal for Structures."

Approved Electrodes and Flux-Electrode Combinations. Use only electrodes and flux-electrode combinations found on the Department's MPL. To request a product be added to this list or to renew an expired approval, electronically submit a current Certificate of Conformance containing all tests required by the applicable AWS A5 specification according to the applicable welding code (for most construction, AASHTO/AWS D1.5, *Bridge Welding Code*, or AWS D1.1*, Structural Welding Code—Steel*) to the Construction Division.

High-Strength Bolts. Use fasteners that meet Item 447, "Structural Bolting." Use galvanized fasteners on field connections of bridge members when ASTM A325 bolts are specified and steel is painted.

Paint Systems. Provide the paint system (surface preparation, primer, intermediate, and appearance coats as required) shown on the plans. Provide System IV if no system is specified.

Standard Paint Systems. Standard paint systems for painting new steel include the following:

System III-B. Provide paint in accordance with DMS-8101, "Structural Steel Paints-Performance." Provide inorganic zinc (IOZ) prime coat, epoxy intermediate coat, and urethane appearance coat for all outer surfaces except those to be in contact with concrete. Provide epoxy zinc prime coat for touchup of IOZ.

System IV. Provide paint in accordance with DMS-8101, "Structural Steel Paints-Performance." Provide IOZ prime coat and acrylic latex appearance coat for all outer surfaces except those to be in contact with concrete. Provide epoxy zinc prime coat for touchup of IOZ.

Paint Inside Tub Girders and Closed Boxes. Provide a white polyamide cured epoxy for all interior surfaces, including splice plate but excluding the faying surfaces, unless otherwise shown on the plans. Provide IOZ primer meeting the requirements of DMS-8101, "Structural Steel Paints—Performance," to all interior faying surfaces and splice plates.

Special Protection System. Provide the type of paint system shown on the plans or in special provisions to this Item. Special Protection Systems must have completed NTPEP Structural Steel Coatings (SSC) testing regimen as a complete system, with full data available through NTPEP.

Galvanizing. Provide galvanizing, as required, in accordance with Item 445, "Galvanizing."

Paint over Galvanizing. Paint over galvanized surfaces, when required, in accordance with Item 445, "Galvanizing."

Field Painting. Provide field paint, as required, in accordance with Item 446, "Field Cleaning and Painting Steel."

CONSTRUCTION

General Requirements.

Item 441

Steel Structures

Applicable Codes. Perform all fabrication of bridge members in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1. Follow all applicable provisions of the appropriate AWS code (D1.5 or D1.1) except as otherwise noted on the plans or in this Item. Weld sheet steel (thinner than 1/8 in.) in accordance with ANSI/AWS D1.3, Structural Welding Code—Sheet Steel. Unless otherwise stated, requirements of this Item are in addition to the requirements of S2.1 for bridge members. Follow the more stringent requirement in case of a conflict between this Item and S2.1. Perform all bolting in accordance with Item 447, "Structural Bolting."

Fabricate railroad underpass structures in accordance with the latest AREMA *Manual for Railway Engineering* and this Item. In the case of a conflict between this Item and the AREMA manual, the more stringent requirements apply.

Notice of Fabrication. Give adequate notice before commencing fabrication work as specified in Table 1. Include a schedule for all major fabrication processes and dates when inspections are to occur.

Table 1
Notice of Beginning Work

Plant Location	Notice Required
In Texas	7 days
In the contiguous United States	21 days
Outside the contiguous United States	60 days

Perform no Department work in the plant before the Engineer authorizes fabrication. The Contractor must bear all Department travel costs when changes to their fabrication or inspection schedules are not adequately conveyed to the Department.

When any structural steel is fabricated outside of the contiguous 48 states, the additional cost of inspection will be in accordance with Article 6.4., "Sampling, Testing, and Inspection."

Bridge Members. Primary bridge members include:

web and flanges of plate, tub, and box girders;
rolled beams and cover plates;
floor beam webs and flanges;
arch ribs and arch tie beams or girders;
truss members;
diaphragm members for curved plate girders or beams;
pier diaphragm members for tub girders;
splice plates for primary members; and
any other member designated as "primary" or "main" on the plans.

Secondary bridge members include:

bracing (diaphragms, cross frames, and lateral bracing); and
all other miscellaneous bridge items not considered primary bridge members.

Responsibility. The Contractor is responsible for the correctness and completeness of shop drawings and for the fit of shop and field connections.

Qualification of Plants and Personnel.

Plants. Fabrication plants that produce bridge members must be approved in accordance with DMS-7370, "Steel Bridge Member Fabrication Plant Qualification." The Department's MPL has a list of approved bridge member fabrication plants.

Item 441

Steel Structures

Fabrication plants that produce non-bridge steel members listed below must be approved in accordance with DMS-7380, "Steel Non-Bridge Member Fabrication Plant Qualification." The Construction Division maintains a list of approved non-bridge fabrication plants for the following items:

Roadway Illumination Poles,
High Mast Illumination Poles,
High Mast Rings and Support Assemblies,
Overhead Sign Support Structures,
Traffic Signal Poles, and
Intelligent Transportation System (ITS) Poles

The Department will evaluate non-bridge member fabrication plants for competence of the plant, equipment, organization, experience, knowledge, and personnel to produce acceptable work.

Personnel. Provide a QC staff qualified in accordance with the applicable AWS code. Provide an adequate number of qualified QC personnel for each specific production operation. QC must be on-site and independent of production personnel, as the Engineer determines. QC personnel must be proficient in utilizing the applicable plans, specifications, and test methods, and in verifying compliance with the plant QC and production procedures. Welding inspectors must be current AWS Certified Welding Inspectors for bridge member plants, and for non-bridge member plants requiring Department approval per DMS-7380, "Steel Non-Bridge Member Fabrication Plant Qualification." The QC staff must provide inspection of all materials and workmanship before the Department's inspection. Provide the Department inspector with adequate personnel and equipment needed to move material for inspection access. QC is solely the Contractor's responsibility.

Nondestructive Testing (NDT). Personnel performing NDT must be qualified in accordance with the applicable AWS code and the employer's Written Practice. Level III personnel who qualify AS Level I and Level II inspectors must be certified by ASNT for which the NDT Level III is qualified. Testing agencies and individual third-party contractors must also successfully complete periodic audits for compliance, performed by the Department. In addition, ultrasound technicians must pass a hands-on test the Construction Division administers. This will remain current provided they continue to perform testing on Department materials as evidenced by test reports requiring their signature. A technician who fails the hands-on test must wait 6 months before taking the test again. Qualification to perform ultrasonic testing will be revoked when the technician's employment is terminated or when the technician goes 6 months without performing a test on a Department project. The technician must pass a new hands-on test to be re-certified.

Welding Procedure Specifications Qualification Testing. For bridge member fabrication, laboratories performing welding procedure specifications (WPSs) qualified by testing must be approved in accordance with DMS-7360, "Qualification Procedure for Laboratories Performing Welding Procedure Qualification Testing." The Department's MPL has a list of laboratories approved to perform WPS qualification testing.

Drawings.

Erection Drawings. Submit erection drawings prepared by a licensed professional engineer, including calculations, for approval in accordance with Item 5, "Control of the Work," at least 4 weeks before erecting any portion of field-spliced (welded or bolted) girders, railroad underpasses, trusses, arches, or other members for which erection drawings are required on the plans. Include drawings and calculations for any temporary structures used to support partially erected members. Erection drawings are not required for rolled I-beam units unless otherwise noted on the plans.

Prepare erection drawings following the procedures outlined in Section 2.2 of the AASHTO/NSBA Steel Bridge Collaboration S10.1. As a minimum, include:

plan of work area showing structure location relative to supports and all obstructions;

equipment to be used including allowable load information;
erection sequence for all pieces;
member weights and center of gravity location of pieces to be lifted;
locations of cranes, holding cranes, and temporary supports (falsework), including when to release load from temporary supports and holding cranes;
details of falsework including specific bracing requirements with maximum allowable design wind speed clearly indicated;
girder lifting points;
diaphragm and bracing requirements; and
minimum connection requirements when more than the standard requirements.

Perform girder erection analyses using UT-Lift and UT-Bridge software available on the Department's website or other suitable commercial software. Ensure temporary stresses in members being erected will not cause permanent damage and that stability is maintained throughout the erection operations. Provide actual input files and output results from UT-Lift and UT-Bridge, or graphical and hard copy results from commercial software programs.

Do not proceed if site conditions differing from those depicted on the approved erection drawings could affect temporary support stresses, erected girders, or public safety in any manner. Revise erection drawings and resubmit to the Engineer for approval before proceeding if site conditions could affect these things.

Shop Drawings. Prepare and electronically submit shop drawings before fabrication for each detail of the general plans requiring the use of structural steel, forgings, wrought iron, or castings as documented in the *Guide to Electronic Shop Drawing Submittal* available on the Bridge Division website and as directed for other items the standard specifications require.

Indicate joint details on shop drawings for all welds. Provide a title block on each sheet in the lower right corner that includes:
project identification data including federal and state project numbers,
sheet numbering for the shop drawings,
name of the structure or stream for bridge structures,
name of owner or developer,
name of the fabricator or supplier, and
name of the Contractor.

Provide one set of 11 × 17-in. approved shop drawings in hardcopy to the Department for the inspector at the fabrication plant.

Bridge Members. Prepare drawings in accordance with AASHTO/NSBA Steel Bridge Collaboration G1.3, "Shop Detail Drawing Presentation" unless otherwise approved. Print a bill of material on each sheet, including the Charpy V-Notch (CVN) and fracture-critical requirements, if any, for each piece. Indicate fracture-critical areas of members.

Non-Bridge Members. Furnish shop drawings for non-bridge members when required by the plans or pertinent Items.

Welding Procedure Specifications (WPSs). Submit WPSs and test reports in accordance with the applicable AWS code to the Construction Division before fabrication begins, and notify the Engineer which procedures will be used for each joint or joint type. Do not begin fabrication until the Engineer approves WPSs.

Post the approved WPSs for the welding being performed on each welding machine, or use another approved method of ensuring the welder has access to the procedure information at all times.

Item 441

Steel Structures

Documentation. Before beginning fabrication, provide a completed Material Statement Form 1818 (a.k.a. D-9-USA-1) with supporting documentation (such as mill test reports (MTRs)) that the producing mill issues and qualified personnel verifies. Ensure the documentation legibly reflects all information the applicable ASTM specifications require. Supply documents electronically to the Department.

Provide a copy of the shipping or storage invoice, as material is shipped or placed in approved storage that reflects:

member piece mark identification and calculated weight per piece from the contract drawings,

number of pieces shipped or in storage,

total calculated weight for each invoice per bid item, and

the unique identification number of the shipping or storage invoice.

The inspector's acceptance of material or finished members will not prohibit subsequent rejection if the material or members are found to be damaged or defective. Replace rejected material promptly.

Material Identification. Assembly-mark individual pieces and issue cutting instructions to the shop using a system that will maintain identity of the original piece.

Identify structural steel by standard and grade of steel. Also differentiate between material toughness requirements (CVN, fracture-critical) as well as any other special physical requirements. In addition, identify structural steel for primary members by mill identification numbers (heat numbers). Use an approved identification system. Use either paint or low-stress stencils to make identification markings on the metal. Mark the material as soon as it enters the shop and carry the markings on all pieces through final fabrication. Transfer the markings before cutting steel for primary members of bridge structures into smaller pieces. Loss of identification marking on any piece, with no other positive identification, or loss of heat number identification on any primary member piece will render the piece unacceptable for use. Unidentifiable material may be approved for use after testing to establish acceptability to the satisfaction of the Engineer. Have an approved testing facility perform testing and a licensed professional engineer sign and seal the results.

Welding.

Details.

Rolled Edges. Trim plates with rolled edges used for webs by thermal cutting.

Weld Tabs. Use weld tabs at least 2 in. long for manual and semi-automatic processes, at least 3 in. long for automatic processes, and in all cases at least as long as the thickness of the material being welded. Use longer weld tabs as required for satisfactory work.

Weld Termination. Terminate fillet welds approximately 1/4 in. from the end of the attachment except for galvanized structures and flange-to-web welds, for which the fillet weld must run the full length of the attachment, unless otherwise shown on the plans.

No-Paint Areas at Field-Welded Connections. Keep surfaces within 4 in. of groove welds or within 2 in. of fillet welds free from shop paint.

Galvanized Assemblies. Completely seal all edges of tightly contacting surfaces by welding before galvanizing.

Submerged-Arc Welding (SAW). Do not use hand-held semiautomatic SAW for welding bridge members unless altered to provide automatic guidance or otherwise approved.

Item 441

Steel Structures

Tubular Stiffeners for Bridge Members. Weld in accordance with AWS D1.5, using WPSs qualified based on tests on ASTM A709 Gr. 50W or Gr. 50 steel for non-weathering applications and ASTM A709 Gr. 50W steel for weathering applications.

Non-Bridge Member Weathering Steel Welds. Provide weld metal with atmospheric corrosion resistance and coloring characteristics similar to that of the base metal for weathering steel structures fabricated per AWS D1.1.

Shop Splices.

Shop Splice Locations. Keep at least 6 in. between shop splices and stiffeners or cross-frames. Obtain approval for shop splices added after shop drawings are approved.

Grinding Splice Welds. Grind shop groove welds in flange plates smooth and flush with the base metal on all surfaces whether the joined parts are of equal or unequal thickness. Grind so the finished grinding marks run in the direction of stress, and keep the metal below the blue brittle range (below 350°F). Groove welds in web plates, except at locations of intersecting welds, need not be ground unless shown on the plans except as required to meet AWS welding code requirements.

Joint Restraint. Never restrain a joint on both sides when welding.

Stiffener Installation.

Flange Tilt. Members must meet combined tilt and warpage tolerances before the installation of stiffeners. Cut stiffeners to fit acceptable flange tilt and cupping. Minor jacking or hammering that does not permanently deform the material will be permitted.

Stiffeners Near Field Splices. Tack weld intermediate stiffeners within 12 in. of a welded field splice point in the shop. Weld the stiffeners in the field in accordance with Item 448, “Structural Field Welding,” after the splice is made.

Nondestructive Testing (NDT). Perform magnetic particle testing (MT), radiographic testing (RT), or ultrasonic testing (UT) at the Contractor’s expense as specified in D1.5 for bridge structures. The Engineer will periodically witness, examine, verify, and interpret NDT. Additional welds may be designated for NDT on the plans. Retest repaired groove welds per the applicable AWS code after repairs are made and have cooled to ambient temperature. Complete NDT and repairs before assembly of parts into a member, but after any heat-correction of weld distortion.

Radiographic Testing. Radiographs must have a density of at least 2.5 and no more than 3.5, as a radiographer confirms. The density in any single radiograph showing a continuous area of constant thickness must not vary in this area by more than 0.5. Use only ASTM System Class I radiographic film as described in ASTM E1815. Use low-stress stencils to make radiograph location identification marks on the steel.

Ultrasonic Testing. Have UT equipment calibrated yearly by an authorized representative of the equipment manufacturer or by an approved testing laboratory.

Magnetic Particle Testing. Use half-wave rectified DC when using the yoke method unless otherwise approved. Welds may be further evaluated with prod method for detecting centerline cracking.

Testing of Galvanized Weldments. If problems develop during galvanizing of welded material, the Engineer may require a test of the compatibility of the combined galvanizing and welding procedures in accordance with this Section and may require modification of one or both of the galvanizing and welding procedures.

Prepare a test specimen with a minimum length of 12 in. using the same base material, with the same joint configuration, and using the welding procedure proposed for production work if testing is required. Clean and galvanize this test specimen using the same conditions and procedure that will be applied to the production galvanizing.

Examine the test specimen after galvanizing. There must be no evidence of excessive buildup of zinc coating over the weld area. Excessive zinc coating buildup will require modification of the galvanizing procedure.

Remove the zinc from the weld area of the test specimen and visually examine the surface. There must be no evidence of loss of weld metal or any deterioration of the base metal due to the galvanizing or welding procedure. Modify the galvanizing or welding procedure as required if there is evidence of deterioration or loss of weld metal, and run a satisfactory retest on the modified procedures before production work. Report procedures and results on the galvanized weldment worksheet provided by the Department.

Bolt Holes. Detail holes on shop drawings 1/16 in. larger in diameter than the nominal bolt size shown on the plans unless another hole size is shown on the plans.

Thoroughly clean the contact surfaces of connection parts in accordance with Item 447, “Structural Bolting,” before assembling them for hole fabrication. Make holes in primary members full-size (by reaming from a subsize hole, drilling full-size, or punching full-size where permissible) only in assembly unless otherwise approved.

Ream and drill with twist drills guided by mechanical means unless otherwise approved. If subpunching holes, punch them at least 3/16 in. smaller than the nominal bolt size. Submit the proposed procedures for approval to accomplish the work from initial drilling or punching through check assembly when numerically controlled (N/C) equipment is used. Use thermal cutting for holes only with permission of the Engineer. Permission for thermal cutting is not required for making slotted holes, when slotted holes are shown on the plans, by drilling or punching 2 holes and then thermally cutting the straight portion between them. Perform all thermal cutting in accordance with Section 441.3.5.1., “Thermal Cutting.”

Slightly conical holes that naturally result from punching operations are acceptable provided they do not exceed the tolerances of S2.1. The tolerance for anchor bolt hole diameter for bridge bearing assemblies is +1/8 in., −0.

Dimensional Tolerances. Meet tolerances of the applicable AWS specifications and S2.1 except as modified in this Section.

Rolled Sections. Use ASTM A6 mill tolerances for rolled sections, except D1.5 camber tolerances apply to rolled sections with a specified camber.

Flange Straightness. Ensure flanges of completed girders are free of kinks, short bends, and waviness that depart from straightness or the specified camber by more than 1/8 in. in any 10 ft. along the flange. Rolled material must meet this straightness requirement before being laid out or worked. Plates must meet this requirement before assembly into a member. Inspect the surface of the metal for evidence of fracture after straightening a bend or buckle. The Engineer may require nondestructive testing.

Alignment of Deep Webs in Welded Field Connections. For girders 48 in. deep or deeper, the webs may be slightly restrained while checking compliance with tolerances of S2.1 for lateral alignment at field-welded connections. In the unrestrained condition, webs 48 in. deep or deeper must meet the tolerances of Table 2. Girders under 48 in. deep must meet the alignment tolerances of S2.1.

Item 441

Steel Structures

Table 2
Web Alignment Tolerances for Deep Girders

Web Depth (in.)	Maximum Web Misalignment (in.)
48	1/16
60	1/8
72	1/4
84	5/16
96	5/16
108	3/8
120	7/16
132	7/16
144	1/2

Bearings. Correct bearing areas of shoes, beams, and girders using heat, external pressure, or both. Grind or mill only if the actual thickness of the member is not reduced by more than 1/16 in. below the required thickness.

I-Beams, Plate Girders, and Tub Girders. The plane of the bearing area of beams and girders must be perpendicular to the vertical axis of the member within 1/16 in. in any 24 in.

Closed Box Girders. Meet these tolerances:

The plane of the bearing areas of the box girder is perpendicular to the vertical axis of the girder within 1/16 in. across any horizontal dimension of the bearing.

The planes of the beam supports on the box girder are true to the vertical axis of the supported beams or girders to 1/16 in. in any 24 in.

In the shop, verify the plane of all bearing areas with the box placed on its bearings to field grade, using an approved process for verification.

Shoes. Meet these tolerances:

The top bolster has the center 75% of the long dimension (transverse to the girder) true to 1/32 in., with the remainder true to 1/16 in., and is true to 1/32 in. across its entire width in the short dimension (longitudinal to the girder).

The bottom bolster is true to 1/16 in. across its diagonals.

For a pin and rocker type expansion shoe, the axis of rotation coincides with the central axis of the pin.

When the shoe is completely assembled, as the top bolster travels through its full anticipated range, no point in the top bolster plane changes elevation by more than 1/16 in. and the top bolster does not change inclination by more than 1 degree, for the full possible travel.

Beam supports. Fabricate beam support planes true to the box girder bearing to 1/16 in. in the short direction and true to the vertical axis of the nesting girders to 1/16 in.

End Connection Angles. For floor beams and girders with end connection angles, the tolerance for the length back to back of connection angles is ±1/32 in. Do not reduce the finished thickness of the angles below that shown on the shop drawings if end connections are faced.

Other Fabrication Processes.

Thermal Cutting. Use a mechanical guide to obtain a true profile. Hand-cut only where approved. Hand-cutting of radii for beam copes, weld access holes, and width transitions is permitted if acceptable profile and finish are produced by

grinding. Provide a surface finish on thermal-cut surfaces, including holes, in accordance with D1.5 requirements for base metal preparation. Obtain approval before using other cutting processes.

Oxygen-Gouging. Do not oxygen-gouge quenched and tempered (Q&T), normalized, or thermo-mechanically controlled processed (TMCP) steel.

Annealing and Normalizing. Complete all annealing or normalizing (as defined in ASTM A941) before finished machining, boring, and straightening. Maintain the temperature uniformly throughout the furnace during heating and cooling so the range of temperatures at all points on the member is no more than 100°F.

Machining. Machine the surfaces of expansion bearings so the travel direction of the tool is in the direction of expansion.

Camber. Complete cambering in accordance with S2.1 before any heat-curving.

Heat Curving. Heat-curve in accordance with S2.1. The methods in the AASHTO bridge construction specifications are recommended. Attach cover plates to rolled beams before heat-curving only if the total thickness of one flange and cover plate is less than 2-1/2 in. and the radius of curvature is greater than 1,000 ft. Attach cover plates for other rolled beams only after heat-curving is completed. Locate and attach connection plates, diaphragm stiffeners, and bearing stiffeners after curving, unless girder shrinkage is accounted for.

Bending of Quenched and Tempered Steels. The cold-bending radius limitations for HPS 70W in S2.1 apply to all Q&T steels.

Nonconformance Reports (NCRs). Submit an NCR to the Engineer for approval when the requirements of this Item are not met. Submit NCRs in accordance with the Construction Division's NCR guidelines document. Have readily available access to the services of a licensed professional engineer experienced in steel structures design and fabrication. This licensed professional engineer may be responsible for reviewing potentially structurally deficient members in accordance with the NCR guidelines document. Receive Department approval before beginning repairs. Perform all repair work in strict compliance with the approved NCR and repair procedure.

Shop Assembly.

General Shop Assembly. Shop-assemble field connections of primary members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, field connections of floor beams and stringers (including for railroad structures), field-bolted diaphragms for curved plate girders and railroad underpasses, and rigid frames. Field-bolted cross-frames and rolled-section diaphragms do not require shop assembly. Complete fabrication, welding (except for shear studs), and field splice preparation before members are removed from shop assembly. Obtain approval for any deviation from this procedure. The Contractor is responsible for accurate geometry.

Use a method and details of preassembly consistent with the erection procedure shown on the erection plans and camber diagrams. The sequence of assembly may start from any location in the structure and proceed in one or both directions. An approved method of sequential geometry control is required unless the full length of the structure is assembled.

Verify by shop assembly the fit of all bolted and welded field connections between bent cap girders and plate girders or between plate girders and floor beams.

Do not measure horizontal curvature and vertical camber for final acceptance until all welding and heating operations are completed and the steel has cooled to a uniform temperature. Check horizontal curvature and vertical camber in a no-load condition.

Item 441

Steel Structures

Bolted Field Connections. Each shop assembly, including camber, alignment, accuracy of holes, and fit of milled joints, must be approved before the assembly is dismantled.

Assemble with milled ends of compression members in full bearing. Assemble non-bearing connections to the specified gap. Ream all subsize holes to the specified size while the connections are assembled, or drill full size while the connections are assembled. Notify the Engineer before shipping if fill plates or shims are added. Adding or increasing the thickness of shims or fill plates in bearing connections requires approval. Use drift pins and snug-tight bolts during the drilling process to ensure all planes of the connection (webs and flanges) can be assembled simultaneously. Do not use tack welds to secure plates while drilling.

Secure parts not completely bolted in the shop with temporary bolts to prevent damage in shipment and handling. Never use tack welds in place of temporary bolts.

Match-mark connecting parts in field connections using low-stress stencils in accordance with the diagram in the erection drawings.

Welded Field Connections. Mill or grind bevels for groove welds. Do not cut into the web when cutting the flange bevel adjacent to the web. End preparation, backing, and tolerances for girder splices must be in accordance with Item 448, "Structural Field Welding." Details for all other field-welds must conform to the applicable AWS code unless otherwise shown on the plans.

In the shop, prepare ends of beams or girders to be field-welded taking into account their relative positions in the finished structure due to grade, camber, and curvature. Completely shop-assemble and check each splice. Match-mark the splice while it is assembled with low-stress stencils in accordance with the diagram in the erection drawings.

Finish and Painting.

Shop Painting. Perform shop painting of bridge members as required in DMS-8104, "Paint, Shop Application for Steel Bridge Members." Grind corners on new steel items to be painted (except for the coatings on box and tub girder interiors) that are sharp or form essentially 90° angles to an approximately 1/16 in. flat surface before blast cleaning. (A corner is the intersection of 2 plane faces.) This requirement does not apply to punched or drilled holes. Do not omit shop paint to preserve original markings.

Ensure painted faying surfaces meet the required slip and creep coefficients for bolted connections as outlined in DMS-8104, "Paint, Shop Application for Steel Bridge Members."

Use a Class A slip (minimum slip coefficient of 0.33) if no slip coefficient or corresponding surface condition is specified Perform all required testing at no expense to the Department.

Surface preparation and painting the interiors of Tub Girders and Closed Boxes is in accordance with DMS-8104, "Paint, Shop Application for Steel Bridge Members."

Weathering Steel. Provide an SSPC-SP 6 blast in the shop to all fascia surfaces of unpainted weathering steel beams. Fascia surfaces include:

exterior sides of outermost webs and undersides of bottom flanges of plate girders and rolled beams,
all outer surfaces of tub girders and box girders,
all surfaces of truss members,
webs and undersides of bottom flanges of plate diaphragms,
bottom surfaces of floor beams, and
any other surfaces designated as "fascia" on the plans.

Do not mark fascia surfaces. Use one of the following methods as soon as possible to remove any markings or any other foreign material that adheres to the steel during fabrication and could inhibit the formation of oxide film:

SSPC-SP 1, “Solvent Cleaning,”
SSPC-SP 2, “Hand Tool Cleaning,”
SSPC-SP 3, “Power Tool Cleaning,” and
SSPC-SP 7, “Brush-off Blast Cleaning.”

Do not use acids to remove stains or scales. Feather out touched-up areas over several feet.

Machined Surfaces. Clean and coat machine-finished surfaces that are in sliding contact, particularly pins and pinholes, with a non-drying, water-repellent grease-type material containing rust-inhibitive compounds. Ensure the coating material contains no ingredients that might damage the steel. Protect machined surfaces from abrasive blasting.

Handling and Storage of Materials. Prevent damage when storing or handling girders or other materials. Remove or repair material damaged by handling devices or improper storage by acceptable means in accordance with ASTM A6 and the applicable AWS code.

Place stored materials on skids or acceptable dunnage above the ground. Keep materials clean. Shore girders and beams to keep them upright and free of standing water. Place support skids close enough to prevent excessive deflection in long members such as columns. Do not stack completed girders or beams at the jobsite.

Protect structural steel from salt water or other corrosive environments during storage and transit.

Marking and Shipping. Mark all structural members in accordance with the erection drawings. If a surface is painted, make the marks over the paint. Do not use impact-applied stencils to mark painted surfaces.

Mark the weight directly on all members weighing more than 3 tons.

Keep material clean and free from injury during loading, transportation, unloading, and storage. Pack bolts of each length and diameter, and loose nuts or washers of each size, separately and ship them in boxes, crates, kegs, or barrels. Plainly mark a list and description of the contents on the outside of each package.

Field Erection. Do not lift and place any steel member, including girders and diaphragms, over an open highway or other open travel way unless otherwise approved. Do not allow traffic to travel under erected members until sufficiently stable as shown on approved erection drawings.

Pre-Erection Conference. Schedule and attend a pre-erection conference with the Engineer at least 7 days before commencing steel erection operations. Do not install falsework or perform any erection operations before the meeting.

Methods and Equipment. Do not tack-weld parts instead of using erection bolts. Do not tack-weld parts to hold them in place for bolting. Provide falsework, tools, machinery, and appliances, including drift pins and erection bolts. Provide enough drift pins, 1/32 in. larger than the connection bolts, to fill at least 1/4 of the bolt holes for primary connections. Use erection bolts of the same diameter as the connection bolts.

Securely tie, brace, or shore steel beams or girders immediately after erection as shown on the erection drawings. Maintain bracing or shoring until the diaphragms are in place and as specified in the erection drawings. Protect railroad, roadway, and marine traffic underneath previously erected girders or beams from falling objects associated with other construction activities.

Item 441

Steel Structures

Only welders certified or working directly under the supervision of a foreman certified in accordance with Item 448, "Structural Field Welding," may handle torches when applying heat to permanent structural steel members.

Falsework. Construct falsework in accordance with the erection plan. Construct foundations for shore towers as shown on erection drawings. Do not use timber mats with deteriorated timbers or soil to construct shore tower foundations. Notify the Engineer of completed falsework to obtain approval before opening roadway to traffic or starting girder erection activities. Ensure falsework is protected from potential vehicle impact. Inspect and maintain falsework daily. Use screw jacks or other approved methods to control vertical adjustment of falsework to minimize the use of shims.

Handling and Assembly. Accurately assemble all parts as shown on the plans and the approved shop drawings. Verify match-marks. Handle parts carefully to prevent bending or other damage. Do not hammer if doing so damages or distorts members. Do not weld any member for transportation or erection unless noted on the plans or approved by the Engineer.

Welded Connections. Weld flange splices to 50% of their thickness and meet the minimum erection bracing and support requirements before releasing the erection cranes, as shown on the plans and on the approved erection plans. Field-weld in accordance with Item 448, "Structural Field Welding."

Bolted Connections. Before releasing the erection cranes:

install 50% of the bolts in the top and bottom flanges and the web with all nuts finger-tight,

meet the minimum erection bracing and support requirements shown on the plans and on the approved erection plans, and

install top lateral bracing across the connection for tub girders, and fully tension the bolts connecting the bracing to the top flanges.

Install high-strength bolts, including erection bolts, in accordance with Item 447, "Structural Bolting." Clean bearing and faying surfaces for bolted connections in accordance with Item 447, "Structural Bolting." Clean the areas of the outside ply under washers, nuts, and bolt heads before bolt installation. Ensure the required faying surface condition is present at the time of bolting.

Misfits. Correct minor misfits. Ream no more than 10% of the holes in a plate connection (flange or web), and ensure no single hole is more than 1/8 in. larger than the nominal bolt diameter. Submit proposed correction methods for members with defects that exceed these limits or prevent the proper assembly of parts. Straighten structural members in accordance with S2.1. Make all corrections in the presence of the Engineer at no expense to the Department. Do not remove and reweld gusset plates without approval.

Bearing and Anchorage Devices. Place all bearing devices such as elastomeric pads, castings, bearing plates, or shoes on properly finished bearing areas with full and even bearing on the concrete. Place metallic bearing devices on 1/4 in.-thick preformed fabric pads manufactured in accordance with DMS-6160, "Water Stops, Nylon-Reinforced Neoprene Sheet, and Elastomeric Pads," to the dimensions shown on the plans. Provide holes in the pad that are no more than 1/4 in. larger than the bolt diameter.

Build the concrete bearing area up to the correct elevation once it has been placed below grade using mortar that meets Item 420, "Concrete Substructures," and provide adequate curing. Use only mortar for build-ups between 1/8 in. and 3/8 in. thick. Use galvanized steel shims or other approved shim materials in conjunction with mortar if the bearing area must be raised more than 3/8 in.

Provide at least 75% contact of flange to shoe with no separation greater than 1/32 in. for beams and girders. Make corrections using heat or pressure in accordance with S2.1, or with galvanized shims. Correct small irregularities by grinding.

Provide at least 85% contact between the rocker plate and the base plate. Adjust the location of slotted holes in expansion bearings for the prevailing temperature. Adjust the nuts on the anchor bolts at the expansion ends of spans to permit free movement of the span. Provide lock nuts or burr the threads.

Remove all foreign matter from sliding or machine-finished surfaces before placing them in the structure.

Restore distorted bearing pads or expansion bearings to an equivalent 70°F position after completion of all welded or bolted splices, using an approved method of relieving the load on the bearing devices.

Erecting Forms. Do not erect forms until all welding or bolting is complete and the unit is positioned and properly set on the bearings unless otherwise noted on the plans.

Field Finish. Paint in accordance with Item 446, “Field Cleaning and Painting Steel.” Restore weathering steel that will remain unpainted to a uniform appearance by solvent cleaning, hand cleaning, power brush, or blast cleaning after all welding and slab concrete placement has been completed. Remove from all unpainted weathering steel fascia surfaces (see Section 441.3.8.2., “Weathering Steel,”) any foreign material, including markings, that adheres to the steel and could inhibit formation of oxide film as soon as possible. Feather out touched-up areas over several feet. Do not use acids to remove stains or scales.

MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.

Item 446
Field Cleaning and Painting Steel

1. DESCRIPTION

Prepare steel surfaces for painting and apply paint.

1. MATERIALS

Provide the paint system (surface preparation, primer, intermediate, and appearance coats as required) shown on the plans. Provide System II if no system specified. Provide a concrete gray appearance coat (Federal Standard 595C, color 35630,) unless otherwise shown on the plans. Use differing colors for each individual coat with enough contrast between colors to distinguish the various steps in the painting process, including differing the color of the stripe coat relative to the primer and intermediate coat.

Paint Systems. Standard paint systems for painting new and existing steel include the following:

1. **System I-A (Overcoating, One Coat)**. Provide an overcoating system in accordance with DMS-8105, "Paint, One Coat Overcoat," and the manufacturer's specifications.

2. **System I-B (Overcoating, High Corrosion Environment)**. Provide paint in accordance with DMS-8101, "Structural Steel Paints—Performance." Provide a penetrating sealer, intermediate prime coat on bare steel areas, and an appearance coat in accordance with manufacturer's specifications.

3. **System II**. Provide #810 Prime Coat meeting DMS-8100, "Structural Steel Paints—Formula," and acrylic latex appearance coat meeting DMS-8101, "Structural Steel Paints—Performance."

4. **System III-A**. Provide paint in accordance with DMS-8101, "Structural Steel Paints—Performance." Provide organic zinc (OZ) prime coat, epoxy intermediate stripe coat, epoxy intermediate full coat and urethane appearance coat.

5. **System III-B**. Provide paint in accordance with DMS-8101, "Structural Steel Paints—Performance." Provide inorganic zinc (IOZ) prime coat, epoxy intermediate, and urethane appearance coat. Provide epoxy zinc prime coat, as recommended by the IOZ manufacturer, for touchup of IOZ.

6. **System IV**. Provide paint in accordance with DMS-8101, "Structural Steel Paints—Performance." Provide IOZ prime coat and acrylic latex appearance coat. Provide epoxy zinc prime coat, as recommended by the IOZ manufacturer, for touchup of IOZ.

Paint Inside Tub Girders and Closed Boxes. In accordance with Item 441, "Steel Structures."

Paint over Galvanizing. In accordance with Item 445, "Galvanizing."

Special Protection System. Provide the type of paint system shown on the plans or in special provisions to this Item. Special Protection System paints must have completed NTPEP Structural Steel Coatings (SSC) testing regimen as a complete system, with full data available through NTPEP unless specified otherwise.

Item 446

Field Cleaning and Painting Steel

2. EQUIPMENT

Ensure spray equipment:

has adequate capacity and sufficient gauges, filters, agitators, regulators, and moisture separators to ensure delivery of clean dry air at the proper pressure and volume;

is adequate for the type of paint being used;

has spray heads that provide a smooth, uniform coat of paint;

will remove moisture from air stream in contact with the paint; and

has no dried coatings, solvents, or other foreign matter on surfaces that paint is likely to contact.

Maintain all equipment and accessories in good working order.

Keep paint pots no more than 20 ft. above or below the level of spray application of paint during painting operations. Do not allow fluid hoses to sag more than 10 ft. below the level of the bottom of the paint pot or actual spraying operations, whichever is the lowest point. Keep hoses serviceable with no cracks or deterioration. Equip paint pots (or other containers from which the paint is dispensed) with agitators that operate whenever paint is in the pot.

Airless Spray Equipment. Use regulator and air or fluid pressure gauges. Use fluid hoses with at least 1/4-in. inside diameter (I.D.) and a maximum length of 75 ft.

Conventional Spray Equipment. Use independent fluid pressure and atomization pressure regulators and gauges. Use fluid and air hoses with at least 1/2-in. I.D. and a maximum length of 75 ft.

3. CONSTRUCTION

Qualification. Certification of the cleaning and painting contractor, subcontractor, or fabricator is required as follows:

Submit to the Engineer documentation verifying SSPC QP 1 certification for work requiring the removal or application of coatings. Additionally, submit to the Engineer documentation verifying SSPC QP 2 Cat A certification when work requires removal of coatings containing hazardous materials. Maintain certifications throughout the project. No work may be performed without current and active certifications unless otherwise shown on the plans. The Engineer may waive QP 1 certification for minor, touch-up repair work and coating steel members repaired in accordance with Item 784, “Steel Member Repair.”

The Engineer may waive certification requirements, when stated on the plans, for the purpose of qualification in the SSPC QP program if the SSPC has accepted the project as a qualification project as part of the process for obtaining SSPC QP1 or QP2 Cat A certification. Submit SSPC QP applications and proof of acceptance before beginning work or provide SSPC QP 7 certification when required on the plans.

Inform the Engineer within 1 business day of all scheduled or unannounced inspections or audits by SSPC, OSHA, EPA, TCEQ, or other agencies or organizations. Furnish the Engineer a complete copy of all inspection and audit reports and any SSPC DAC actions within 7 days of receipt.

Responsibility for Hazards. Comply with Section 6.10., “Hazardous Materials.” Handle all paints and cleaning products in accordance with the information provided by the manufacturer and all applicable federal and state regulations.

Access. Provide safe access to all parts of the work for proper inspection. Do not place rigging, scaffolds, etc., in contact with previously painted surfaces until the previously applied coating has fully cured. Protect previously painted

and cured surfaces with an approved padding to minimize damage when rigging, scaffolds, etc., will be placed on or hung from those surfaces. Avoid and minimize coating damage to the extent possible. Repair all coating damaged as a result of rigging or scaffolding as directed.

Remove tree limbs, bushes, grass, and other items that will interfere with the cleaning and painting operations as directed. Remove vertical clearance signs, and erect and maintain temporary ground-mounted signs matching the content and letter size on the existing sign unless otherwise directed. Re-attach permanent clearance signs as directed.

Steel to be Painted. Clean and paint all structural steel except weathering steel that is to remain unpainted, unless otherwise shown on the plans. Structural steel includes all main members, bearing apparatus, diaphragms, floor beams, rivets, bolts, lateral bracing, etc., where applicable. Paint the rolling faces of rockers and base plates, all surfaces of bearing plates, and all surfaces of iron or steel castings, whether or not the surfaces are milled unless otherwise shown on the plans or exempted in this Item. Perform the initial cleaning and application of required prime and intermediate coatings on new steel before shipment of the steel to the jobsite unless otherwise provided in the Contract or approved in writing.

Special Protection System. Apply paint as shown on the plans.

Cleaning and Painting New Steel. Clean and prime new steel in accordance with Item 441, “Steel Structures,” before erection or installation of repair pieces. Clean and paint unpainted areas of newly erected steel, including bolts, nuts, washers, and areas where the shop-applied paint has been damaged or fails to meet specification requirements, in accordance with the method required under the paint system specified and Section 446.4.7.3.1., “General Preparation.” Water blast exposed surfaces of all newly erected steel. Provide Tool Cleaning surface preparation to all repair areas. Prepare all unpainted areas with Abrasive Blast Cleaning. Repair primer coat and apply remaining coats after erection and maintenance work is complete. Prevent paint and overspray from coming in contact with passing traffic, private and public property, and areas of the bridge not designated to be painted.

Cleaning and Painting Existing Steel.

1. **Hold Points**. No work may proceed beyond the listed hold point until the Engineer has reviewed and given provisional approval. Provide the following hold points at a minimum:
   at containment completion,
   following any surface preparation,
   immediately before each coating application,
   after coating application,
   after each coat has cured, and
   after preparation of areas for repair.

2. **Containment**. Submit a plan that details the procedures and type and size of equipment proposed to keep public property, private property, and the environment from being adversely affected by the cleaning and painting operations. Approval of the plan is required before cleaning and painting operations begin. Containment is not required for painting newly erected, shop primed steel other than to comply with Section 446.4.6., “Cleaning and Painting New Steel.”

   When required on the plans, submit a containment plan and engineering analysis showing the loads, including wind loads, added to the existing structure by the containment system and waste materials. Verify the forces and stresses induced in the members from these loads do not result in overstress of the members. Have a licensed professional engineer sign, seal, and date the submittal.

Item 446

Field Cleaning and Painting Steel

Provide containment during all cleaning and painting operations of existing steel structures. Obtain approval of the constructed containment system before beginning cleaning and painting.

Unless otherwise shown on the plans, construct and maintain a structure meeting the following minimum requirements:

SSPC Guide 6, Class 1A, Level 1 Emissions;

ability to withstand winds up to 30 mph;

enclosure of all sides of area with air-impenetrable walls;

illumination meeting SSPC Guide 12;

rigid, watertight floor formed from minimum 20 gauge steel;

overlapping seams and entryways; and

exhaust air filtration system capable of creating negative pressure inside the enclosure causing the sides of the containment to have a concave appearance and demonstrating minimum 100 ft. per minute cross draft air flow and minimum 50 ft. per minute downdraft air flow in all areas within the containment.

In place of a full containment structure, a modified containment system may be proposed for the following situations:

when using abrasive blasting equipment equipped with negative pressure able to contain all blast refuse. Demonstrate, for approval, the equipment's ability to contain all blast refuse.

when using hand tools for spot cleaning only, provide a system that will contain all removed paint, rust, and other debris. Place an airtight membrane below the member being cleaned to collect all falling debris.

when using power hand tools for spot cleaning only that are equipped with high-efficiency particulate air (HEPA) filter vacuums that will capture all removed paint, rust, and other debris. Otherwise, provide an airtight membrane below the member being cleaned to collect all falling debris.

Provide a system meeting SSPC Guide 6, Class 1W, when using water blasting.

Store, characterize, and dispose of all recovered debris in accordance with 30 TAC 335, "Industrial Solid Waste and Municipal Hazardous Waste." Alternatively, Universal Waste rules may be used. Discharge liquids in accordance with the TCEQ Texas Pollution Discharge Elimination Program (30 TAC 305, "Effluent Guidelines and Standards for TPDES Permits") and Texas Surface Water Quality Standards (30 TAC 307). Alternatively, liquids may be captured, stored, and characterized for disposal at an authorized facility in accordance with 30 TAC 315, "Pretreatment Regulation for Existing and New Sources of Pollution," or 30 TAC 335, "Industrial Solid Waste and Municipal Hazardous Waste."

Use a skimmer when cleaning and painting over bodies of water. Remove any blast or paint material the skimmer collects the day the release occurs. Correct the containment problem that allowed the release before continuing work.

Ensure air is clear of dust and remove all blast refuse from cleaned members before the inspector enters the containment to inspect the cleaned surfaces. Remove all blast refuse from the containment before ending work for the day.

3. **Preparation of Surfaces**. Prepare surfaces before applying paint.

1. **General Preparation**. Clean far enough into any shop-applied paint to ensure removal of all contaminants. Feather edges of sound paint around cleaned areas.

Item 446

Field Cleaning and Painting Steel

Ensure all surfaces to be painted are completely free of oil, grease, moisture, dirt, sand, overspray, welding contamination (slag or acid residue); loose or flaking mill scale, rust, or paint; weld spatter; and any other conditions that will prevent the paint from forming a continuous, uniform, tightly adhering film. Remove all hackles, splinters weld spatter, sharp edges, fins, slag, or other irregularities which may interfere with proper paint adhesion to the steel. Remove all steel splinters (hackles) raised or evident during cleaning. Reblast areas from which hackles are removed when abrasive blast cleaning is required.

Before other cleaning operations, remove grease-like contaminants with clean petroleum solvents or other approved methods. Contain solvents and removed material as approved. Dispose of properly or reuse solvents as approved. This requirement applies to all coats.

When abrasive blast cleaning is required, blast all flame-cut edges to produce a visible anchor pattern over the entire flame-cut surface.

Completely remove, as directed, the protective coating on machined surfaces and pins.

Do not damage adjacent materials such as concrete during surface preparation or painting.

Feather all sound, tightly adhered coating edges surrounding cleaned or repaired areas a minimum of 1 in. and ensure a smooth, blended transition.

Round all corners and edges to a 1/16-in. radius. Reblast as needed. Remove pack rust to depth of at least 0.5 in.

2. **Classes of Cleaning**. The requirements of Section 446.4.7.3.1., “General Preparation,” apply whether or not a class of cleaning is specified. Use an approved abrasive for abrasive blasting. Do not use steel shot. Use an abrasive recycling system with an approved recyclable abrasive when abrasive blast cleaning is used to remove existing paint containing lead or chromium. Abrasive will be considered recyclable if it is separated from the dust and paint debris before being reused. All abrasives must meet SSPC-AB1, AB2, or AB3 as appropriate.

   All paint systems require water blasting to remove contaminants before any other surface preparation. Both System I-A and I-B require tool cleaning for defective areas of disbonded coating or rust. All other paint systems require abrasive blast cleaning unless otherwise shown on the plans.

1. **Abrasive Blast Cleaning**. Meet the surface preparation requirements of SSPC-SP 10 unless otherwise shown on the plans. Ensure a minimum profile of 1.5 mils. Do not add depth to existing profile when the surface profile exceeds 4.0 mils. Measure surface profile in accordance with ASTM D4417, Method C, “Standard Test Methods for Field Measurement of Surface Profile of Blast Cleaned Steel.” Containment mounting points and other repair areas under 1 sq. ft. may be tool-cleaned to SSPC SP-11 with at least a minimum 2 mil profile when approved by the Engineer.

2. **Tool Cleaning**. Meet the requirements of SSPC-SP2 or SP3 unless otherwise shown on the plans. Probe the perimeter of peeled areas of paint with a putty knife to ensure remaining paint is tightly adhered.

3. **Water Blasting**. Meet the requirements of SSPC-SP WJ-4. Tight mill scale and tightly adhered rust and paint are permitted. Probe the perimeter of peeled areas of paint with a putty knife to ensure remaining paint is tightly adhered.

3. **Tape Test**. Perform the tape test, as necessary to determine cleanliness, on any surface before painting as follows:

Press a strip of filament tape onto the surface by rubbing with moderate thumb pressure 4 times, leaving approximately 2 in. of one end of the tape free from the surface.

Grasp the free end and remove the tape from the surface with a sharp pull.

The surface will be considered to be contaminated and not adequately cleaned if visible particles cling to the tape.

4. **Painting**.

1. **Paint Condition**. Thoroughly mix and strain paints to be applied. Mix by mechanical methods. Provide continuous mechanical agitation during painting operations to prevent settling. Ensure the paint is a completely homogeneous mixture free of lumps, skins, and agglomerates and contains all pigments, vehicle solids, and thinners required in the original formulation. Keep paint containers tightly covered and protected from weather when not in use.

2. **Thinning**. Adjust paint to the correct application consistency by using suitable thinners or by using properly applied heat up to 150°F. Using heat to thin paints may decrease their useful pot life.

3. **Paint System Requirements**. Ensure all coatings in the paint system, including shop-applied coats, are from the same manufacturer.

4. **Stripe Coat**. All stripe coat, when specified, will be unthinned and worked in by brush to achieve a contiguous film over all edges, corners, bolts, nuts, threads, rivets, and weld seams, extending at least 1 in. onto adjacent steel.

5. **Paint Systems**.

1. **System I-A (Overcoating, One Coat)**. Apply at least 4.0 mils dry film thickness (DFT) maintenance overcoat to all surfaces to be painted.

2. **System I-B (Overcoating, High Corrosion Environment)**.

Penetrating Sealer. Apply 0.5–1.0 mil DFT of penetrating sealer to all surfaces to be painted.

Prime Coat. Apply 4.0–8.0 mils DFT of primer to areas that have received tool cleaning and to other areas where there is no existing primer.

Appearance Coat. Apply 2.0–6.0 mils DFT of appearance coat.

3. **System II**.

Prime Coat. Apply 3.5–10.0 mils DFT of primer in at least 2 coats.

Appearance Coat. Apply 2.0–5.0 mils DFT of appearance coat.

4. **System III-A**.

Prime Coat. Apply at least 3.5 mils DFT of epoxy zinc primer.

Stripe Coat. Apply stripe coat of epoxy intermediate coating.

Intermediate Coat. Apply at least 2.0 mils DFT of epoxy intermediate coating.

Appearance Coat. Apply at least 2.0 mils DFT of appearance coating.

5. **System III-B**.

Prime Coat. Apply at least 3.0 mils DFT of inorganic zinc primer to new steel in accordance with Item 441, "Steel Structures." Spot-clean all damaged and unpainted areas in accordance with Section 446.4.6., "Cleaning and Painting New Steel." Apply at least 3.0 mils DFT of epoxy zinc primer to the spot cleaned areas.

Stripe Coat. Apply stripe coat of epoxy intermediate coating.

Intermediate Coat. Apply at least 2.0 mils DFT of epoxy intermediate coating.

Appearance Coat. Apply at least 2.0 mils DFT of appearance coat.

6. **System IV**.

Prime Coat. Apply at least 3.0 mils DFT of inorganic zinc primer to new steel in accordance with Item 441, "Steel Structures." Spot-clean all damaged and unpainted areas in accordance with Section 446.4.6., "Cleaning and Painting New Steel." Apply at least 3.0 mils DFT of epoxy zinc primer to the spot cleaned areas.

Appearance Coat. Apply at least 2.0 mils DFT of appearance coat.

7. **Special Protection System**. Apply paint as shown on the plans.

6. **Temperature**. Do not apply #810 Prime Coat when the steel or air temperature is below 50°F or when the steel or air temperature is expected to drop below 50°F within 2 hr. after application. Follow product data sheets for temperature requirements for all other paints.

7. **Application**. Clean steel surfaces or surfaces of previously applied coats of paint immediately before painting by blowing with clean compressed air, brushing, or both to remove traces of dust or other foreign particles. Wash the surfaces of previously applied coatings either with clean, fresh water or with a mild detergent and water mixture followed by a complete and thorough rinse with clean, fresh water when directed.

Do not apply paint to any surface with discernible moisture. Do not apply paint to any surface when steel is within 5°F of the dewpoint. Do not apply any paint when impending weather conditions might result in injury to fresh paint.

Provide environmental controls such as dehumidification, heaters, or additional containment measures as needed to control and maintain favorable atmospheric conditions in all areas of the containment. Provide environmental controls at no additional cost to the Department.

Apply each coat of paint to clean, dry, firm surfaces complying with all specification requirements. Ensure surfaces to be painted are free of all forms of contamination. Ensure each coat fully cures to form a smooth, continuous, tightly adhering film of uniform thickness and appearance, free of sags, runs, pinholes, holidays, overspray, or other defects before applying the next coat. Apply all coats by spray, except brush-applied stripe coats. Obtain Engineer approval for alternative methods of application to paint inaccessible areas.

Repair all runs, sags, and other defects in each coat of paint before application of subsequent coats.

Measure the dry film thickness of coatings in accordance with Tex-728-I.

If, in the opinion of the Engineer, there is an objectionable amount of dust in the atmosphere, discontinue painting or take necessary precautions to prevent dust and dirt from coming in contact with freshly painted surfaces or with surfaces before the paint is applied.

Item 446

Field Cleaning and Painting Steel

Provide full coverage of the steel with the concrete surface when painting steel that is in contact with concrete. Do not extend the paint more than 4 in. onto the concrete surfaces or as directed. Ensure when painting is complete the only visible paint on concrete surfaces is the finish coat. Remove excessive or objectionable paint on concrete surfaces in an approved manner.

Cure the primer, when System II is specified, in accordance with Table 1 before applying appearance coat.

Table 1
System II Primer Cure Times

Temperature	Days Cure, Min
77°F and above	2
65–77°F	3
55–65°F	4
40–55°F	5

Clean coated surfaces by an approved method that does not damage the paint to remove all dirt, grease, concrete, overspray, and any other substance that may impair adhesion before the application of the next coat.

Provide an even and uniform appearance throughout the painted portion of the structure.

8. **Workmanship**. Perform all painting with skilled painters who can adjust equipment and application techniques as dictated by the type of paint, weather conditions, environment, and size and shape of the surface being painted. Painters who, in the opinion of the Engineer, do not adjust equipment to apply coatings in a uniform, full wet coat free of runs, sags, holidays, and overspray will not be considered skilled painters.

   Apply sprayed coatings essentially 90° to the surface and between 10 and 18 in. from the surface as necessary to apply a full wet coat of paint free of overspray, runs, sags, and holidays. Any spray painter who does not consistently spray in this manner or extends the spraying stroke so paint is applied to the surface at an angle of less than 80° will not be allowed to spray paint. Brush application for touchup is acceptable as long as the paint is mixed in the appropriate proportions by weight and is agitated continuously during the painting operation.

5. **Handling and Shipping**. Pad the blocks, chains, slings, braces, clamps, etc., used for handling, moving, storing, and shipping painted members so the paint will not be damaged.

Paint Improperly Applied. To uncover evidence of improperly applied paint, the Engineer may at any time during construction explore underneath the surface of any paint coats already applied. Repair these areas of investigation at no additional expense to the Department. Whenever unsatisfactory conditions are found, the Engineer may require remedial measures.

Repair or completely remove and replace all paint that has been applied improperly, has been applied to improperly cleaned surfaces, fails to dry and harden properly, fails to adhere tightly to underlying metal or other paint film, or does not have a normal, workmanlike appearance in conformance with this Item. When the final field coat does not have a uniform color and appearance throughout the structure, correct it by the use of whatever additional coats or other corrective measures are required. Remove freshly applied paint that has not yet set with the use of suitable solvents. Remove dried paint films with blast cleaning, scraping, or flame torches, as approved.

Storage and Disposal. Collect all waste generated by cleaning and painting operations as necessary to prevent release into the environment. At a minimum, collect all waste before leaving the jobsite each day. Handle and store the waste as if it was hazardous or Universal Waste until classification is made. Follow the requirements of 30 TAC 335

for on-site handling of the waste. Store waste collected in containers that comply with 49 CFR Part 178. Seal containers containing waste each day before leaving the jobsite.

Test a representative sample of waste using EPA Test Method 1311, "Toxicity Characteristic Leaching Procedure" (TCLP), to determine existing metal and organic content. Handle and dispose of non-hazardous waste as a "Special Waste" as defined in 30 TAC 330.2 or as directed. Provide documentation showing disposal of the waste was done in a suitable landfill holding permits to handle this type of material. Dispose of hazardous waste in compliance with applicable waste rules and regulations. Transport hazardous waste using a permitted transporter and dispose of in an authorized hazardous waste facility.

When the plans specify the existing coating to be removed contains hazardous materials and steel grit is used as the abrasive, the waste generated is classified as hazardous or Universal Waste regardless of the results of the TCLP. For manifesting purposes, the Department is considered the waste generator for paint removal wastes generated from structures owned or controlled by the State. Dispose of this waste in compliance with applicable waste rules and regulations as specified above and by the Contract.

Provide copies of all test reports and transportation manifests to the Engineer before shipping waste. Provide signed original manifests to the Engineer verifying all steps of the handling and disposal process were correctly handled.

Miscellaneous. Notify the Engineer of any condition that may require the repair or replacement of any portion of the bridge.

Stencil on the exterior face of the outside beam the control, section, and structure number upon completion of the painting operations for each structure as directed. Stencil on the interior face of the outside beam the completion date of the painting operation. Do this work at each end of the structure where painting is specified.

4. MEASUREMENT

When this Item is specified on the plans to be a pay item, this Item will be measured by the lump sum or by each structure, structure unit, or group of structures as shown on the plans.

5. PAYMENT

When this Item is specified as a pay item, the work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the price bid for "Cleaning and Painting Existing Structures," "Cleaning and Painting Existing Railing," or "Cleaning and Painting Existing Piling" for the system specified and, when paid by each, for the structure description by reference number. "Cleaning and Painting Existing Structures" includes painting of railing and piling unless otherwise shown on the plans. This price is full compensation for paint; cleaning, spot painting, and painting; removal of vegetative obstructions; containment systems; traffic protection and scaffolding; disposal of waste; and materials, equipment, labor, tools, and incidentals.

When the Item is not specified as a pay item, the work performed and materials furnished in accordance with this Item will not be measured or paid for directly but will be subsidiary to pertinent Items.

DMS - 8101

STRUCTURAL STEEL PAINTS — PERFORMANCE

EFFECTIVE DATE: SEPTEMBER 2007

8101.1. Description. This Specification governs the performance requirements and testing of structural steel coatings and describes the pre-approval procedures.

8101.2. Units of Measurements. The values given in parentheses (if provided) are not standard and may not be exact mathematical conversions. Use each system of units separately. Combining values from the two systems may result in nonconformance with the standard.

8101.3. Material Producer List. The Materials and Pavements Section of the Construction Division (CST/M&P) maintains the Material Producer List (MPL), titled "Structural Steel Paints — Performance," require sampling and testing before use.

Tex-736 describes the sampling procedure.

8101.4. Bidders' and/or Suppliers' Requirements. Before any material is considered, it must be of manufacture and product code or designation shown on the MPL.

8101.5. Regulation Compliance. It is not a requirement or intent of this Specification to cause infringement of any health, safety, or environmental regulation. Some paints are harmful to the health, and since the Engineer cannot anticipate or control the many different conditions under which cleaning and painting may be accomplished, the Contractor is responsible for the safety of his operation and for compliance with all federal, state, or local regulations.

NOTE: The material manufacturer must supply a Material Safety Data Sheet to comply with OSHA's Hazard Communication Standard 29 CFR § 1910.1200.

8101.6. Sampling and Testing. The Department or a designated commercial laboratory will sample and test in accordance with CST/M&P's appropriate manual of test procedures.

To assure that the paints supplied to projects are of the same quality and composition as the paint samples used for pre-approval and that changes have not occurred without notifying the Department, the Department may use some or all of the following tests to characterize the paints. The Department reserves the right to use whatever tests are necessary.

- Adhesion
  - ASTM D 4541
- Amine Value
  - ASTM D 1652
- Bend Test
  - ASTM D 522
- Blistering
  - ASTM D 714
- Color
  - ASTM D 2244
- Contrast Ratio
  - Federal Test Method 4122
- Density
  - ASTM D 1475
- Dry Time
  - ASTM D 1640
- Epoxide Equivalent
  - ASTM D 1652
- Flash Point, Cleveland Open Cup (COC)
  - ASTM D 92
- Gloss
  - ASTM D 523
- Grind
  - ASTM D 1210
- Infrared Spectrum
  - Tex-888-B
- Leafing
  - ASTM D 480
- Minimum Film Formation Temperature
  - ASTM D 2354
- Percent Pigment
  - ASTM D 2698
  - ASTM D 3723
  - ASTM D 4451

- Percent Solids
  - ASTM D 2369
  - Tex-808-B
- Sag
  - Tex-812-B
- Skinning
  - Tex-811-B
- Viscosity (Poises)
  - ASTM D 2196
  - ASTM D 4287
- Viscosity (Krebs Unit [KU])
  - ASTM D 562
- Volume Solids
  - ASTM D 6093
- Weathering
  - ASTM G 155
- Zinc Dust
  - ASTM D 522.

Address all questions to the Texas Department of Transportation, Construction Division, Director of Materials and Pavements Section (CP51), 125 East 11th Street, Austin, TX 78701-2483.

8101.7. Costs.

Supply all materials for pre-approval testing at your expense.

The Department will normally bear the costs of sampling and testing of project paints. However, the Contractor will bear the costs of sampling and testing of materials that fail to conform to the requirements of this Specification.

The cost of sampling and testing will be that established by the Director of CST/M&P and in effect at the time of testing.

CST/M&P must receive a cashier's check made payable to "TxDOT Fund" before scheduling a replacement batch. The Contractor may be required to reimburse the Department for the cost of storage and handling of paints failing to meet specified requirements.

The Department reserves the right to conduct random sampling of pre-approved, certified materials for testing and to perform random audits of test reports. Department representatives may sample material from the manufacturing plant, the project site, and the warehouse. CST/M&P reserves the right to test samples to verify compliance with this Specification.

8101.8. Finished Products. When canned, the finished product must be free from skins and foreign materials.

The Department or a designated commercial laboratory will make consistency, drying, and gallon weight (density) determinations on coatings at 77°F. Tester will measure the consistency with a Krebs Stormer Viscometer.

Tester will run density in accordance with ASTM D 1475 and viscosity in accordance with ASTM D 562.

8101.9. Containers and Markings. Ship the finished products in suitable, strong, well-sealed containers that meet specification and federal requirements and are sufficiently sturdy to withstand normal shipping and handling.

Label the sides of the containers and cases with a durable label, legibly printed with the following:

- manufacturer's name,
- product designation, including component part,
- batch number,
- date of manufacture, and
- gross weight.

NOTE: The label must be moisture-resistant to withstand outdoor storage for a minimum of 1 yr. When palletizing for shipment, securely attach the label to the outside for easy identification.

8101.10. Paint Requirements. All paints covered by this Specification must comply with the Environmental Protection Agency's Electronic Code of Federal Regulations (e-CFR), Title 40: Protection of Environment, Part 59 – National Volatile Organic Compound Emission Standards for Consumer and Commercial Products, Subpart D – National Volatile Organic Compound Emission Standards for Architectural Coatings.

Coatings listed in this Article are not specified as high solids (volatile organic content-compliant) coatings. The supplier may qualify a high solids version of any of the coatings providing the supplier can demonstrate that the high solids version is essentially the same coating as the pre-approved lower solid coatings.

Purchase all specified paints on the open market. Secure materials in sufficient time to allow for testing and timely execution of the work. Each of the paints must meet the specified requirements for its type.

The requirements for these paints that are proprietary in nature do not relieve the manufacturer of any obligations relating to patents nor does it give the manufacturer the right to patent infringement.

Supply the chosen coating system from the same manufacturer and one that the manufacturer recommends as a system.

Submit coating samples for preliminary evaluation to the Texas Department of Transportation, Construction Division, Director of Materials and Pavements, 9500 Lake Creek Parkway, Austin, TX 78717. Include a list of structures or jobs within the Texas coastal area that documents satisfactory performance for a minimum of 10 yr.

The Engineer reserves the right to inspect any or all sites listed by the supplier. If inspection is necessary, secure permission from the owner for inspection by Department personnel.

8101.11. System III Inorganic Zinc Primer. This primer is a solvent-based inorganic zinc coating of the self-curing ethyl-silicate type.

Supply the coating as either a two- or a three-component system consisting of one container of zinc dust and one or two containers of liquid components.

Package the coating, so that when mixing one can of each component with the others, the mixing of components will be the correct ratios. Applicator must mix the components before application to form the complete coating.

A. Liquid Component.

- The density of this component must be within ±0.10 1b. per gallon of the material contained in the preliminary evaluation sample.
- When determined in accordance with Tex-808-B, the percent solids by weight of the clear vehicle must be ±0.7 of the percent value determined from the preliminary evaluation sample and the percent solids of the whole vehicle must be ±1.5 of the percent value determined from the preliminary evaluation sample.
- This component must be a solution of ethyl-silicate containing suspending agents, colorant pigments, and inert filler material. An infrared spectrum of the clear vehicle, obtained by centrifuging, must match the infrared spectrum of the evaluation sample on file at CST/M&P. X-ray diffraction patterns of the clear and whole vehicle must match the X-ray diffraction patterns on file at CST/M&P.
- A gas chromatographic analysis of the liquid portion of the coating must match the chromatogram on file at CST/M&P.

B. Powder Component.

- This component must contain ±0.2 lb. per gallon of the material contained in the preliminary evaluation sample.
- This component must consist of essentially zinc dust at a minimum of 94.0% zinc metal and must be free of hard lumps or agglomerates of zinc dust.

C. Activator (optional).

- The density of the activator component must be within ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- The percent solids by weight of the activator component must be ±1.0 of the percent value determined from the preliminary evaluation sample.
- An infrared spectrum of the activator must match the infrared spectrum of the evaluation sample on file at CST/M&P.

D. Mixed Coating.

- When mixed in the correct proportion of vehicle to powder, the resulting material must be of sprayable viscosity.

- Slight agitation must keep the zinc dust properly suspended.
- When applied to blasted steel to achieve a 3-mil dry film, the coating must be water insoluble within 15 min. above 32°F and within 30 min. at 32°F.
- Atmospheric moisture or spray mist must aid in achieving maximum film hardness. Alkali metal salts must not form in the curing process.
- A 3- to 4-mil dry film applied to white metal blasted steel and cured for a minimum of 24 hr. at 70 to 80°F and 50 to 100% relative humidity must withstand temperatures up to 600°F with no film deterioration.
- This coating must have a minimum of 80.0% zinc metal in the dry film.

8101.12. Epoxy Zinc Primer. This primer is a polyamide-cured epoxy coating containing a minimum of 84.0% zinc metal in the dry film.

Supply this primer as a three-component system with one of the components being the dry zinc dust.

- The base and curing agent portions must contain ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- The percent solids by weight of both liquid components must be ±1.0 of the percent value determined from the preliminary evaluation sample.

An infrared spectrum of the vehicle system obtained by centrifuging, must match the infrared spectrum of the evaluation sample on file at CST/M&P.

Package the coating so that mixing the two cans of vehicle and the can of zinc dust will be the correct ratio. Applicator must mix the three components before application to form the complete coating.

8101.13. Epoxy Intermediate Coating. This coating is a polyamide-cured or polyamide/amine-cured epoxy containing inhibitive type pigments.

- The base and curing agent portions must contain ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.
- The percent solids by weight of both liquid components must be ±1.0 of the percent value determined from the preliminary evaluation sample.

An infrared spectrum of the vehicle system, obtained by centrifuging, must match the infrared spectrum of the evaluation sample on file at CST/M&P.

Package the coating so that mixing one can of base and one can of catalyst, will be the correct ratio. Applicator must mix the two components before application to form the complete coating.

8101.14. Urethane Appearance Coat. This appearance coat is a glossy, acrylic-cured aliphatic urethane-appearance coat recommended by the manufacturer for marine service.

- The manufacturer recommends the urethane appearance coat for use over any pre-approved epoxy zinc primer, epoxy intermediate coating, or epoxy penetrating sealer from the same manufacturer.
- The cured film must have a minimum 60° gloss of 85.

Unless otherwise shown on the plans, the color of the urethane appearance coat is light gray to match Federal Standard 595B, Color number 34630.

8101.15. Acrylic Latex Appearance Coat. This appearance coat is a water-borne acrylic latex coating designed for long-term durability on structures.

- The resin system must be acrylic.
- Do not use vinyl-acrylic, styrene-acrylic resins, or cold blends of nonacrylic resins. (Acrylic resins with a small amount of styrene co-reacted into the polymer will be allowed if they pass the accelerated weather testing.)
- An infrared spectrum of the coating must match the infrared spectrum of the evaluation sample on file at CST/M&P.
- The coating must have a minimum Hegman grind reading of four and a minimum sag reading of 8 mils.
- The Krebs-Stormer viscosity must be ±10 KU of the pre-approved sample and have a maximum ICI Cone and Plate viscosity of 3.0 Poises.
- If more than one sample of any color is tested, the density of the subsequent samples must fall within ±0.10 lb. per gallon and the percent solids must fall within ±2.0 percentage value of the original sample.

Do not use universal tint colorants in creating the colors in these paints. Use only:

- colorants dispersed in an acrylic system designed for use with durable, exterior, acrylic latex paints and
- lightfast pigments.

When tested as an appearance coat on a panel primed with the System II epoxy zinc primer for 3,000 hr. in an Atlas Xenon Weather-Ometer (WOM), the acrylic latex must not show any serious failure. A serious failure could be peeling, chipping, blistering, discoloring, cracking, crazing, or eroding away with film thickness loss, splitting, or disbonding.

- A small amount of chalking is acceptable.
- Tester will operate the WOM in accordance with ASTM G 155 using Exposure Cycle 1 with a quartz inner filter glass and Type "S" Borosilicate outer filter glass.

After 3,000 hr. of testing, the coating must have a delta E (ΔE [L*, a*, b*]) of less than three for white and light colors. For darker colors (L* less than 80), the ΔE must be less than five.

A pull-off adhesion test run on the panel after 3,000 hr. WOM testing must have a minimum pull-off strength of 400 psi and maximum of 20% adhesion failure of the coating from the primer or cohesive failure. Run the pull-off adhesion test in accordance with ASTM D 4541 using a Type II Fixed Alignment Adhesion Tester.

8101.16. Epoxy Penetrating Sealer. This sealer is a two-package, low-viscosity epoxy coating designed for wetting aged coatings and poorly prepared surfaces, and is essentially free of solvent.

A one mil wet film thickness application must have a set-to-touch dry time of greater than 2.0 hr.

The base and catalyst portions must contain ±0.10 lb. per gallon of the material contained in the preliminary evaluation sample.

The percent solids by weight of the coating must be ±1.0 of the percent value determined from the preliminary evaluation sample. (These percent solids must be determined on the mixed coating and dried for 24 hr. in a silica gel desiccator.)

An infrared spectrum of the systems must match the infrared spectrum of the evaluation sample on file at CST/M&P.

Package the coating so that mixing one can of base and one can of curing agent, will be the correct ratio. Applicator must mix the two components before application to form the complete coating.

8101.17. Coating Combinations. The Department allows the use of various combinations of the listed coating on structural steel.

A. Class "A" Blasted Steel.

- Combination A (System III)
  - Inorganic Zinc Primer (Shop Painting)
  - Epoxy Zinc Primer (Field Touch-Up Painting)
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination B
  - Epoxy Zinc Primer
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination C
  - Epoxy Zinc Primer
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination D (System IV)
  - Inorganic Zinc Primer (Shop Painting)
  - Epoxy Zinc Primer (Field Touch-up Painting)
  - Acrylic Latex Appearance Coat.

B. Class "B" Blasted Steel.

- Combination A
  - Epoxy Penetrating Sealer
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.
- Combination B
  - Epoxy Intermediate Coating
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.

C. Class "C" Cleaning.

- Protection System I (Over Coating)
  - Epoxy Penetrating Sealer
  - Epoxy Intermediate Coating (Apply on hand-tool or power-tool cleaned areas without any old primer remaining or areas where the appearance coating is removed and the remaining primer is too thin.)
  - Urethane Appearance Coating or Acrylic Latex Appearance Coat.

8101.18. Archived Versions. Archived versions are available.

Appendix A

FINAL REPORT_94175317 Geo Report - Buffalo Creek Interceptor Sewer

Geotechnical Engineering Report

Buffalo Creek Parallel Interceptor Sewer, Phase I

FM 740 to Buffalo Creek Wastewater Treatment Plant

Rockwall and Kaufman Counties, Texas

August 21, 2018

Terracon Project No. 94175317

Prepared for:

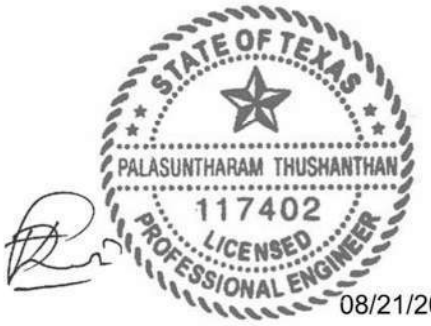
Huitt-Zollars, Inc.

Dallas, Texas

Prepared by:

Terracon Consultants, Inc.

Dallas, Texas



08/21/2018

August 21, 2018

Huitt-Zollars, Inc.
1717 McKinney Avenue, Suite 1400
Dallas, TX 75202-1236

Attn: Mr. John Ho
P: (214).871.3311
E: jho@Huitt-Zollars.com

Re: Geotechnical Engineering Report
Buffalo Creek Parallel Interceptor Sewer, Phase I
FM 740 to Buffalo Creek Wastewater Treatment Plant
North Texas Municipal Water District
Rockwall and Kaufman Counties, Texas
Terracon Project No. 94175317

Dear Mr. Ho:

This report presents the findings of the subsurface exploration and provides geotechnical recommendations for the design and construction of the proposed Buffalo Creek Parallel Interceptor Sewer – Phase I for North Texas Municipal Water District (NTMWD). These services have been performed in general accordance with our Subconsultant Agreement dated November 2017.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.
Texas Registration #3272

STATE OF TEXAS
PALASUNTHARAM THUSHANTHAN
117402
LICENSED PROFESSIONAL ENGINEER
8/21/18

Palasuntharam (Thusha) Thushanthan, P.E.
Project Manager

Tim G. Abrams, P.E.
Senior Principal

TABLE OF CONTENTS

EXECUTIVE SUMMARY

North Texas Municipal Water District (NTMWD) is planning to install an approximately 8-mile long interceptor sewer main along Buffalo Creek to add capacity to the existing system in Rockwall and Kaufman Counties, Texas. Subsurface conditions were explored with 22 borings drilled to depths of approximately 20 to 35 feet.

The following geotechnical considerations were identified:

- Subsurface conditions were found to typically consist of fat clays to depths of 20 to 30 feet. Marl and weathered marl was encountered in 9 borings at depths ranging from 8 to 22 feet. Groundwater was observed in all but four borings.

- The proposed interceptor sewer main can be installed by open cut trench excavation and launch shaft-microtunnelling-pipe jacking methods. Excavations for the open cut trench and launch shaft pits are expected to be primarily in clays and marl. The soils will need to be sloped or braced during construction. Applicable OSHA standards should be followed. The marl is relatively hard and can be difficult to excavate.

- Groundwater is expected to be encountered in the excavations and particularly at creek crossings and near Rainbow Lake and ponds. The groundwater could adversely impact trench wall stability. Dewatering may be required during construction. Sumps and pumps are expected to be adequate for most of the excavations, but if sand layers are encountered, well points could be required.

- Based on the 2012/2015 International Building Code and ASCE/SEI 7-10, seismic site classification for this site may be considered Site Class C.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
BUFFALO CREEK PARALLEL INTERCEPTOR SEWER – PHASE I
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

Terracon Project No. 94175317
August 21, 2018

1.0 INTRODUCTION

North Texas Municipal Water District (NTMWD) is planning to install an approximately 8-mile long interceptor sewer main is to add capacity to the existing system. The new line will parallel the existing sewer main along Buffalo Creek. Our scope of services included drilling and sampling 22 borings to depths of about 20 to 35 feet, laboratory testing, and engineering analysis. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil and rock conditions
- groundwater conditions
- earthwork
- trenching and excavation
- seismic considerations
- bore tunnel

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	See Exhibits A-1 in Appendix A
Proposed Improvements	A new interceptor sewer main is planned to add capacity to the existing system. The new line will parallel the existing sewer main. The sewer main will range from 36 to 48 inches in diameter The pipeline is expected to be of flexible construction.
Proposed Invert Depth of Pipe	Approximately 8 to 28 feet below existing grade to match the existing sewer main flow line.
Grading	No change from existing
Type of Installation	The sewer main is expected to be constructed using open-cut and cover methods except at crossings of streets, and a golf course. At these locations, micro-tunneling methods is anticipated to be used.

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	Phase I of Buffalo Creek Parallel Interceptor Sewer will be from FM 740 to the Buffalo Creek Wastewater Treatment Plant (WWTP). Station Limits: 328+98 (FM 740) to 755+16 (Buffalo Creek WWTP). Approx. GPS Coordinates: Station 328+98: 32.7766 N, -96.4703 W Station 755+16: 32.8781 N, -96.4583 W
Existing improvements	Existing sewer main, residential neighborhood, trails, streets, and a golf course
Current ground cover	Bare soil, grass, and trees
Existing Grades	Existing grades along the pipeline vary approximately between 398 feet at Station 328+98 and 496 feet near Station 755+16.
Water Features	Buffalo Creek, Little Buffalo Creek, Brockway Branch, Long Branch, Rainbow Lake and ponds.

3.0 SUBSURFACE CONDITIONS

3.1 Exploration and Laboratory Testing

Subsurface conditions were planned to be explored by 25 borings. Due to the accessibility, a total of 22 borings were drilled at the approximate locations shown on Exhibit A-1 in Appendix A. The boring locations were selected to be near ponds and at tunnel bore locations. A description of the field work is given in Exhibit A-2 in Appendix A. Conditions encountered at individual boring locations are indicated on the boring logs presented on Exhibits A-3 through A-25. It should be noted that stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual.

Laboratory tests were performed to classify the soil and measure soil strength. Brief descriptions and results of these tests are presented in Appendix C. Results of the laboratory tests are tabulated on the boring logs in Appendix A.

3.2 Typical Profile

Subsurface conditions encountered at the borings are generalized in the following table. Subsurface profiles along the pipeline are presented on Exhibits A-26 through A-29 in Appendix A.

Stratum	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency
1	8 to 30 feet	Fat Clay (CH) Liquid Limits: 51 to 87 Plasticity Indices: 33 to 62	Medium stiff to hard
2	12 to 22 feet in 5 borings	Weathered Marl	--
3	20 to 35 feet in 9 borings	Marl	--

3.3 Groundwater

The borings were advanced using dry auger drilling techniques, which allows short-term groundwater observations to be made during drilling and upon completion of drilling. Groundwater seepage observed in the boreholes can be found on the boring logs in Appendix A, on the soil profiles on Exhibits A-26 through A-29, and are summarized below.

Boring Number	Approximate Depth to Groundwater (feet)		Approximate Elevation of Groundwater (feet)	
	While Drilling	Upon Completion	While Drilling	Upon Completion
B- 1	18	22	384	380
B- 2	18	28	396	386
B- 3	18	23	397	392
B- 4	13	20	410	403
B- 5	18	22	407	403
B- 6	14	18	412	408
B- 7	4	18	432	418
B- 8	14	18	424	420
B- 9	6	18	432	420
B- 10	18	12	426	432
B- 12	14	20	432	426
B- 13	14	Not encountered	436	Not encountered
B- 14	14	18	436	432
B- 15	Trace at 14	Not encountered	--	Not encountered
B- 16	17	22	441	436
B- 17	14	23	444	435
B- 18	14	18	445	441
B- 19	19	19	444	444

Boring Number	Approximate Depth to Groundwater (feet)		Approximate Elevation of Groundwater (feet)	
	While Drilling	Upon Completion	While Drilling	Upon Completion
B- 20	Not encountered	Not encountered	Not encountered	Not encountered
B- 21	Not encountered	Not encountered	Not encountered	Not encountered
B- 22	Not encountered	Not encountered	Not encountered	Not encountered
B- 23	19	23	470	466

These groundwater observations provide an indication of the groundwater conditions present at the time of drilling. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, creek levels, landscape irrigation and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the pipeline may be higher than the levels indicated on the boring logs. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The subsurface soils encountered at the site are predominantly medium stiff to hard, highly expansive fat clays. These soils are capable of significant volume change with variations in moisture levels. The potential magnitude of post construction movements at this site is dependent on several factors including the invert depths of the pipeline and moisture levels at the time of construction. We estimate that the potential magnitude of post construction vertical movements vary from less than one inch for a portion of the pipeline with an invert depth of 15 feet or more to 2 to 3 inches for a portion of the pipeline with an invert depth of 8 feet at this site.

The proposed Buffalo Creek parallel interceptor sewer main is planned to be installed by open cut trench excavation and launch shaft-microtunnelling-pipe jacking methods under major roadways.

Groundwater was present in all borings, except in Borings B-15, B-20, B-21, and B-22. Groundwater could be encountered during trench excavations and the excavation for the launch shafts and during the tunneling process. The groundwater could adversely impact trench wall stability. Dewatering may be required during construction. We expect the groundwater entering the

excavations is anticipated to be at inflow rates that can be typically handled with sumps and pumps. But if sand layers are encountered, well points could be required.

Geotechnical recommendations for earthwork, open cut trench excavations, and microtunnelling-launch shafts are presented in the following report sections.

4.2 Earthwork

All existing loose fill, debris or other unsuitable materials should be removed prior to placing the bedding, embedment or backfill material for the pipeline. If unsuitable material extends below the proposed pipeline bearing elevations, then these materials should be removed and replaced in accordance with the following recommendations.

4.2.1 Material Requirements

Fill materials should meet the criteria given below.

Fill Type	Technical Description and Physical Properties	Appropriate Use
On-site soils	Free of vegetation, organic material, debris, and rocks greater than 4 inches in maximum dimension	▪ General site grading ▪ Embedment materials ▪ Backfill for pipeline
Imported fill	Clean clay soil (free of deleterious material and debris) with a Liquid Limit (LL) less than 60 and Plasticity Index more than 15 and no rock greater than 4 inches in maximum dimension	
Free Draining Material	Clean crushed stone that meets the gradation requirements of ASTM C-33 No. 56 or 57 aggregate.	▪ Pipe Zone Embedment[1]
Flowable Fill	TXDOT Item 401 – Flowable Backfill, Excavatable	

1. Embedment materials should conform to the NTMWD requirements.

4.2.2 Compaction Requirements

Recommendations for compaction are presented in the following table. We recommend that engineered fill be tested for moisture content, compaction and free swell during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test must be reworked and retested as required until the specified moisture and compaction requirements are achieved.

Item	Compaction Criteria
Subgrade preparation to receive fill	Surface scarified to a minimum depth of 6 inches and compacted to criteria below. Scarification is not necessary for trench backfill, provided trench subgrade is free of loose fills and debris
Lift thickness	Loose lift thickness of 9 inches or less.
General site fill and backfill for pipeline	A minimum of 95% maximum standard Proctor dry density (ASTM D 698) at least 2 percentage points above optimum moisture content.
Free Draining backfill	95% maximum index density (ASTM D4254).

4.2.3 General Bedding, Embedment, and Backfill Recommendations

The bedding and embedment materials should conform to the NTMWD requirements. The bedding should be uniform, and free of large rocks, debris, or other items that could damage the pipe.

Backfill above the top of the pipe bedding embedment backfill can be onsite soils. The backfill materials should be spread in loose lifts, less than 6 inches thick or thinner depending on the compaction equipment used. If granular materials are used to backfill excavations, a minimum 2-foot thick clay layer should be placed to cap the granular backfill to reduce water infiltration.

For trench backfill, field density tests should be taken at the rate of 1 test per each 1,000 square feet, per lift. For areas where hand tamping is required, the testing frequency should be approximately 1 test, per lift, per 100 linear feet of the compacted length.

4.3 Open-Cut Trench Excavations

The proposed interceptor sewer trench excavations should be performed in accordance with current Occupational Safety and Health Administration's (OSHA) Excavation and Trench Safety Standards (OSHA Standards 29 CFR-1926, Appendices A and B). Excavation sides should be either sloped or temporary bracing to control excavation side stability. Installation methods, expected soil conditions, and construction considerations for open cut trench excavations are presented in the following table.

Item	Description
Type of Method	Open Cut Method
Procedure	Open cut trench method involves excavating down and manually installing a new pipe and then backfilling.
Expected Soil Conditions	Medium stiff to hard clays such as soils encountered in the borings drilled for this study.

Item	Description
Maximum Allowable Side Slope	Based on the shear strength of soils encountered in the borings, a maximum allowable side slope of 1-Horizontal to 1-Vertical (1H:1V) is recommended for short term excavations, flatter slopes may be required due to groundwater seepage into the excavation.
Construction Considerations	1. The cohesive soils encountered were medium stiff to hard in consistency and open-cut excavations in such soils are expected to stand vertically long enough to allow trench boxes to be placed along most of the alignment; however, there may be localized areas where vertical cuts may not stand long enough to allow trench boxes to be installed. 2. Groundwater was encountered in all but four borings (B-15, B-20, B-21, and B-22) during drilling and could be encountered during construction, particularly during wet periods of the year. Dewatering will likely be required to maintain trench bottom and side stability. The need for excavation dewatering will depend on the depth of excavation and time of the excavation. The groundwater entering the excavations is expected to be at inflow rates that can be handled with sumps and pumps. However, groundwater conditions could be present that could require well points. 3. Any storm water or groundwater that enters the excavations should be removed promptly. 4. Trench excavations should be sloped or braced as required by the OSHA regulations to provide stability and safe working conditions. The contractor is responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations. 5. Open cut excavations should take into account any existing structures or utilities in order to avoid undermining these structures. 6. The trench wall between the existing pipe line and new pipe line may collapse if the new trench is too close to the existing line. Water in the bedding layer under the existing line and excavation trench wall could affect the stability of new excavation. A horizontal distance of at least 10 feet between the existing line nearest trench wall and new trench wall should be maintained. For deeper excavation of more than 15 feet, stability analyses should be performed. The stability analyses can be performed upon request.

4.4 Launch Shafts, Micro-Tunnelling and Pipe Jacking

Based on proposed invert depths, the fat clays are expected be present at the launch shaft locations, except the golf course location where marl is expected to be at the proposed invert depths. Pipe jacking will exert horizontal forces on the surrounding shaft walls. The following

table summarizes the installation methods, expected soil conditions, and construction considerations for this pipe installation method.

Item	Description
Type of Methods	Launch/receiving Shafts, Micro-Tunnelling (Horizontal Directional Drilling (HDD)), and Pipe Jacking
Procedure	Drilling a hole underground horizontally between two points without disturbing the surface between sending and receiving pits.
Expected Soil Conditions	Medium stiff to hard clays and marl
Allowable Horizontal Soil Resistance	The recommended allowable horizontal soil bearing resistance for the pipe jacking design at the anticipated tunneling locations are as follows: ▪ At S. King Road: 1,200 psf ▪ At McClendon Road: 2,000 psf ▪ At FM 549: 1,000 psf ▪ At Country Club Drive: 2,000 psf ▪ At Golf Course: 2,000 psf in clays and 8,000 psf in marl These values include at least a factor of safety of 2.5. The pipe jacking must be performed against undisturbed clays or marl.
Construction Considerations	1. The fat clays encountered have relatively high strengths and should not be difficult to excavate in trenches and tunnels. Golf course Boring B-22 encountered marl at the proposed invert depths. The marl is relatively harder than the clays and require more effort to excavate and tunnel through. A contractor experienced with tunneling through marl should be retained for this project. 2. Groundwater was encountered in most of the borings during drilling and could be encountered during construction, particularly during wet periods of the year. Dewatering techniques should be followed. The groundwater entering the launch shaft pits is expected to be at inflow rates that can be handled with sumps and pumps. However, groundwater conditions could be present that could require well points. 3. Micro-Tunnelling method will require receiving and entrance pits. Pit excavations should be braced as required by the OSHA regulations to provide stability and safe working conditions. The contractor is responsible for designing and constructing stable, temporary pit excavations and should shore the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations. 4. Any storm water or groundwater that enters the pit excavations should be removed promptly.

Item	Description
	5. Pit excavations should take into account any existing structures or utilities in order to avoid undermining these structures. 6. The pit wall portion between the existing pipe line and new pipe line may collapse, if the new pit is too close to the existing line. Water in the bedding layer under the existing line and pit wall could affect the stability of new pit excavation. A horizontal distance of at least 10 feet between the existing line trench wall and new pit wall should be maintained. For deeper excavation of more than 15 feet, stability analyses should be performed. The stability analyses can be performed upon request.

4.5 Trench and Launch Shaft Pit Bracing

If sidewalls of the excavations are cut near vertical, an adequate internal bracing system will be necessary. Bracing may consist of steel sheet piling with cross bracing and trench boxes. The trench bracing should be designed in accordance with the lateral pressure distributions shown in in Exhibit A-30 in Appendix A.

The surcharge loads resulting from excavation spoils, equipment, adjacent structures, and traffic live loads should be considered if they will be present within an area defined by an angle of 45 degrees extending up from the base of the wall. Water pressures should be included in the bracing design if wall drainage is not provided. Design groundwater level is recommended to be considered as at 2 feet above the water level encountered during drilling. It is our opinion that considering groundwater level above 2 feet of that encountered at the borings should account for groundwater level fluctuations that might occur due to seasonal variations. However, groundwater level should be re-evaluated during construction to confirm that groundwater level used in the design is shallower than that encountered during construction; if shallower groundwater is encountered, the designs should be re-evaluated.

4.6 Backfill Settlement

Settlement of the backfill in the pipeline trench should be anticipated. Vertical pipes, such as pipes at the manhole locations, in the backfill material can be pulled down and joints opened. The pipe joints should be rigidly connected. Sidewalks and pavements over fills may also settle. Fills compacted to 95 percent of standard Proctor density are anticipated to settle on the order of one to two percent of the total fill depth. If settlement must be limited to less than about one inch, the trench should be backfilled with compacted ASTM - C 33 No. 57 stone, cement treated sand or flowable fill.

4.7 Seismic Considerations

	Site Classification	S_{Ds}	S_{D1}
2012/2015 International Building Code (IBC) [1]	C [2]	0.079 g	0.061 g

1. In general accordance with the ASCE/SEI 7-10.
2. The ASCE/SEI 7-10 requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope does not include the required 100 foot soil profile determination. Borings were extended to a maximum depth of approximately 35 feet and this seismic site class definition considers that very dense soils and soft rock exist below the maximum depth of the subsurface exploration, which is consistent with the site geology. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration. Alternatively, a geophysical exploration could be utilized in order to attempt to justify a higher seismic site class.

5.0 GENERAL COMMENTS

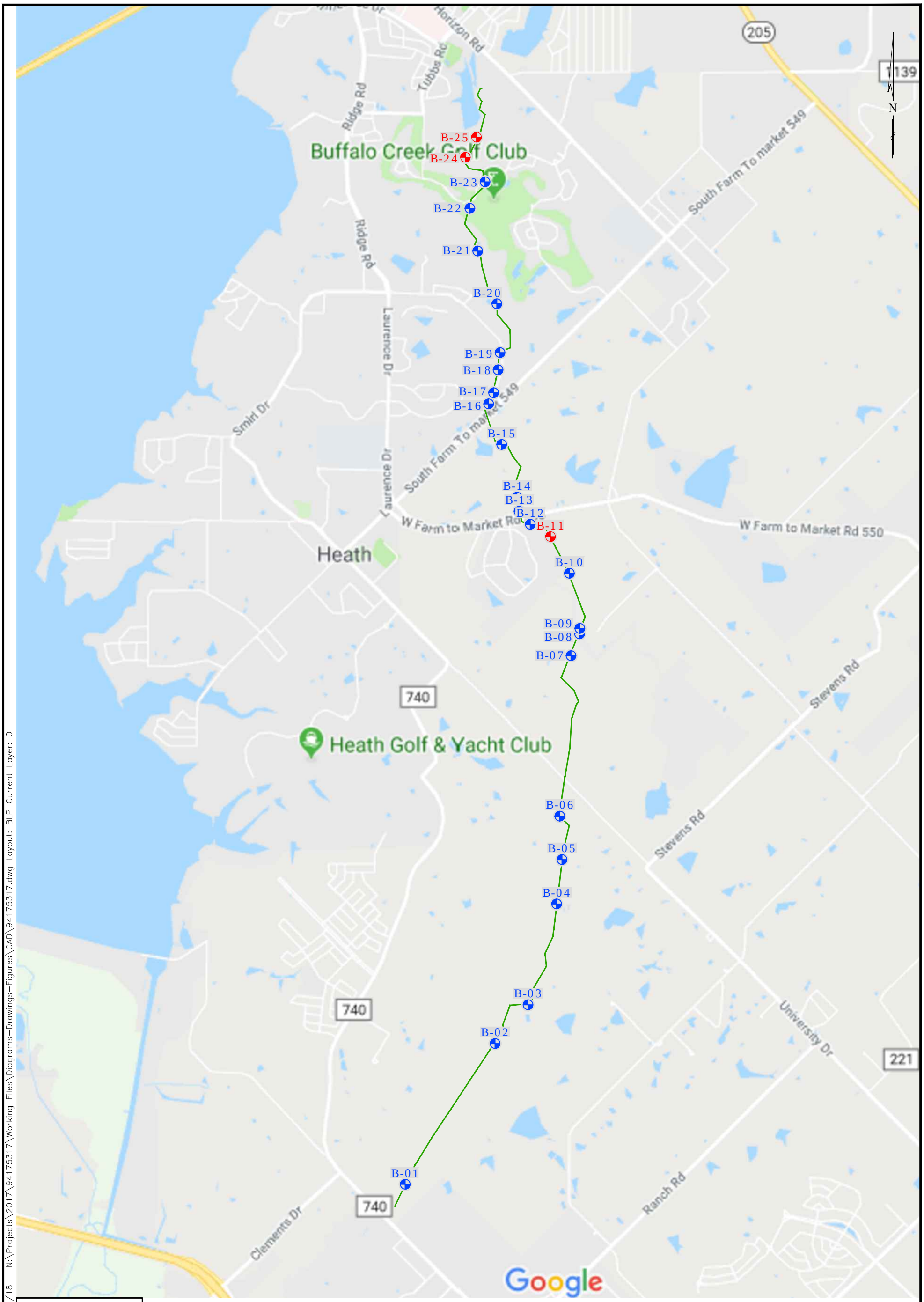
Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A
FIELD EXPLORATION



Date: 08/09/18 N:\Projects\2017\94175317\Working Files\Diagrams-Drawings-Figures\CAD\94175317.dwg Layout: BLP Current Layer: 0

THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

0 1500 3000 FEET
APPROXIMATE SCALE

SOURCE: GOOGLE MAPS, 2018

NOTE:
BORING NOT DRILLED AT THIS TIME DUE TO ACCESSIBILITY.

NOTE: BORING LOCATIONS ARE APPROXIMATE.

Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94175317
Scale:	AS SHOWN
Date:	08/09/18

Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

BORING LOCATION PLAN

BUFFALO CREEK PARALLEL INTERCEPTOR SEWER - PHASE I
FM 740 TO BUFFALO CREEK WASTEWATER TREATMENT PLANT
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

EXHIBIT
A-1

Field Exploration Description

Subsurface conditions were explored by drilling 22 borings at the approximate locations indicated on the Exploration Plan on Exhibit A-1 in Appendix A. Three borings (B-11, B-24, and B-25) were not drilled due to the accessibility. The field exploration for 20 borings, except Borings B-21 and B-22, was performed in May 2018. Borings B-21 and B-22 located in the Buffalo Creek golf course were drilled on July 17, 2018. Plywood was used to aid in drilling golf course borings in order to reduce rutting on golf course areas. The test locations were established in the field along the proposed alignment and offset based on areas that were accessible for a drill rig and clear from existing utilities. The elevations of the borings were obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006. The boring locations and elevations should be considered accurate only to the degree implied by the methods employed to determine them.

The borings were performed using truck-mounted drill rigs. Samples of the cohesive soils encountered in the borings were obtained using thin-walled tube sampling procedures. Upon the completion of drilling, the boreholes were backfilled with soil cuttings. The samples were tagged for identification, sealed to reduce moisture loss, and taken to the laboratory for further examination, testing, and classification. The load-carrying capacity of the marl was also evaluated in-place by the Texas Department of Transportation (TxDOT) cone penetrometer tests.

Field boring logs were prepared by an experienced field technician. These logs included visual classifications of the materials encountered as well as interpretation of the subsurface conditions between samples. The boring logs included with this report represent the engineer's interpretation of the field logs and include modifications based on visual evaluation of the samples and laboratory test results. The boring logs are presented in Exhibits A-3 through A-25 in Appendix A. General Notes to log terms and symbols are presented in Exhibit C-1 in Appendix C.

BORING LOG NO. B- 1

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.7786° Longitude: -96.4691°

Surface Elev.: 402 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
					3.25 (HP)							
					3.25 (HP)				26			
		5			3.25 (HP)							
					3.25 (HP)	UC	2.96	13.3	22	106	70-18-52	
					3.75 (HP)							
		10										
					2.25 (HP)				26		71-20-51	
		15										
			▽									
					2.75 (HP)	UC	2.04	4.5	25	103	74-21-53	
		20										
			▽									
					2.5 (HP)				26			
		25										

FAT CLAY (CH), dark gray, stiff

6.0 / 396

FAT CLAY (CH), gray, stiff to very stiff

11.0 / 391

FAT CLAY (CH), tan and gray, stiff

16.0 / 386

FAT CLAY (CH), brown and gray, stiff

25.0 / 377

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-3

BORING LOG NO. B- 2

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.7914° Longitude: -96.4591°

Surface Elev.: 414 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray, hard to stiff				4.5+ (HP)							
					4.5+ (HP)							
		5			2.75 (HP)	UC	1.72	13.3	27	94	71-21-50	
					2.5 (HP)							
					3.25 (HP)				25			
11.0	403	10										
	FAT CLAY (CH), brown and gray, medium stiff to stiff				1.75 (HP)	UC	2.06	12.2	25	99		
		15	▽									
					2.5 (HP)				22			
		20										
					2.0 (HP)	UC	1.14	13	26	98	62-19-43	
27.0	387	25	▽									
	FAT CLAY (CH), tan and gray, hard				4.5+ (HP)				20			
30.0	384	30										
	Boring Terminated at 30 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-4

BORING LOG NO. B- 3

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.7949° Longitude: -96.4554°

Surface Elev.: 417 (Ft.)

DEPTH	ELEVATION (Ft.)	FIELD TEST RESULTS	TEST TYPE	COMPRESSIVE STRENGTH (tsf)	STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
FAT CLAY (CH), dark gray, stiff to very stiff									
		2.5 (HP)							
		3.5 (HP)				20		75-23-52	
		4.5+ (HP)							
		3.5 (HP)				25			
		3.0 (HP)	UC	2.67	13	24	100		
12.0	405								
FAT CLAY (CH), yellowish brown and gray, stiff to medium stiff									
		3.0 (HP)				22			
		1.0 (HP)	UC	0.94	13.2	26	96	55-16-39	
23.0	394								
FAT CLAY (CH), brown, stiff									
		2.5 (HP)	UC	1.18	13	22	103		
		2.25 (HP)				26			
30.0	387								
Boring Terminated at 30 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

While drilling

At completion of drilling

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-5

BORING LOG NO. B- 4

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8041° Longitude: -96.4521°

Surface Elev.: 424 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
					2.75 (HP)							
					4.5+ (HP)				22			
		5			1.5 (HP)				23			
					2.0 (HP)	UC	1.63	13.2	28	93	60-16-44	
					2.0 (HP)							
		10										
12.0	412											
			▽									
					3.25 (HP)				22			
		15										
			▽		2.75 (HP)	UC	2.45	13.2	26	100		
		20										
					4.0 (HP)				21			
25.0	399	25										

FAT CLAY (CH), dark gray and gray, stiff to medium stiff

FAT CLAY (CH), tan, stiff to very stiff

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-6

BORING LOG NO. B- 5

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8081° Longitude: -96.4514°

Surface Elev.: 425 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray and tan, stiff				3.25 (HP)							
					2.25 (HP)				26			
4.0	421											
	FAT CLAY (CH), dark gray, stiff to medium stiff	5			2.5 (HP)							
					2.5 (HP)				26			
					1.75 (HP)				29			
11.0	414	10										
	FAT CLAY (CH), gray and yellowish brown, stiff				2.75 (HP)	UC	2.34	11.6	25	98	73-19-54	
		15										
17.0	408		▽									
	FAT CLAY (CH), brown and gray, very stiff				3.75 (HP)	UC	2.26	7.3	25	99		
		20										
22.0	403		▽									
	FAT CLAY (CH), yellowish brown and gray, very stiff				3.75 (HP)				22		51-18-33	
25.0	400	25										
	Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-7

BORING LOG NO. B- 6

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8121° Longitude: -96.4516°

Surface Elev.: 428 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
					3.25 (HP)							
					4.5+ (HP)							
		5			3.0 (HP)				24		66-17-49	
					2.0 (HP)	UC	1.45	8.3	24	100		
8.0	420											
					2.5 (HP)				24			
		10										
12.0	416											
			▽		4.25 (HP)				21			
		15										
			▽									
					2.75 (HP)	UC	1.56	13.1	25	98		
		20										
					3.0 (HP)	UC	2.41	13.7	17	111	53-16-37	
25.0	403	25										

FAT CLAY (CH), dark gray and tan, very stiff to stiff

FAT CLAY (CH), dark gray, stiff

FAT CLAY (CH), gray and yellowish brown, very stiff to stiff

Boring Terminated at 25 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-8

BORING LOG NO. B- 7

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8268° Longitude: -96.45°

Surface Elev.: 438 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray, medium stiff to stiff				1.0 (HP)							
			▽		1.0 (HP)				28			
		5			1.5 (HP)	UC	1.59	13.1	28	93		
					2.5 (HP)				23			
8.0	430											
	FAT CLAY (CH), brown and gray, stiff				2.25 (HP)				22			
		10										
					2.75 (HP)	UC	3.07	12.3	23	108	64-16-48	
		15										
17.0	421		▽									
	FAT CLAY (CH), tan and gray, very stiff				3.75 (HP)				22			
20.0	418	20										
	Boring Terminated at 20 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-9

BORING LOG NO. B- 8

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8288° Longitude: -96.4491°

Surface Elev.: 439 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
					2.0 (HP)							
					2.0 (HP)				27			
		5			1.5 (HP)	UC	0.84	8.1	28	95		
					2.5 (HP)				26		62-18-44	
					2.5 (HP)							
		10										
			▽		2.0 (HP)				26			
		15										
			▽		2.0 (HP)	UC	1.50	12.9	27	99		
		20										

FAT CLAY (CH), brown and gray, medium stiff to stiff

4.0 435

FAT CLAY (CH), gray, medium stiff to stiff

12.0 427

FAT CLAY (CH), gray and brown, medium stiff to stiff

20.0 419

Boring Terminated at 20 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-10

BORING LOG NO. B- 9

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8293° Longitude: -96.449°

Surface Elev.: 440 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		FAT CLAY (CH), gray, stiff to medium stiff				3.0 (HP)							
						1.0 (HP)				25			
			5			1.0 (HP)				34			
				▽		1.0 (HP)	UC	1.06	11.3	29	94		
						1.25 (HP)				31			
	12.0	428	10										
		FAT CLAY (CH), gray and brown, stiff				3.0 (HP)	UC	2.35	12.6	23	102		
			15										
				▽									
	20.0	420				2.0 (HP)				23		63-16-47	
		Boring Terminated at 20 Feet	20										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-11

BORING LOG NO. B-10

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8344° Longitude: -96.45°

Surface Elev.: 445 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), gray, very stiff to stiff				4.0 (HP)							
					4.5+ (HP)				21			
		5			2.5 (HP)				26		67-19-48	
					2.25 (HP)	UC	2.11	12.9	25	97		
					2.75 (HP)							
12.0	433	10	▽									
	FAT CLAY (CH), gray and brown, stiff to medium stiff				2.0 (HP)				22			
		15	▽									
					1.0 (HP)	UC	0.75	9.5	29	94		
23.0	422	20										
	FAT CLAY (CH), with gravel, gray, medium stiff				1.75 (HP)				21			63
25.0	420	25										
	Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-12

BORING LOG NO. B-12

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8389° Longitude: -96.4542°

Surface Elev.: 450 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
					3.5 (HP)							
					3.25 (HP)				22			
		5			2.25 (HP)	UC	1.93	12.8	26	94		
					2.5 (HP)				25			
					2.0 (HP)				24		71-18-53	
		10										
13.0	437											
FAT CLAY (CH), gray and tan, stiff			▽		3.0 (HP)	UC	2.06	13.3	22	102		
17.0	433	15										
MARL, weathered, tan					4.5+ (HP)				21			
22.0	428	20	▽									
MARL, gray												
25.0	425				TC=100/2.0"							
Boring Terminated at 25 Feet		25										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-13

BORING LOG NO. B-13

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8402° Longitude: -96.4554°

Surface Elev.: 452 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray, stiff				2.5 (HP)							
					2.0 (HP)				22		58-17-41	
		5			2.0 (HP)	UC	1.72	12	26	98		
					2.25 (HP)				26			
8.0	444											
	FAT CLAY (CH), gray and tan, stiff				2.0 (HP)				26			
		10										
12.0	440											
	FAT CLAY (CH), brown and gray, stiff		▽		2.5 (HP)	UC	2.77	13.2	22	105	61-17-44	
		15										
					2.75 (HP)	UC	2.13	13	22	111		
		20										
22.0	430											
	MARL, gray and tan				4.5+ (HP)				19			
25.0	427				TC=100/3.25"							
	Boring Terminated at 25 Feet	25										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Dry at Completion

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-14

BORING LOG NO. B-14

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8414° Longitude: -96.4555°

Surface Elev.: 451 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		FAT CLAY (CH), dark gray and tan, stiff				2.25 (HP)							
	2.0	449											
		FAT CLAY (CH), dark gray, stiff				2.5 (HP)							
			5			2.75 (HP)				24			
	6.0	445											
		FAT CLAY (CH), gray and tan, medium stiff to stiff				2.25 (HP)				24		61-16-45	
						1.25 (HP)	UC	1.16	6.1	25	97		
			10										
	12.0	439											
		FAT CLAY (CH), brown and gray, stiff		▽		2.5 (HP)	UC	2.34	12.7	26	100		
			15										
				▽									
	19.0	432											
	20.0	**FAT CLAY (CH)**, tan and gray, very stiff to hard 431				4.5+ (HP)				26			
		Boring Terminated at 20 Feet	20										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-15

BORING LOG NO. B-15

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8463° Longitude: -96.4571°

Surface Elev.: 457 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
0.0	457										
FAT CLAY (CH), dark gray and tan, hard				4.5+ (HP)							
2.0	455										
FAT CLAY (CH), dark gray, hard				4.5+ (HP)				16			
4.0	453										
FAT CLAY (CH), dark brown, stiff to hard		5		3.0 (HP)				20			
				4.5+ (HP)				20			
				3.0 (HP)	UC	3.89	13.3	20	105		
		10									
12.0	445										
FAT CLAY (CH), gray and yellowish brown, stiff				2.25 (HP)	UC	3.42	13.2	20	109		
16.0	441	15									
MARL, weathered, gray and tan				4.5+ (HP)				24		68-18-50	
		20									
22.0	435										
MARL, gray				TC=100/2.0"							
25.0	432	25									
Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

trace of water at 14 feet while drilling

Dry at Completion

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-11-2018 | Boring Completed: 05-11-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-16

BORING LOG NO. B-16

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8501° Longitude: -96.4584°

Surface Elev.: 461 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray and tan, very stiff				4.5 (HP)							
					3.5 (HP)				29			
4.0	457											
	FAT CLAY (CH), dark gray, very stiff	5			3.5 (HP)	UC	1.80	9.3	27	95		
6.0	455											
	FAT CLAY (CH), brown and gray, very stiff to stiff				3.75 (HP)				25			
					4.5 (HP)	UC	2.83	7.8	25	99		
		10										
					2.75 (HP)	UC	1.98	13.4	31	89	87-25-62	
		15	▽									
17.0	444											
	FAT CLAY (CH), gray and yellowish brown, stiff				3.25 (HP)				33		73-16-57	
		20	▽									
22.0	439											
	MARL, gray				TC=100/2.0"				28			
25.0	436	25										
	Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-09-2018 | Boring Completed: 05-09-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-17

BORING LOG NO. B-17

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8511° Longitude: -96.4579°

Surface Elev.: 461 (Ft.)

DEPTH	ELEVATION (Ft.)	DESCRIPTION	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		FAT CLAY (CH), dark gray and tan, very stiff to stiff				4.0 (HP)							
						3.25 (HP)				26		70-20-50	
			5			2.0 (HP)				26			
						2.5 (HP)							
6.0	455					1.75 (HP)	UC	1.57	9.2	27	95		
		FAT CLAY (CH), brown and gray, medium stiff to stiff	10										
12.0	449			▽		2.5 (HP)	UC	1.22	12.4	28	89	65-20-45	
		FAT CLAY (CH), tan and gray, stiff	15										
17.0	444					4.5+ (HP)				19			
		MARL, weathered, gray and tan	20										
21.0	440			▽									
		MARL, gray				TC=100/1.75"							
25.0	436		25										
		Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-09-2018 | Boring Completed: 05-09-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-18

BORING LOG NO. B-18

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8532° Longitude: -96.4573°

Surface Elev.: 463 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		FAT CLAY (CH), dark gray and tan, very stiff				4.5 (HP)							
	2.0	461											
		FAT CLAY (CH), dark gray, very stiff to stiff				4.25 (HP)							
			5			3.0 (HP)				24		60-20-40	
						3.0 (HP)	UC	3.39	13.1	21	106		
	8.0	455											
		FAT CLAY (CH), brown and gray, stiff to very stiff				3.75 (HP)				19			
			10										
				▽		3.0 (HP)	UC	2.47	12.8	26	101	65-19-46	
			15										
				▽									
	20.0	443				3.75 (HP)				24			
		Boring Terminated at 20 Feet	20										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-09-2018 | Boring Completed: 05-09-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-19

BORING LOG NO. B-19

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8547° Longitude: -96.4571°

Surface Elev.: 464 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray and tan, medium stiff				2.0 (HP)							
2.0	462											
	FAT CLAY (CH), dark gray, soft to stiff				1.25 (HP)				31			
		5			0.75 (HP)	UC	0.45	10.7	34	81		
					2.75 (HP)				24			
8.0	456											
	FAT CLAY (CH), gray, stiff				2.25 (HP)				22			
		10										
12.0	452											
	FAT CLAY (CH), with calcareous nodules, brown and gray, stiff				3.25 (HP)	UC	2.26	13.4	19	104	67-19-48	
		15										
19.0	445		▽									
	MARL, weathered, tan				4.5+ (HP)				17			
		20			4.5+ (HP)							
22.0	442											
	Boring Terminated at 22 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-09-2018 | Boring Completed: 05-09-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-20

BORING LOG NO. B-20

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8592° Longitude: -96.4573°

Surface Elev.: 470 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray, stiff				3.25 (HP)							
					3.0 (HP)				24			
4.0	466	5			2.5 (HP)				23			
	FAT CLAY (CH), gray, stiff											
6.0	464				3.5 (HP)	UC	4.38	12.3	20	108	68-18-50	
	FAT CLAY (CH), tan, stiff to very stiff											
8.0	462				4.5+ (HP)				16			
	MARL, weathered, tan	10										
12.0	458											
	MARL, gray	15			TC=100/1.0"							
20.0	450	20			TC=100/1.0"							
	Boring Terminated at 20 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

No seepage encountered during drilling

Dry at completion

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-09-2018 | Boring Completed: 05-09-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-21

BORING LOG NO. B-21

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8641° Longitude: -96.4593°

Surface Elev.: 473 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
			3.0 (HP)							
			4.0 (HP)				19			
		5	2.5 (HP)				25			
6.0	467									
FAT CLAY (CH), shaley, with iron staining, tan and gray, stiff to hard			2.0 (HP)	UC	1.38	8.8	26	96	78-23-55	
			2.0 (HP)				26			
		10								
14.5	458.5		4.5+ (HP)				17			
MARL, gray		15								
			TC=100/1.0"							
		20								
25.0	448		TC=100/1.5"							
Boring Terminated at 25 Feet		25								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

No seepage encountered during drilling

Dry at completion

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 07-17-2018 | Boring Completed: 07-17-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-22

BORING LOG NO. B-22

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.868° Longitude: -96.4601°

Surface Elev.: 483 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), with calcareous nodules, brown and dark brown, stiff to very stiff			3.5 (HP)				15			
				4.0 (HP)				15		64-20-44	
4.0	479										
	FAT CLAY (CH), with calcareous nodules, tan and gray, very stiff to hard	5		4.5+ (HP)	UC	5.56	5.1	12	111		
				4.5+ (HP)				19			
				3.5 (HP)				20			
12.0	471	10									
	MARL, gray			TC=100/1.75"							
		15									
				TC=100/1.5"							
		20									
				TC=100/1.5"							
		25									
				TC=100/1.25"							
		30									

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

No seepage encountered during drilling

Dry at completion

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 07-17-2018 | Boring Completed: 07-17-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-23

BORING LOG NO. B-22

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.868° Longitude: -96.4601°

Surface Elev.: 483 (Ft.)

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
		MARL, gray *(continued)*											
	35.0	448	35			TC=100/1.75"							
		Boring Terminated at 35 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No seepage encountered during drilling

Dry at completion

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 07-17-2018 | Boring Completed: 07-17-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-24

BORING LOG NO. B-23

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8704° Longitude: -96.4584°

Surface Elev.: 480 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray and tan, hard to stiff				4.5+ (HP)							
					3.25 (HP)				20			
		5			2.75 (HP)	UC	2.62	7.2	23	107	62-24-38	
6.0	474											
	FAT CLAY (CH), tan, very stiff				4.0 (HP)				21			
8.0	472											
	FAT CLAY (CH), dark gray, very stiff				4.5 (HP)	UC	3.80	10.6	21	106		
11.0	469	10										
	FAT CLAY (CH), brown and gray, stiff											
					3.25 (HP)	UC	3.19	12.3	21	107	62-18-44	
		15	▽									
					2.75 (HP)				21			
21.0	459	20										
	MARL, gray and tan		▽									
					TC=100/1.0"							
25.0	455	25										
	Boring Terminated at 25 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

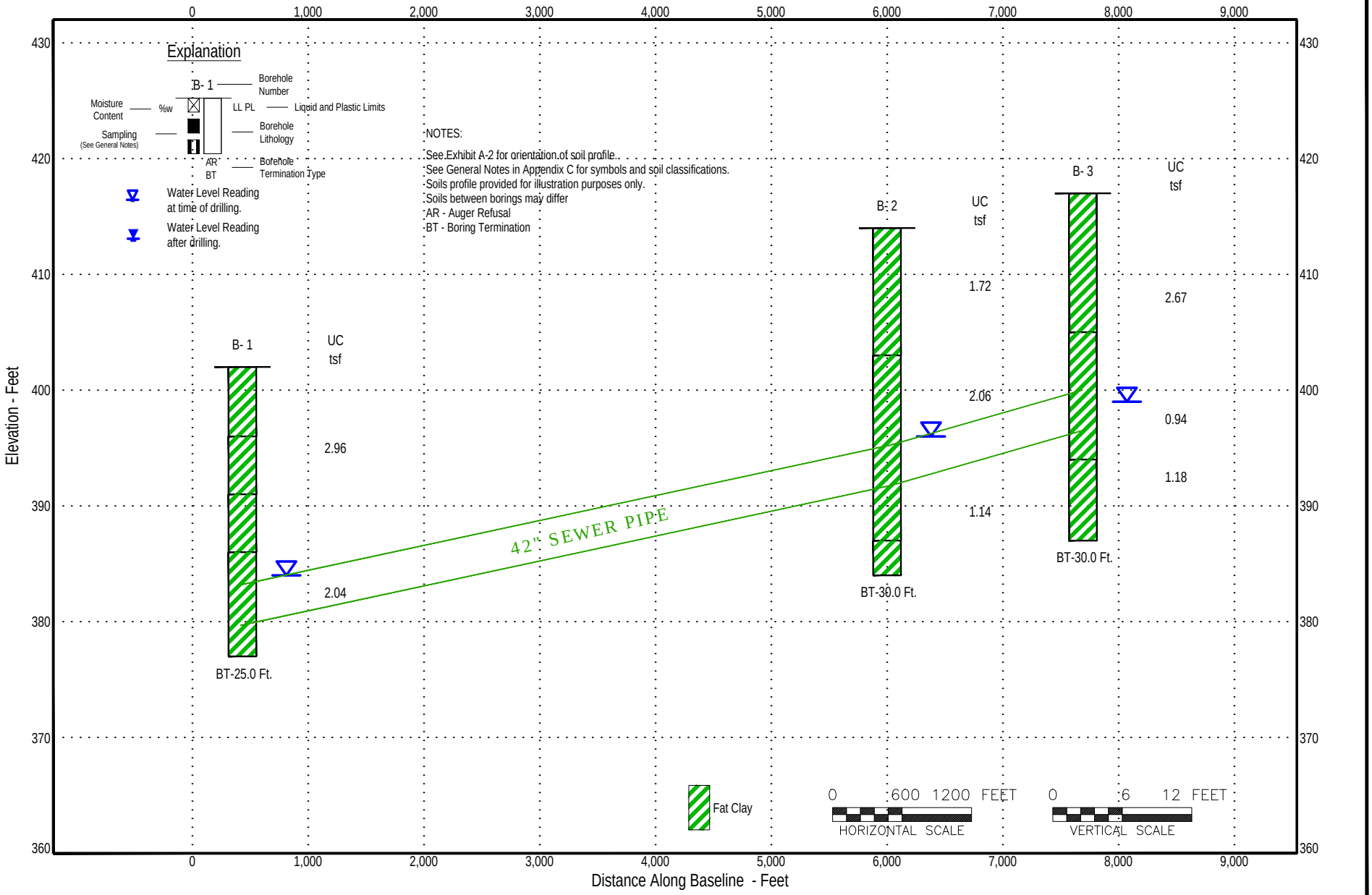
Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-25

Date: 06/22/18 N:\Projects\2017\94175317\Working Files\Diagrams-Drawings-Figures\CAD\94175317.dwg Layout: profile1-1 Current Layer: 0



THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

NOTE: ALL BORING LOCATIONS ARE APPROXIMATE.

Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA

Project No.	94175317
Scale:	AS SHOWN
Date:	06/22/18

Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

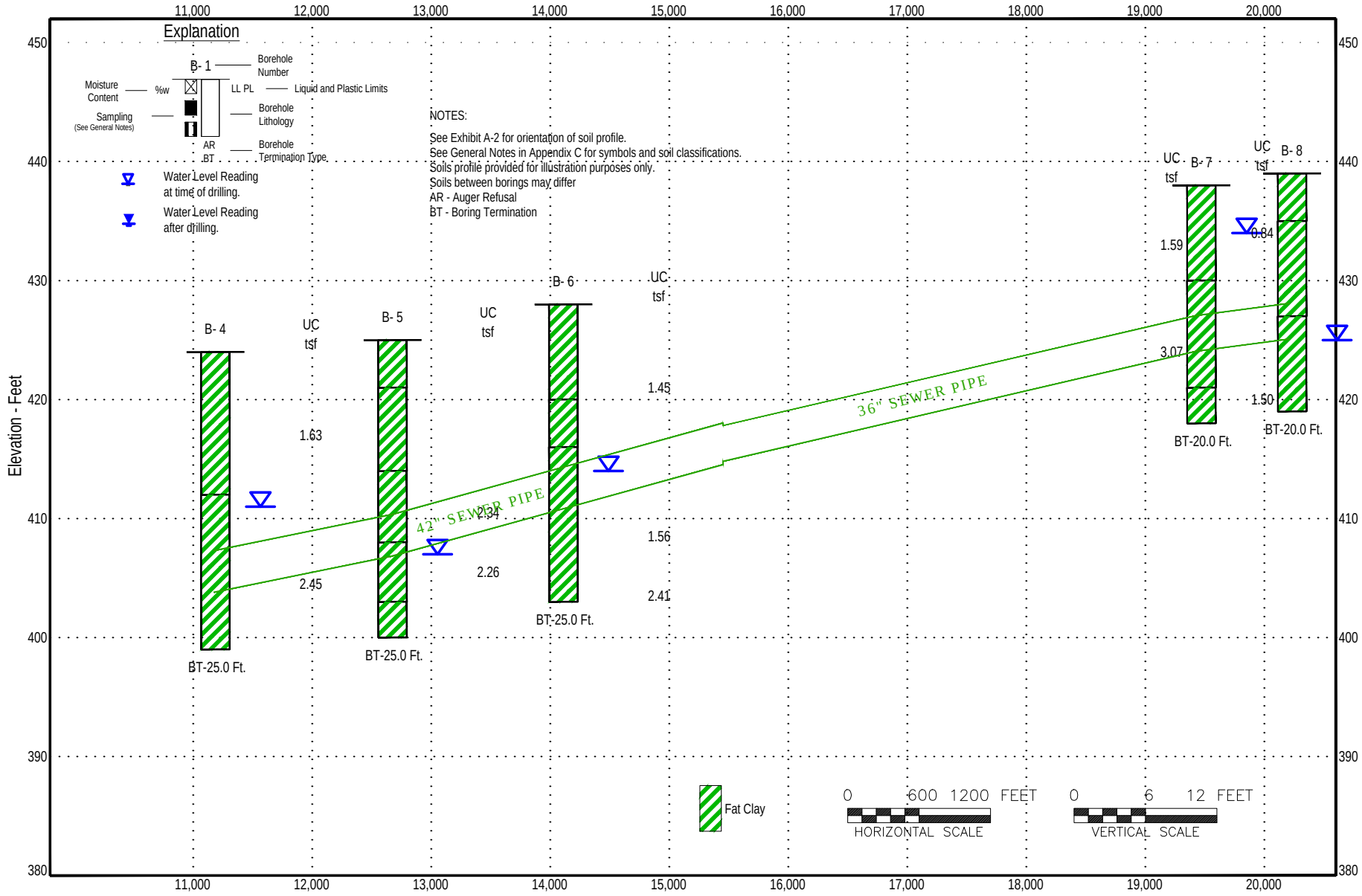
SUBSURFACE PROFILE

BUFFALO CREEK PARALLEL INTERCEPTOR SEWER - PHASE I
FM 470 TO BUFFALO CREEK WASTEWATER TREATMENT PLANT
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

EXHIBIT

26

Date: 06/22/18 N:\Projects\2017\94175317\Working Files\Diagrams-Drawings-Figures\CAD\94175317.dwg Layout: profile2-2 Current Layer: 0



THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

NOTE: ALL BORING LOCATIONS ARE APPROXIMATE.

Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94175317
Scale:	AS SHOWN
Date:	06/22/18

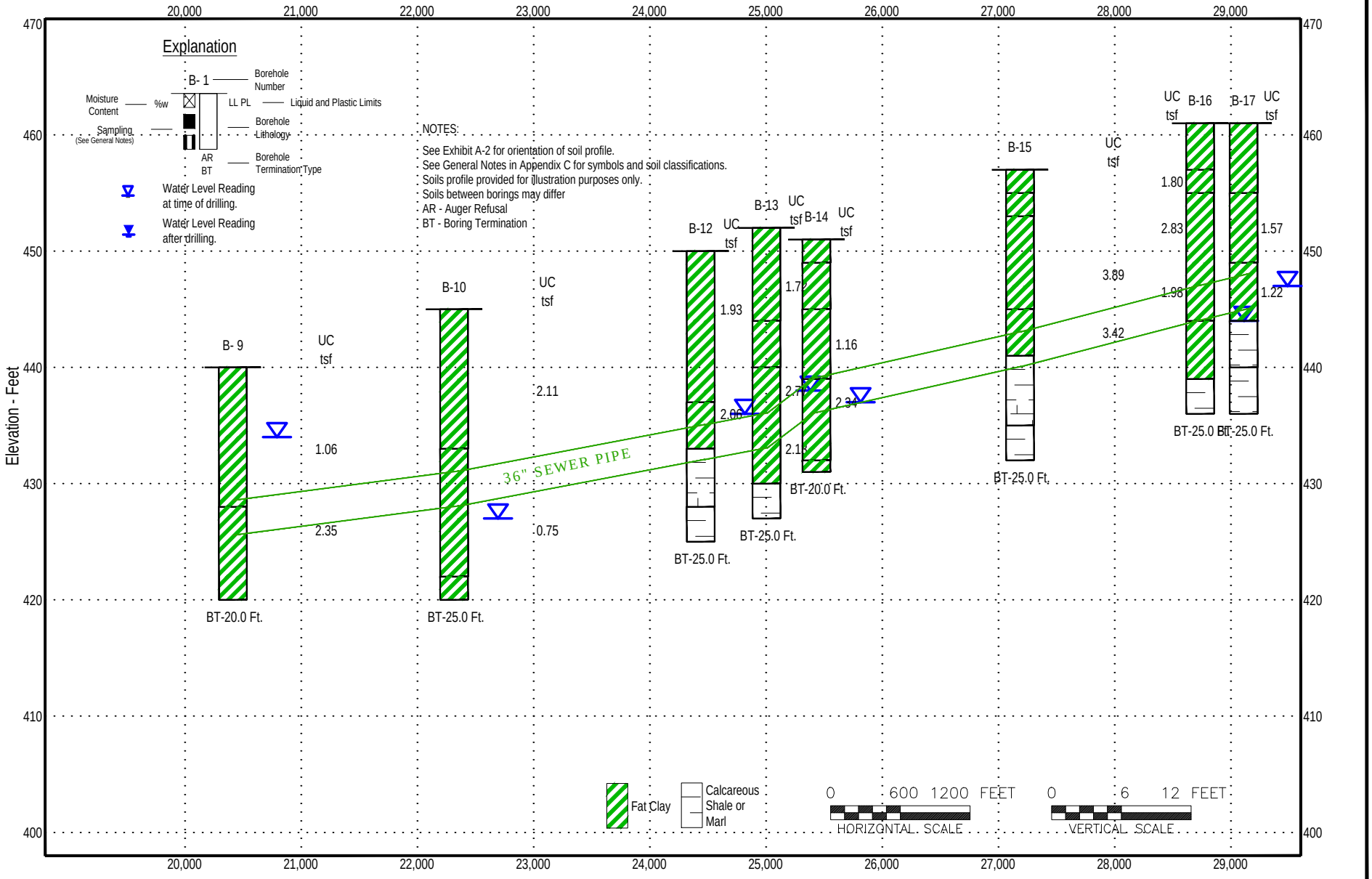
Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

SUBSURFACE PROFILE

BUFFALO CREEK PARALLEL INTERCEPTOR SEWER - PHASE I
FM 470 TO BUFFALO CREEK WASTEWATER TREATMENT PLANT
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

EXHIBIT 27

Date: 06/22/18 N:\Projects\2017\94175317\Working Files\Diagrams-Drawings-Figures\CAD\94175317.dwg Layout: profile3-3 Current Layer: 0



THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

NOTE: ALL BORING LOCATIONS ARE APPROXIMATE.

Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94175317
Scale:	AS SHOWN
Date:	06/22/18

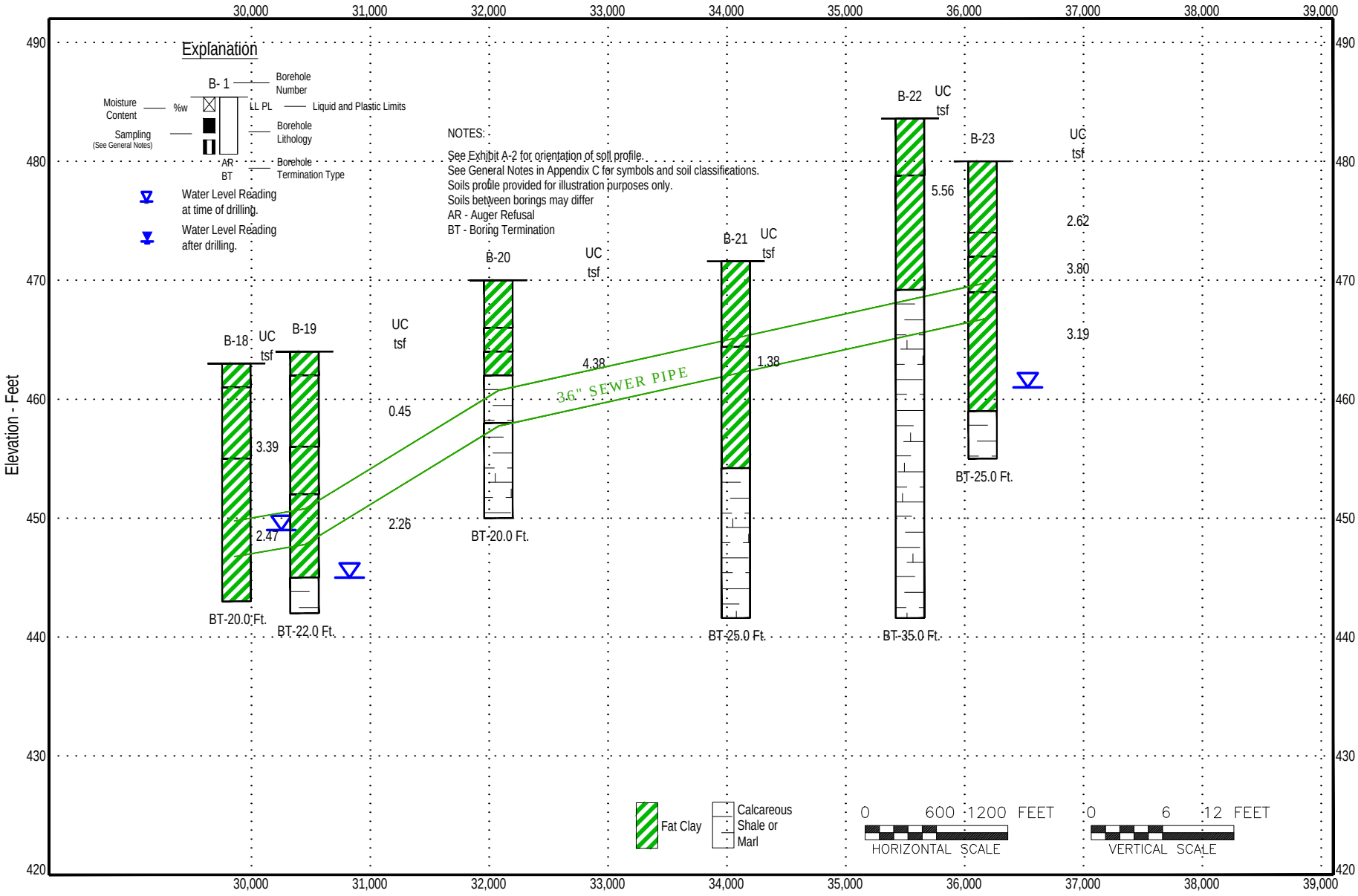
Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

SUBSURFACE PROFILE

BUFFALO CREEK PARALLEL INTERCEPTOR SEWER - PHASE I
FM 470 TO BUFFALO CREEK WASTEWATER TREATMENT PLANT
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

EXHIBIT 28

Date: 07/26/18 N:\Projects\2017\94175317\Working Files\Diagrams-Drawings-Figures\CAD\94175317.dwg Layout: profile4-4 Current Layer: 0



THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

NOTE: ALL BORING LOCATIONS ARE APPROXIMATE.

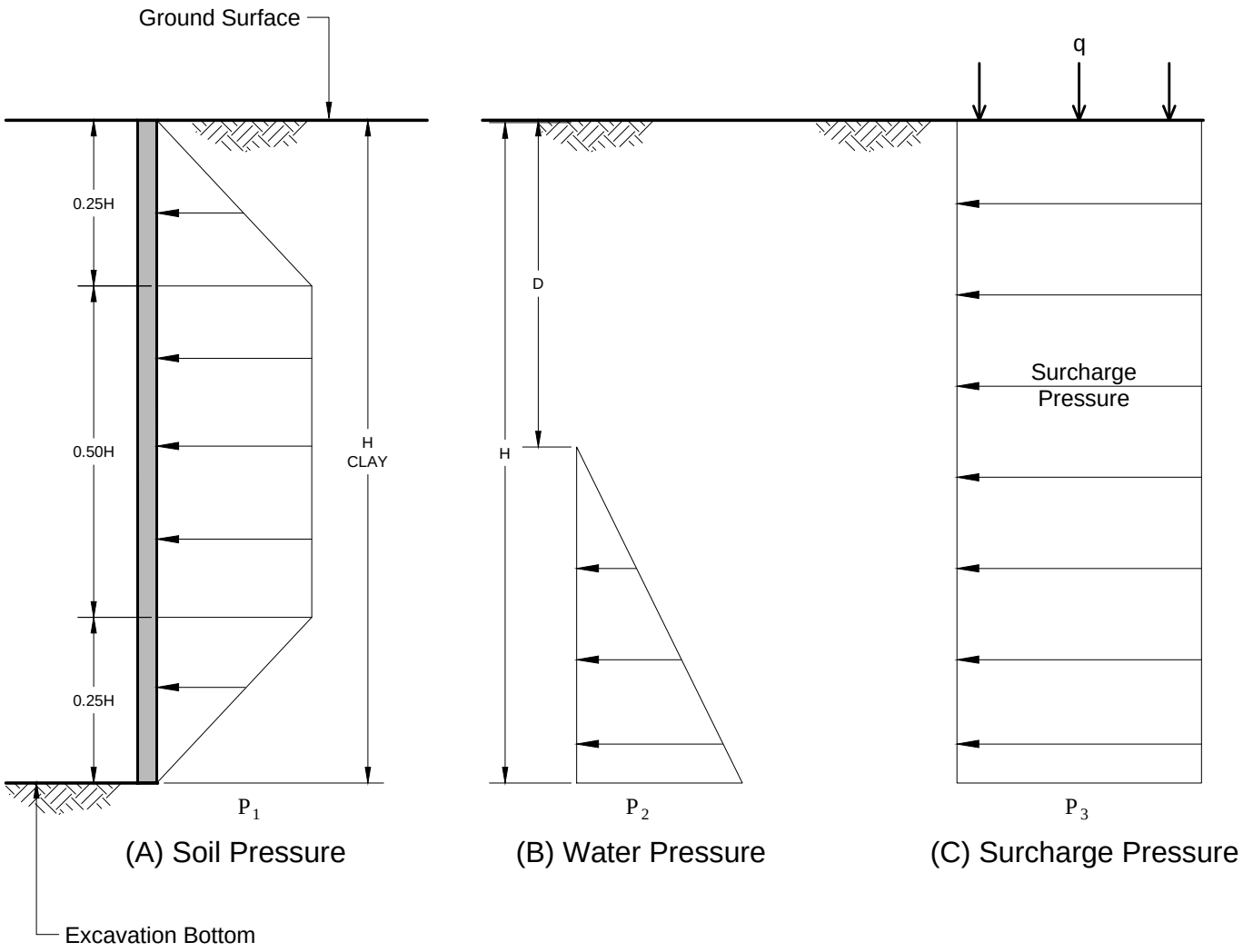
Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94175317
Scale:	AS SHOWN
Date:	07/26/18

Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

SUBSURFACE PROFILE

BUFFALO CREEK PARALLEL INTERCEPTOR SEWER - PHASE I
FM 470 TO BUFFALO CREEK WASTEWATER TREATMENT PLANT
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

EXHIBIT 29



EMPIRICAL PRESSURE DISTRIBUTIONS

H = Total Ecavation Depth, in feet
D = Depth to Water Table, in feet
P_1 = Lateral Earth Pressure = 0.25γH = 32.5 H, psf
P_2 = Water Pressure = (H-D)γ_w psf
P_3 = Surcharge Lateral Load = 1/3q, psf
γ = Unit Weight of Soil, pcf
γ_w = Unit Weight of Water, 62.4 pcf

NOTES:

1) All Pressures are Additive
2) No Safety Factors are Included
3) For use only during short term construction
4) Water Pressures should be included if there is no wall drainage

THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

Date: 06/22/18 N:\Projects\2017\94175317\Working Files\Diagrams-Drawings-Figures\CAD\Details\94175317 details.dwg Layout: lateral pressure Current Layer: 0

Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94175317
Scale:	AS SHOWN
Date:	06/22/18

Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

LATERAL PRESSURE DIAGRAMS FOR OPEN CUTS

BUFFALO CREEK PARALLEL INTERCEPTOR SEWER, PHASE I
FM 740 TO BUFFALO CREEK WASTEWATER TREATMENT PLANT
ROCKWALL AND KAUFMAN COUNTIES, TEXAS

EXHIBIT 30

APPENDIX B
LABORATORY TESTING

Laboratory Testing

The boring logs and samples were reviewed by a geotechnical engineer who selected soil samples for testing. Tests were performed by technicians working under the direction of the engineer. A brief description of the tests performed follows.

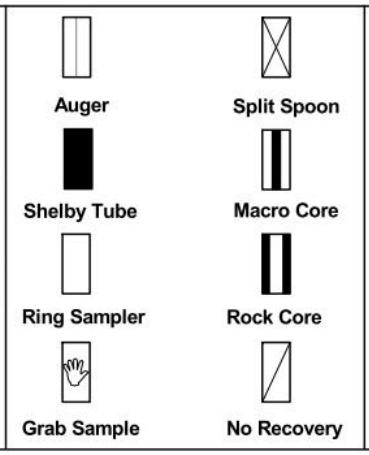
Liquid and plastic limit tests and moisture content measurements were performed to aid in classifying the soils in accordance with the Unified Soil Classification System (USCS). The USCS is summarized on Exhibit C-2 in Appendix C. Strength and consistency of cohesive soils were measured by unconfined compression and hand penetrometer tests. The results of the laboratory tests are presented on the boring logs in Appendix A.

APPENDIX C
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL

Water Initially Encountered

Water Level After a Specified Period of Time

Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines Classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

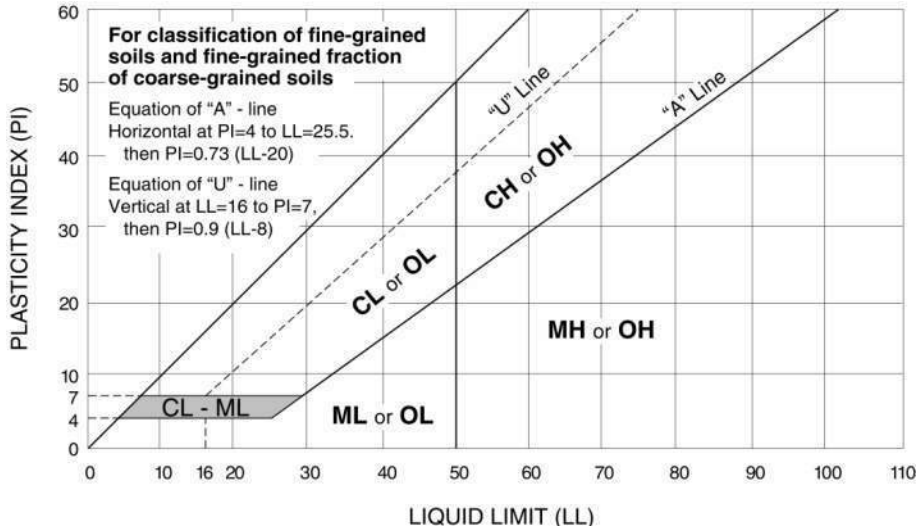
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Appendix B

GeoReport for Country Club Pond Wall 94195009_S

Geotechnical Engineering Report

Country Club Pond Retaining Wall
Heath, Texas
October 30, 2019
Terracon Project No.94195009

Prepared for:
Huitt-Zollars, Inc.
Dallas, Texas

10/30/2019

Prepared by:
Terracon Consultants, Inc.
Dallas, Texas

October 30, 2019

Terracon GeoReport

Huitt-Zollars, Inc.
1717 McKinney Avenue, Suite 1400
Dallas, Texas 75202

Attn: Mr. John Ho
E: jho@Huitt-Zollars.com

Re: Geotechnical Engineering Report
Country Club Pond Retaining Wall
Buffalo Creek Parallel Interceptor Sewer
796 Country Club Drive
Heath, Texas
Terracon Project No.94195009

Dear Mr. Ho:

This report provides geotechnical engineering recommendations for a sheet pile retaining wall to be constructed for the Parallel Interceptor Sewer project. This study was performed in general accordance with Terracon Proposal No. P94195009 dated July 10, 2017.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

STATE OF TEXAS
PALASUNTHARAM THUSHANTHAN
117402
LICENSED
PROFESSIONAL ENGINEER
10/30/19

Palasuntharam (Thusha) Thushanthan, P.E.
Project Manager

Tim G. Abrams, P.E.
Senior Principal

REPORT TOPICS

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

Geotechnical Engineering Report

Country Club Pond Retaining Wall
796 Country Club Drive
Heath, Texas

Terracon Project No.94195009
October 30, 2019

INTRODUCTION

This report provides geotechnical engineering recommendations for the design and construction of a sheet pile retaining wall to be constructed in Country Club Pond as part of Buffalo Creek Parallel Interceptor Sewer project. The project site is located near 796 Country Club Drive in Heath, Texas. The purpose of this geotechnical engineering services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Earthwork recommendations
- Retaining wall design recommendations

Field exploration was not in our Scope of Services for this project. Terracon performed a Geotechnical Engineering study for the Buffalo Creek Parallel Interceptor Sewer, Phase I project and issued a Geotechnical Engineering Report (Terracon Project Number 94175317, report dated August 21, 2018). The results of Boring B-23 completed for our 2018 study were used to develop recommendations for the design and construction of the sheet pile wall.

Maps showing the site, retaining wall and boring location are shown in the **Site Location** and **Retaining Wall Location** sections at the end of this report. The log of Boring B-23 is presented in the **Exploration Results** section.

SITE CONDITION AND PROJECT INFORMATION

Item	Description
Site Information	The project is located at the North Texas Municipal Water District (NTMWD) Buffalo Creek Interceptor Sewer near 796 Country Club Drive in Heath, Texas. Approximate GPS Coordinates of the Pond: 32.87015 N, -96.45811 W. See **Site Location**
Retaining Wall Location	Retaining wall alignment and preliminary finish grades were provided in the preliminary grading plan prepared by Huitt-Zollars and dated October 16, 2019. This grading plan was used to develop retaining wall design recommendations. See **Retaining Wall Location.**

Item	Description
Country Club Pond	Based on the information provided, the pond is filled by surface runoff and being used for a golf course irrigation pond. Grades at the pond bottom vary between 465 and 466 feet. The pond does not have any structural outlet system. Pond water appears to overflow the eastern edge of the pond into Buffalo Creek. Grades at the overflow location are between 468 and 470 feet.
Planned Construction	The Buffalo Creek Interceptor sewer main is planned to be constructed through Country Club pond as shown on **Retaining Wall Location**. It is planned to fill in the western edge of the pond to allow construction of the sewer main. The pond will be enlarged to maintain the water storage capacity due to fill placement in the pond. The north end of the pond will be excavated. A cantilevered sheet pile retaining wall is planned along the edge of the fill in the pond and along the northern pond bank. Retaining wall profiles were not available at the time of this report. The preliminary grading plan indicates the maximum wall height is about 8 feet above the pond bottom. The sequence of construction is anticipated to either proceed by: 1. Dewatering of the pond followed by removing muds and other soft soils, infilling the pond with clay fill, excavating to enlarging the north side of the pond, and driving the sheet piling or: 2. Infilling the pond where needed for the pipeline construction and excavating the north side of the pond without dewatering. After fill and cuts completed drive the sheet piles and remove the fill on the water side of the sheet pile wall.

GEOTECHNICAL CHARACTERIZATION

Design Subsurface Profile

Borings B-23 was used to develop an anticipated subsurface profile at the retaining wall location. Boring B-23 was completed to a depth of 25 feet at the approximate location indicated in **Retaining Wall Location** exhibit. Boring log is presented in **Exploration Results** section.

Boring B-23 encountered stiff to hard fat clays to 21 feet followed by marl to its termination depth of 25 feet. It should be noted that Boring B-23 was completed at about 50 to 80 feet away from the pond and strength of the soils within the pond could be weaker than the soil strengths measured on Boring B-23 soil samples. Soft sediments (muds) may be present in the pond. The following subsurface profile was developed considering information obtained from B-23 and making an allowance for soft soil conditions for use in developing the sheet pile retaining wall design recommendations.

Stratum	Depth below Pond Bottom (feet)	Material Anticipated	Anticipated Consistency
1	0 to 2	Clays consisting of silty soils and organics	Very soft
2	2 to 5	Clays	Soft
2	5 to 15	Clays	Soft to stiff
3	15 to 21	Clays	Stiff to very stiff
4	Below 21	Marl	Soft rock

RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

A cantilevered sheet pile wall is planned to be used to retain fills and natural soils in Country Club pond. The preliminary grading plan indicates the maximum wall height is expected to be 8 feet. A wall anchoring system, such as tiebacks or deadman anchors is not planned. Geotechnical engineering recommendations for earthwork and sheet pile design are provided in the following report sections. The following recommendations are based upon anticipated subsurface conditions noted in the **Design Subsurface Profile** section of this report.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Cut and fill operation are planned for the project. The pond fill soils are assumed to consist of clay soils excavated during the sewer main installation and pond regrading. Very soft to soft soils maybe present in the pond bottom. Placement of fill with water in the pond may not totally displace these soft soils. Embankment constructed on soft to very soft soils are subject to settlements due to immediate and consolidation settlements of foundations soil and self-weight of embankment fill. In addition, because there will be no density control of the fill being placed in the pond, excavations for the pipeline may not stand up long enough to install shoring because of weak fill conditions. Differential settlements could compromise the pipe joint connections.

For the above reasons, we recommend that the pond be dewatered to allow the soft to very soft soils to be removed and excavations be made in the dry. The soft to very soft soils can be used as fill if these soils are processed to water contents required for compaction. The soil excavated from the north side of the pond can also be used for fill. Placing the fill in the dry will allow the fill to be placed in a controlled manner that meets the project compaction requirements.

Embankment fill should meet the requirements provided in Section **Fill Material Types.** Fill should be compacted to the requirements discussed in Section **Compaction Requirements** except where fill is placed underwater**.**

Fill Material Types

Fill materials should meet the following criteria:

Nomenclature	Technical Description	Appropriate Use
On-site clay soils	Free of vegetation, organic material, debris, and no rock greater than 4 inches in maximum dimension.	■ Embankment Fill
Imported fill	Clean clay soil (free of deleterious material and debris) with liquid limits (LL) less than 60 and no rock greater than 4 inches in maximum dimension.	

Fill Compaction Requirements

The recommended compaction criteria are presented in the following table. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

Item	Compaction Criteria
Lift thickness	Loose lift thickness of 9-inches or less
Embankment fill	A minimum of 95% maximum standard Proctor dry density (ASTM D698) at a minimum of -2 to +3 percentage points of optimum moisture content

SHEET PILE RETAINING WALL

Sheet Pile Wall Earth Pressures

A cantilevered sheet pile retaining wall is planned. The wall is anticipated to retain up to 8 feet of clay fill and natural clay soils.

Earth pressure envelopes for the retaining wall are presented in Exhibits 1 and 2. The earth pressure envelops include lateral active and passive earth pressures, surcharge pressure from a

uniformly distributed surface loads, and hydrostatic pressure. Exhibit 1 presents the lateral earth pressure envelopes for a sheet pile wall with relatively flat toe slope (less than 2% slope). Exhibit 2 presents the lateral earth pressure envelopes for a sheet pile wall with a toe slope of 4H:1V (4-Horizontal to 1- Vertical). These pressure envelopes were developed assuming an angle of internal friction of 20 degrees for soils below the pond bottom, embankment clay fill, and existing clays. A differential water head of at least 2 feet between the pond level and behind the sheet pile wall is recommended for design due to a water level drop that may occur due to irrigation watering.

Global stability analyses discussed in the following section indicate that the wall embedment should be at least 11 feet below the lake bottom for an 8 foot high wall and this should be increased up to 17.5 feet for the portion of the sheet pile wall that have a front slope of 4H:1V as shown in **Retaining Wall Location** exhibit. Greater wall embedment may be required based on toe stability, wall deflection control, and bending analyses.

Global Stability Analyses

Stability analyses were performed to compute the minimum sheet pile embedment depths (D). The global stability analyses were performed for 8-foot retained height wall with relatively flat toe slope and 6 and 7.5 foot retained height walls with 4.5 foot tall 4H:1V slope at the toe. Analyzed cross sections are shown as Sections A-A, B-B, and C-C on **Retaining Wall Location** exhibit. The embedment depth was varied until factors of safety of 1.5 and 1.3 was obtained for full pond conditions and drawdown pond conditions, respectively.

The analysis was performed using the Rocscience program “Slide 7.0” and Spencer’s method of analysis. Effective stress soil strength parameters were estimated based on the correlations between the soil Plasticity Index (PI) and soil friction angle. A surcharge load of 250 psf was used in the analyses. A horizontal finished surface was considered behind the retaining walls. Wall and slope configurations were obtained from the provided preliminary grading plan dated October 16, 2019.

Two cases were analyzed for each wall height. These cases include full pond and drawdown pond conditions. The sheet pile wall and pond bank geometrics and soil parameters used for these cases are presented on Exhibits 3 through 8. A 2-foot differential water head between the pond water level and the water level behind the retaining wall was considered in the global stability analyses for irrigation pond drawdown conditions. These analyses indicate that following minimum sheet pile embedment depths are required to provide a global stability factor of safety of at least 1.5 for full pond conditions and 1.3 for drawdown pond conditions.

Retained Height of Wall above Finished Grades (feet)	Toe Slope in front of Sheet Pile Wall	Minimum sheet pile Embedment Depth (feet)
8	Flat Toe Slope	11
7.5	4.5 foot high 4H:1V Slope	17.5
6	4.5 foot high 4H:1V Slope	15

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from Boring B-23. Terracon should be retained as the Geotechnical Engineer to provide observation and testing services during pertinent construction phases. If variations in site conditions appear, we can provide further evaluation and supplemental recommendations. If variations in site conditions are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location

of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

SITE LOCATION AND RETAINING WALL LOCATION

Contents:

Site Location Plan
Retaining Wall Location

SITE LOCATION

Country Club Pond Retaining Wall ■ Heath, Texas
October 30, 2019 ■ Terracon Project No.94195009

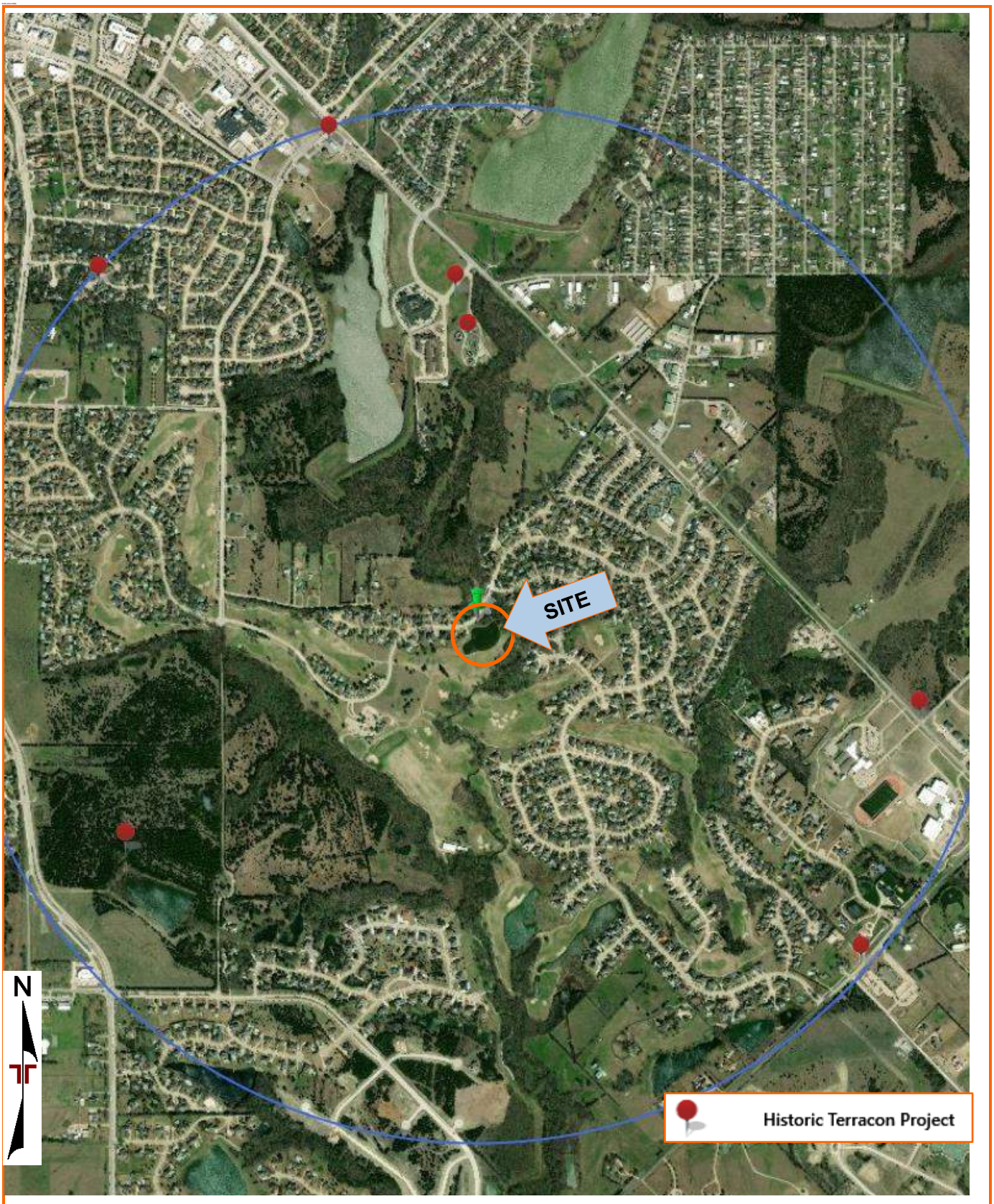


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

RETAINING WALL LOCATION

Country Club Pond Retaining Wall ▪ Heath, Texas

October 23, 2019 ▪ Terracon Project No. 94195009

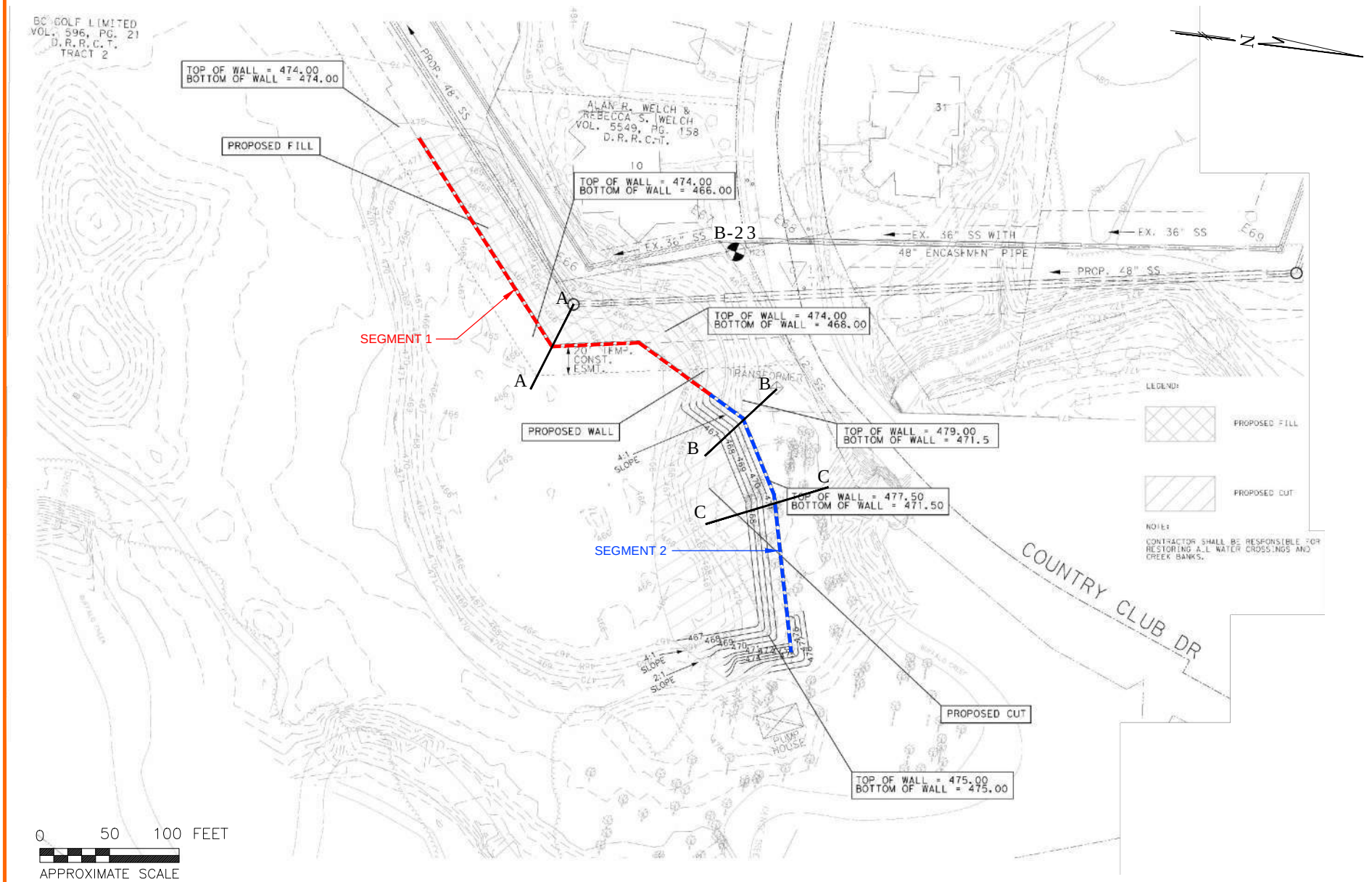
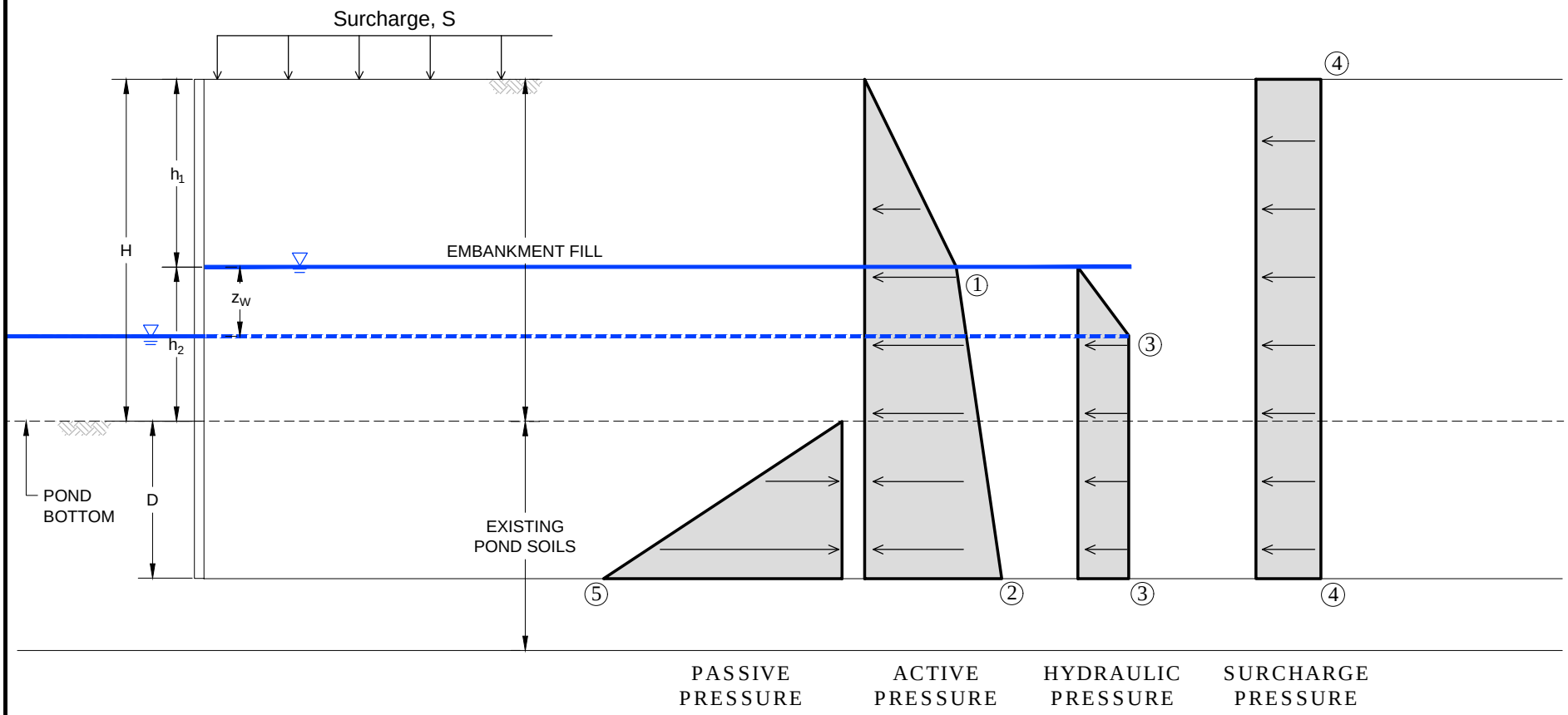


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS
NOT INTENDED FOR CONSTRUCTION PURPOSES

LATERAL EARTH PRESSURES AND RESULTS OF GLOBAL STABILITY

Contents:

Date: 10/30/19 N:\Projects\2019\94195009\Working Files\Diagrams-Drawings-Figures\CAD\Details\94195009-detail.dwg Layout: earth press flat toe Current Layer: 0



Pressures, psf

① $61.3\ h_1$
② $61.3\ h_1 + 30.7\ (h_2+D)$
③ $62.4\ z_w$
④ $0.49\ S$
⑤ $127.7\ D$

Note: z_w = 0 during and at the end of construction; 2 feet is recommended for service condition.
h_1 = Depth to normal pond level below top of wall.

THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94195009
Scale:	NOT TO SCALE
Date:	10/30/19

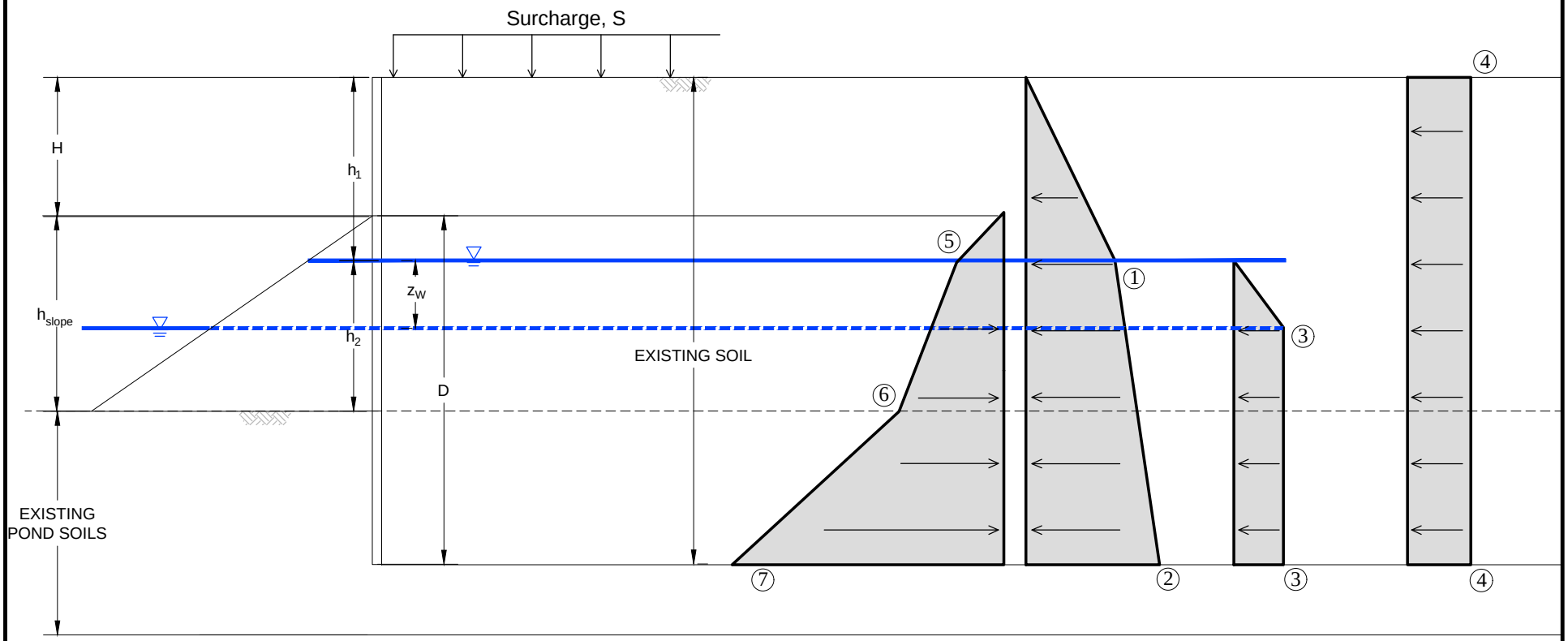
Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

EARTH PRESSURE ENVELOPE FOR RETAINING WALL WITH FLAT TOE (SEGMENT 1)

COUNTRY CLUB POND RETAINING WALL
796 COUNTRY CLUB DRIVE
HEATH, TEXAS

EXHIBIT 1

Date: 10/30/19 N:\Projects\2019\94195009\Working Files\Diagrams-Drawings-Figures\CAD\Details\94195009-detail.dwg Layout: earth press with toe slope (2) Current Layer: 0



Pressures, psf

① $61.3\ h_1$
② $61.3\ h_1 + 30.7\ (D+H-h_1)$
③ $62.4\ z_w$
④ $0.49\ S$
⑤ $162.5(h_1-H)$
⑥ $81.9\ h_{slope}+80.6(h_1-H)$
⑦ $127.7\ D+80.6(h_1-H)-45.8h_{slope}$

Note: z_w = 0 during and at the end of construction; 2 feet is recommended for service condition.
h_1 = Depth to normal pond level below top of wall.

THIS DRAWING SHOULD NOT BE USED SEPARATELY FROM ORIGINAL REPORT.

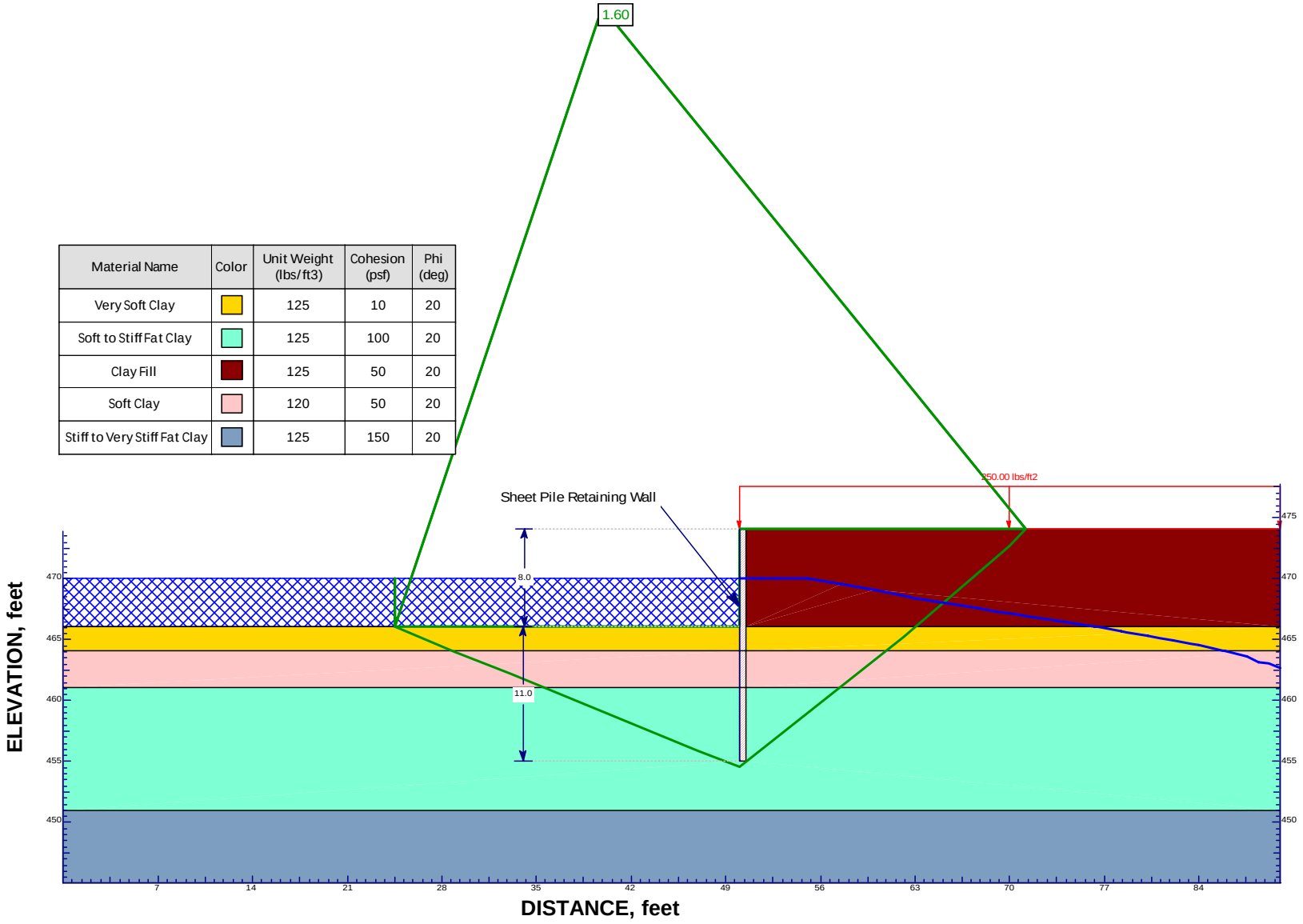
Project Mngr:	PT
Drawn By:	JJD
Checked By:	TGA
Approved By:	TGA
Project No.	94195009
Scale:	NOT TO SCALE
Date:	10/30/19

Terracon
Consulting Engineers and Scientists
(Registration No.: F-3272)
8901 CARPENTER FREEWAY DALLAS, TEXAS 75247
PH. (214) 630-1010 FAX. (214) 630-7070

EARTH PRESSURE ENVELOPE FOR RETAINING WALL WITH TOE SLOPE (SEGMENT 2)

COUNTRY CLUB POND RETAINING WALL
796 COUNTRY CLUB DRIVE
HEATH, TEXAS

EXHIBIT 2



Project Mgr:	PT
Prepared by:	PT
Checked by:	TGA
Approved by:	TGA

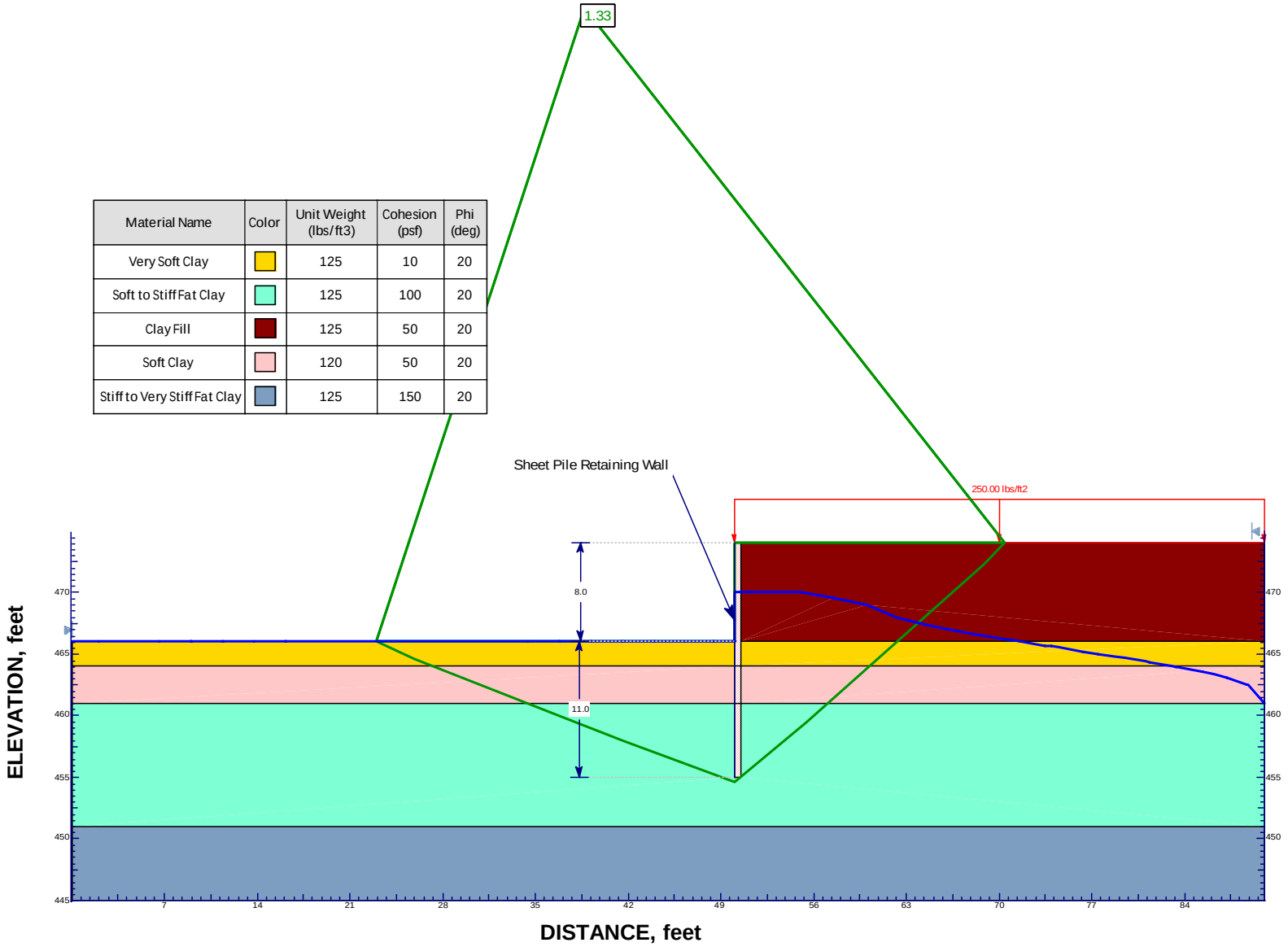
Project No.	94195009
Scale:	NA
Date:	10/18/2019

Terracon
Consulting Engineers and Scientists
Texas Registration 3272
8901 CARPENTER FRWY. DALLAS, TX 75247
PH: (214) 630-1010 Fax. (214) 630-7070

GLOBAL STABILITY - FULL POND CONDITION
8-Foot High Wall with Flat Toe Slope
Country Club Pond Retaining Wall
Heath, Texas

EXHIBIT
3

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Very Soft Clay		125	10	20
Soft to Stiff Fat Clay		125	100	20
Clay Fill		125	50	20
Soft Clay		120	50	20
Stiff to Very Stiff Fat Clay		125	150	20



Project Mgr:	PT
Prepared by:	PT
Checked by:	TGA
Approved by:	TGA

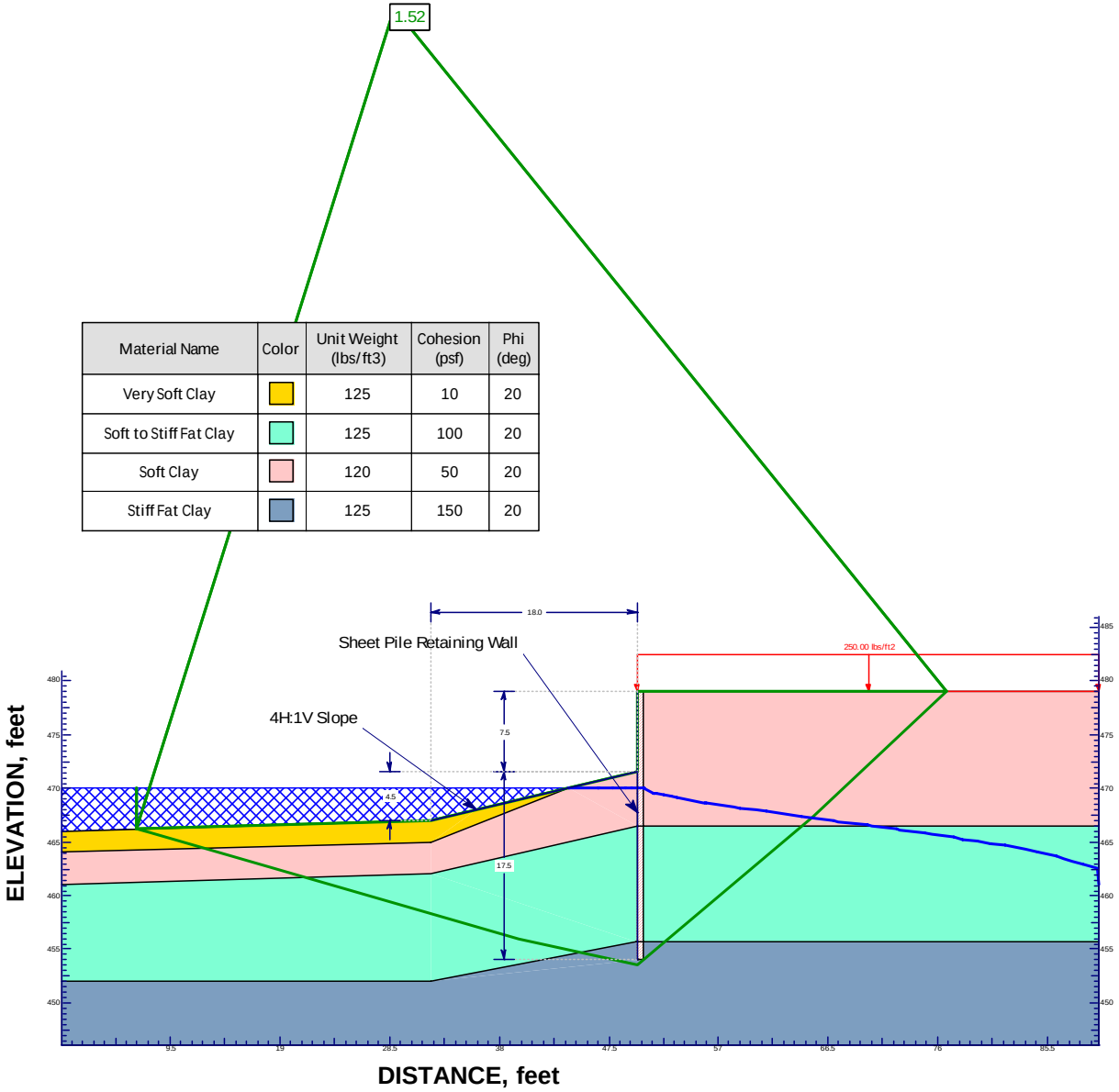
Project No.	94195009
Scale:	NA
Date:	10/18/2019

Terracon
Consulting Engineers and Scientists
Texas Registration 3272
8901 CARPENTER FRWY. DALLAS, TX 75247
PH: (214) 630-1010 Fax. (214) 630-7070

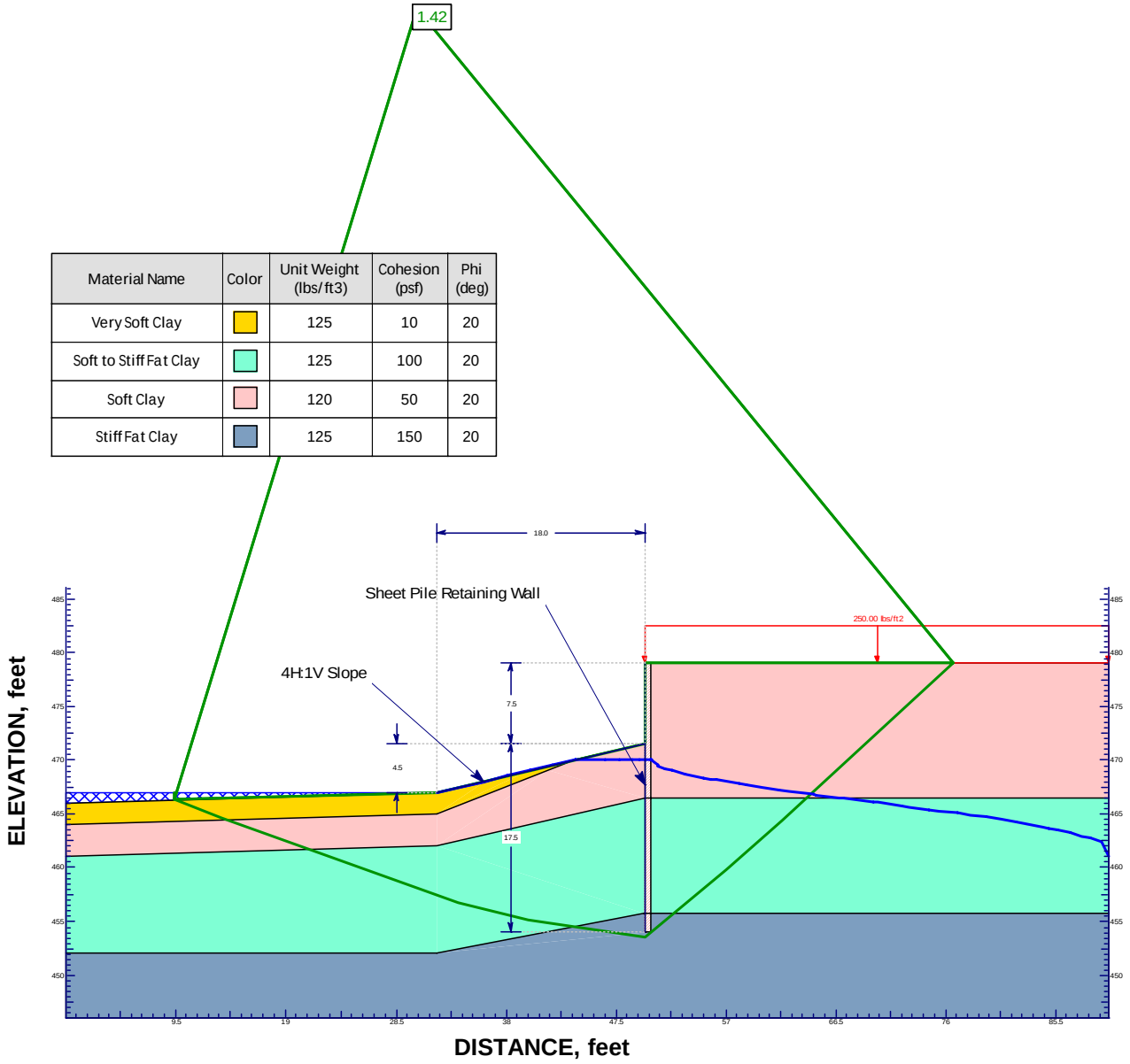
GLOBAL STABILITY - DRAWDOWN CONDITION
8-Foot High Wall with Flat Toe Slope
Country Club Pond Retaining Wall
Heath, Texas

EXHIBIT

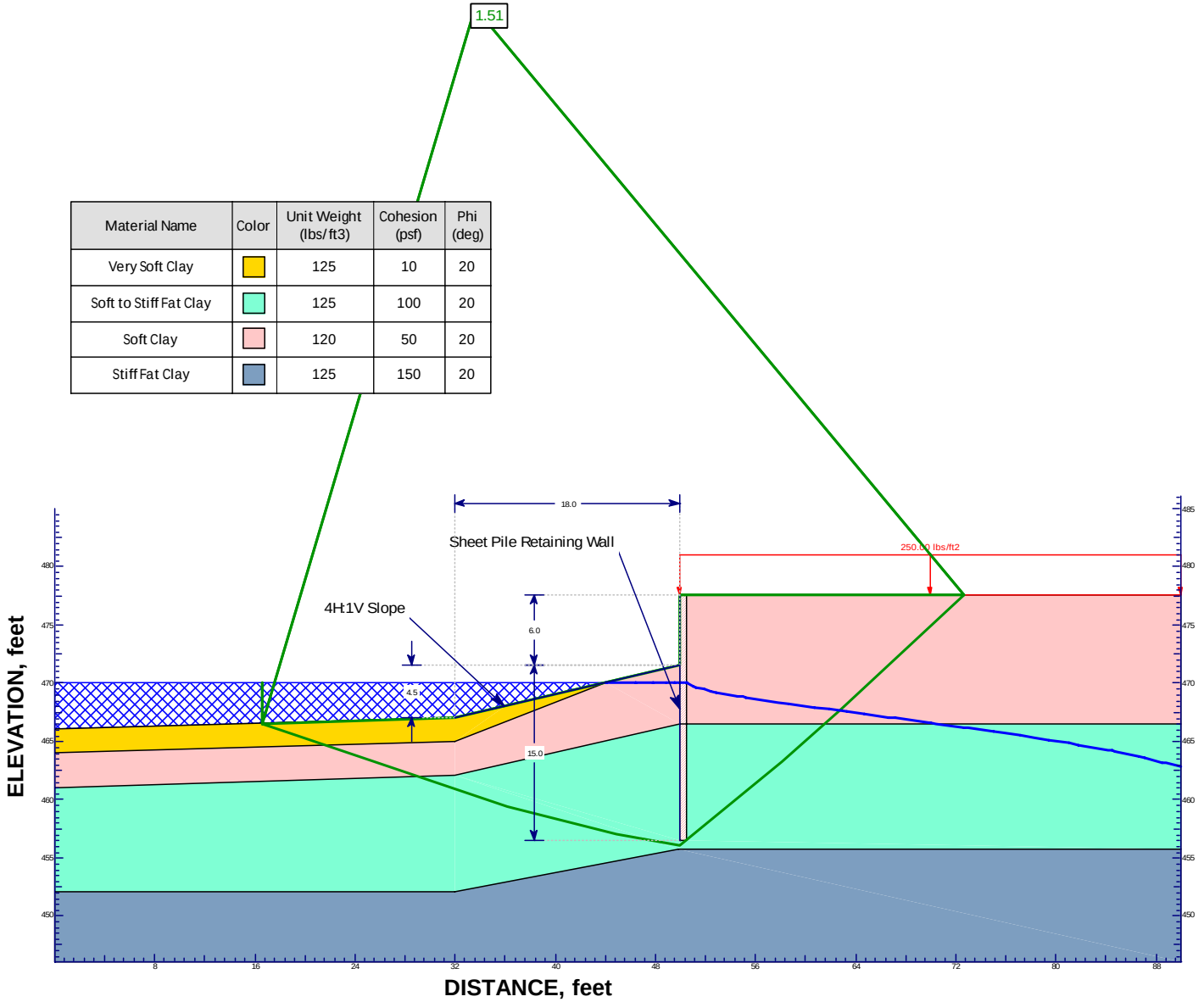
4



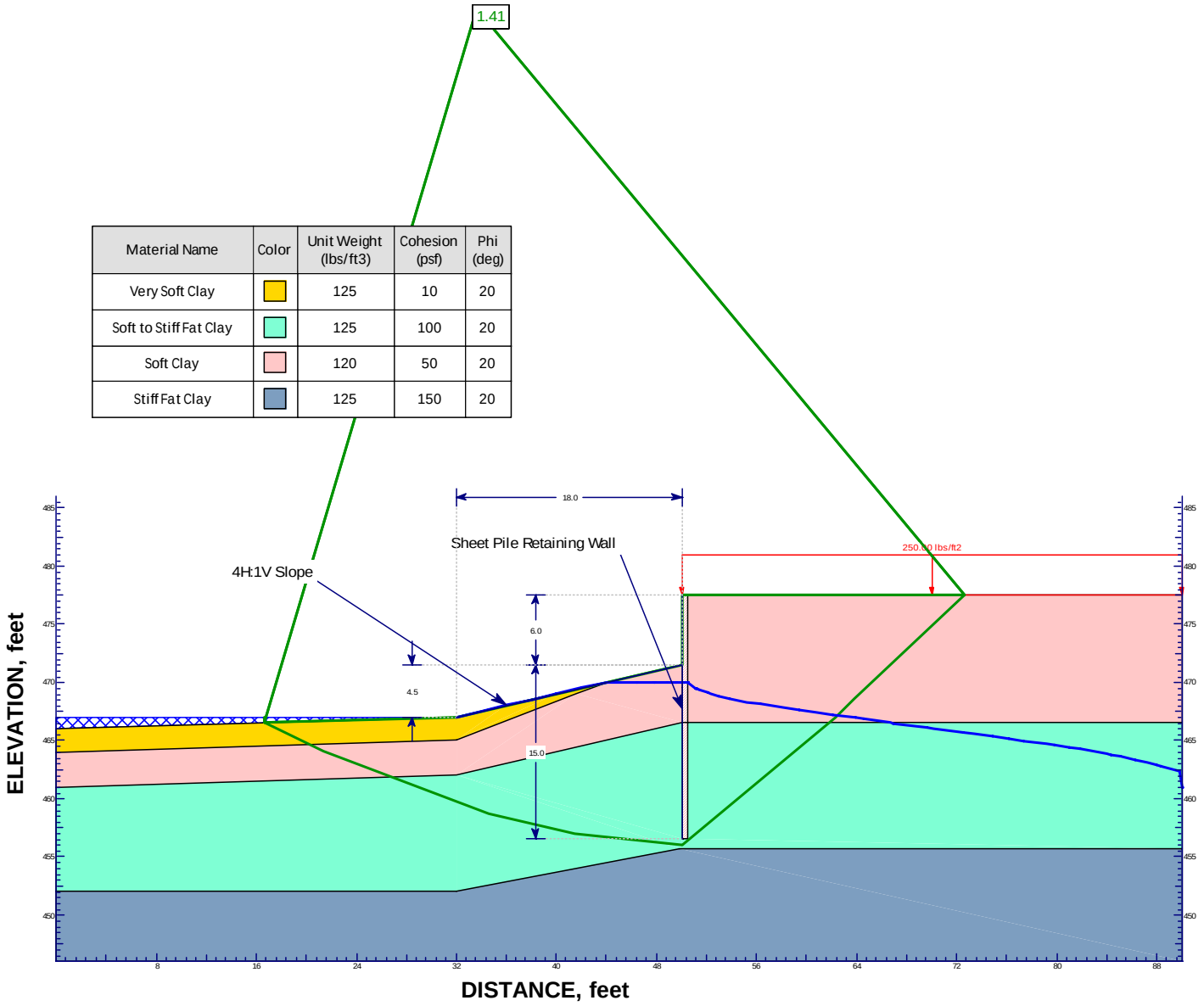
Project Mgr: PT	Project No. 94195009	Terracon Consulting Engineers and Scientists Texas Registration 3272 8901 CARPENTER FRWY. DALLAS, TX 75247 PH: (214) 630-1010 Fax. (214) 630-7070	**GLOBAL STABILITY - FULL POND CONDITION** **8-Foot High Wall with Flat Toe Slope** **Country Club Pond Retaining Wall** **Heath, Texas**	**EXHIBIT** **5**
Prepared by: PT				
Checked by: TGA	Scale: NA			
Approved by: TGA	Date: 10/18/2019			



Project Mgr: PT	Project No. 94195009	Terracon Consulting Engineers and Scientists Texas Registration 3272 8901 CARPENTER FRWY. DALLAS, TX 75247 PH: (214) 630-1010 Fax. (214) 630-7070	**GLOBAL STABILITY - DRAWDOWN CONDITION** **7.5-Foot High Wall with 4H:1V Toe Slope** **Country Club Pond Retaining Wall** **Heath, Texas**	**EXHIBIT** **6**
Prepared by: PT				
Checked by: TGA	Scale: NA			
Approved by: TGA	Date: 10/18/2019			



Project Mgr: PT	Project No. 94195009	Terracon Consulting Engineers and Scientists Texas Registration 3272 8901 CARPENTER FRWY. DALLAS, TX 75247 PH: (214) 630-1010 Fax. (214) 630-7070	**GLOBAL STABILITY - FULL POND CONDITION** **6-Foot High Wall with 4H:1V Toe Slope** **Country Club Pond Retaining Wall** **Heath, Texas**	**EXHIBIT** **7**
Prepared by: PT				
Checked by: TGA	Scale: NA			
Approved by: TGA	Date: 10/18/2019			



Project Mgr: PT	Project No. 94195009	Terracon Consulting Engineers and Scientists Texas Registration 3272 8901 CARPENTER FRWY. DALLAS, TX 75247 PH: (214) 630-1010 Fax. (214) 630-7070	**GLOBAL STABILITY - DRAWDOWN CONDITION** **6-Foot High Wall with 4H:1V Toe Slope** **Country Club Pond Retaining Wall** **Heath, Texas**	**EXHIBIT** **8**
Prepared by: PT	Scale: NA			
Checked by: TGA				
Approved by: TGA	Date: 10/18/2019			

EXPLORATION RESULTS

Contents:

BORING LOG NO. B-23

PROJECT: Buffalo Creek Parallel Interceptor Sewer - Phase I

CLIENT: Huitt-Zollars, Inc. Dallas, Texas

SITE: FM 740 to Buffalo Creek Wastewater Treat. Plant Rockwall and Kaufman Counties, Texas

LOCATION See Exhibit A-3

Latitude: 32.8704° Longitude: -96.4584°

Surface Elev.: 480 (Ft.)

DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS: LL-PL-PI	PERCENT FINES
	FAT CLAY (CH), dark gray and tan, hard to stiff				4.5+ (HP)							
					3.25 (HP)				20			
		5			2.75 (HP)	UC	2.62	7.2	23	107	62-24-38	
6.0	474											
	FAT CLAY (CH), tan, very stiff				4.0 (HP)				21			
8.0	472											
	FAT CLAY (CH), dark gray, very stiff				4.5 (HP)	UC	3.80	10.6	21	106		
11.0	469	10										
	FAT CLAY (CH), brown and gray, stiff				3.25 (HP)	UC	3.19	12.3	21	107	62-18-44	
		15	▽									
					2.75 (HP)				21			
21.0	459	20										
	MARL, gray and tan		▽									
25.0	455				TC=100/1.0"							
	Boring Terminated at 25 Feet	25										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exhibit A-4 for description of field procedures

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

Latitude and longitude were obtained from a handheld GPS device. Elevation was obtained from the Construction Plans for Rockwall-Heath Transfer Sewer Sections 1 and 2 prepared by Kellogg Brown & Root, Inc and dated May 2006.

WATER LEVEL OBSERVATIONS

▽ *While drilling*

▽ *At completion of drilling*

Terracon
8901 Carpenter Fwy, Ste 100
Dallas, TX

Boring Started: 05-08-2018 | Boring Completed: 05-08-2018

Drill Rig: | Driller: StrataBore

Project No.: 94175317 | Exhibit: A-25

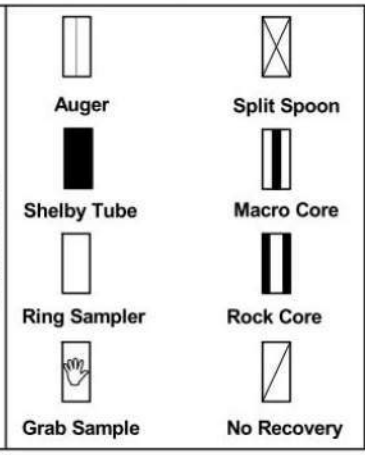
SUPPORTING INFORMATION

Contents:

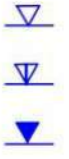
GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING



WATER LEVEL



Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, psf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 500	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	500 to 1,000	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	1,000 to 2,000	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	2,000 to 4,000	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	4,000 to 8,000	15 - 30	19 - 42
			Hard	> 8,000	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

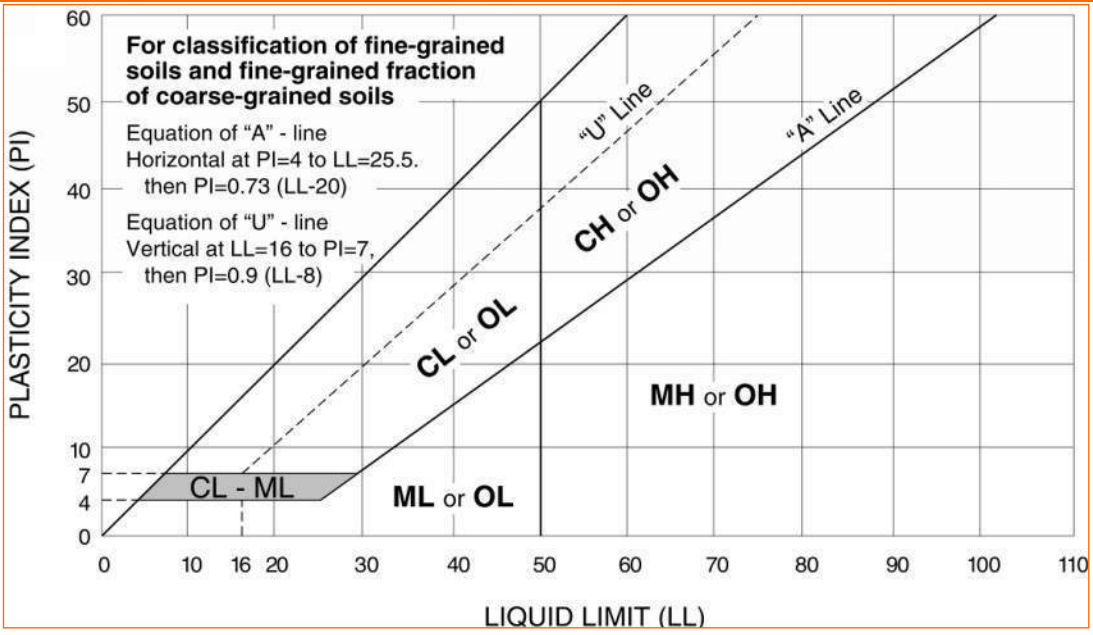
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Appendix C

Buffalo Creek Easement List

Buffalo Creek Easement Status

(1-7-2020)

Parcel No.	Owner
7	Harvey, John J. Jr. & Shelley V.
8	Welch, Alan R. & Rebecca S.
9	BC Golf Ltd.
10	BC Golf Ltd.
11	BC Golf Ltd.
12	TR Heath Partners Ltd.
13	TR Heath Partners Ltd.
14	TR Heath Partners Ltd.
15	TR Heath Partners Ltd.
16	TR Heath Partners Ltd.
17	Johnson Family Trust
18	TR Heath Partners Ltd.
19	TR Heath Partners Ltd.
20	City of Heath
21	Way, William H.
22	McCutcheon, Robert
23	Stoneleigh Homeowners Assoc., Inc.
24	Lazowski, Joseph A. & Laura J. Suenders
25	Fisher, Daniel C. & Laura Haeussler
26	Stoneleigh Homeowners Assoc., Inc.
27	Stoneleigh Homeowners Assoc., Inc.
28	Stoneleigh Homeowners Assoc., Inc.
29	Daedelus Corporation
30	Sumeer Homes, Inc.
31	Higgs, Jeffrey W. & Teresa Nichole
32	Falcon Point HOA
33	Falcon Point HOA
34	Daedelus Corporation
35	Adams, Jackie D.
36	Paintball Properties LP
37	Eubank, Dennis
38	Horvath, Scott & Marlene
39	Eubank, Dennis
40	Lowrance, Stanley D. & Cyndie K.
41	Kokles, Kim & Mary
42	Keats, Pamela Samantha
43	City of Dallas
44	Keats, Pamela Samantha
45	Pacific & Pinson

Appendix D

Buffalo Creek USACE NWP12 Authorization

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT
P. O. BOX 17300
FORT WORTH, TEXAS 76102-0300

August 5, 2019

Regulatory Division

SUBJECT: Project Number SWF-2019-00031, Buffalo Creek Sanitary Sewer Project

Mr. Cesar Baptista
North Texas Municipal Water District
501 E. Brown Street
PO Box 2408
Wylie, Texas 75098

Dear Mr. Baptista:

This letter is in regard to information received January 14, 2019, and subsequent submittal dated July 05, 2019, concerning a proposal by North Texas Municipal Water District to construct a new sanitary sewer interceptor located in Rockwall & Kaufman Counties, Texas. This project has been assigned Project Number SWF-2019-00031. Please include this number in all future correspondence concerning this project.

Under Section 404 of the Clean Water Act the U.S. Army Corps of Engineers (USACE) regulates the discharge of dredged and fill material into waters of the United States, including wetlands. USACE responsibility under Section 10 of the Rivers and Harbors Act of 1899 is to regulate any work in, or affecting, navigable waters of the United States. Based on the description of the proposed work, and other information available to us, we have determined this project will involve activities subject to the requirements of Section 404.

We have reviewed this project under the pre-construction notification procedures of Nationwide Permit General Condition 32 (Federal Register, Vol. 82, No. 4, Friday, January 6, 2017). We have determined the discharge of dredged or fill materials into waters of the United States associated with this project appears to qualify for Nationwide Permit 12 for Utility Line Activities. To use this permit, the person responsible for the project must ensure the work is in compliance with the specifications and conditions listed on the enclosure. Additionally, all activities must comply with the water quality certification conditions of the Texas Commission on Environmental Quality (TCEQ) located at http://www.swf.usace.army.mil/Portals/47/Users/053/21/821/NWP%202017%20Texas%20401cert.pdf.
The special condition is as follows:

1. The permittee shall debit 1.2 temporary credits and 0.9 permanent impact credits from the Bunker Sands Mitigation Bank in compliance with the provisions of the "Mitigation Banking Instrument, Bunker Sands Mitigation Bank, Kaufman County, Texas," dated April 30, 2008. This debit shall compensate off-site for unavoidable adverse project

impacts that would not be compensated for by on-site mitigation. The permittee shall complete the mitigation bank transaction and provide documentation to the USACE that the transaction has occurred prior to commencing any ground-disturbing activity within waters of the United States.

Failure to comply with these specifications and conditions invalidates the authorization and may result in a violation.

Our verification for the construction of this activity under this nationwide permit is valid until March 18, 2022, unless prior to that date the nationwide permit is suspended, revoked, or modified such that the activity would no longer comply with the terms and conditions of the nationwide permit on a regional or national basis. The USACE will issue a public notice announcing the changes when they occur. Furthermore, activities that have commenced, or are under contract to commence, in reliance on a nationwide permit will remain authorized provided the activity is completed within 12 months of the date of the nationwide permit's expiration, modification, or revocation, unless discretionary authority has been exercised on a case-by-case basis to modify, suspend, or revoke the authorization in accordance with 33 CFR 330.4(e) and 33 CFR 330.5(c) or (d). Continued confirmation that an activity complies with the specifications and conditions, and any changes to the nationwide permit, is the responsibility of the permittee.

Our review of this project also addressed its effects on threatened and endangered species. Based on the information provided, we have determined this project will not affect any species listed as threatened or endangered by the U.S. Fish and Wildlife Service within our permit area. However, please note you are responsible for meeting the requirements of General Condition 18 on endangered species.

The permittee must sign and submit to us the enclosed certification that the work, including any proposed mitigation, was completed in compliance with the nationwide permit. The permittee should submit the certification within 30 days of the completion of work.

This permit should not be considered as an approval of the design features of any activity authorized or an implication that such construction is considered adequate for the purpose intended. It does not authorize any damage to private property, invasion of property rights, or any infringement of federal, state, or local laws or regulations.

Thank you for your interest in our nation's water resources. If you have any questions concerning our regulatory program, please refer to our website at http://www.swf.usace.army.mil/Missions/Regulatory or contact Ms. Katie Roeder at the address above or telephone (817) 886-1740.

Please help the regulatory program improve its service by completing the survey on the following website: http://corpsmapu.usace.army.mil/cm_apex/f?p=regulatory_survey

Sincerely,

for Stephen L Brooks
Chief, Regulatory Division

Enclosure

Copy Furnished (without enclosures):

Mr. Tim Capps
Terracon Consultants, Inc.
8901 John W. Carpenter Freeway, Suite 100
Dallas, Texas 75247

Appendix E

Buffalo Creek Utility Test Hole Report

SURVEYING AND MAPPING LLC
1341 W. Mockingbird Ln, DALLAS, TX 75247
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole Summary

Project HZ-NTMWD (Buffalo Creek)

State *Texas* **City** *Heath*

SAM, LLC Project # 41026 **Prepared By:** Dallas Office SUE

Client *Huitt-Zollars*

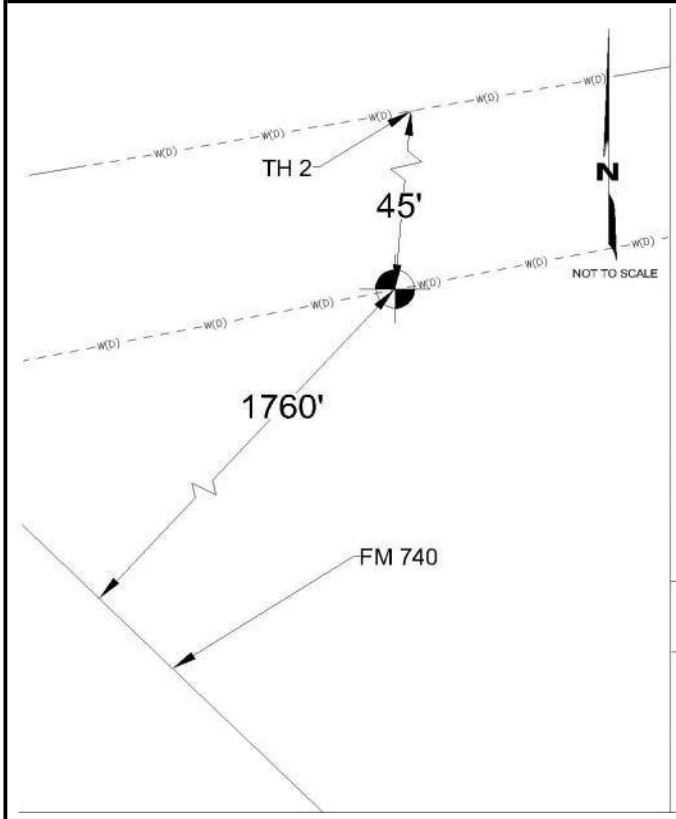
Test Hole#	Utility Type	Utility Owner	Date Completed	Northing	Easting	Elevation Existing Ground	Elevation Top of Utility	Depth of Cover	Material Type, Outside Diameter, and Comments	Surface Material and Thickness
1	Water	City of Dallas	8/26/2019	6973013.02'	2593020.60'	405.5'	400.1'	5.41'	RCP, 72"	Natural Ground
2	Water	City of Dallas	8/27/2019	6973055.64'	2593034.32'	405.7'	399.1'	6.65'	RCP, 84"	Natural Ground
3	Gas	Atmos	8/16/2019	6996966.51'	2595748.86'	457.2'	448.7'	8.54'	Steel Pipe, 30" per record	Natural Ground
5	Sewer	NTMWD	4/24/2018	7003726.54'	2594987.99'	473.7'	465.4'	8.30'	RCP, 8" per record	Natural Ground
6	Electric	Private	10/21/2019	7004816.33'	2594779.10'	483.1'	481.2'	1.92'	PVC, 1.25"	Natural Ground
7	Electric	Oncor	10/21/2019	7005743.95'	2595391.88'	478.3'	474.2'	4.12'	PVC, 2"	Natural Ground

Note: Test Hole 4 was not performed since the target utility did not exist after field investigation.

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

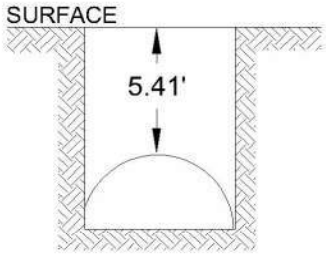
Test Hole # 1
72" RCP Water
City of Dallas

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**8/26/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	45' SW of TH 2 and 1760' to FM740	Field Conditions:	Mostly Sunny H102°|L82°
		Soil Type:	Light Grey Silty Clay
Record Utility:	Water	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	City of Dallas		
Contact:	Dallas Water Utilities Vault	**Utility Found:**	**72" RCP Water**
Phone	(214) 948-4584	**Utility Condition:**	**Average**
Email	DWUVault@dallascityhall.com	**Depth of Cover:**	**5.41'**
Field Crew:	Stephen Frair | Benito Lopez	**Elevation of Utility:**	**400.1'**



UTILITY CROSS SECTION

FACING EAST



72" RCP CITY OF DALLAS

LEGEND

-TEST HOLE

SURVEY MARK COORDINATES

Northing	**6973013.02'**
Easting	**2593020.60'**
Elevation	**405.5'**

STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER
9/26/2019

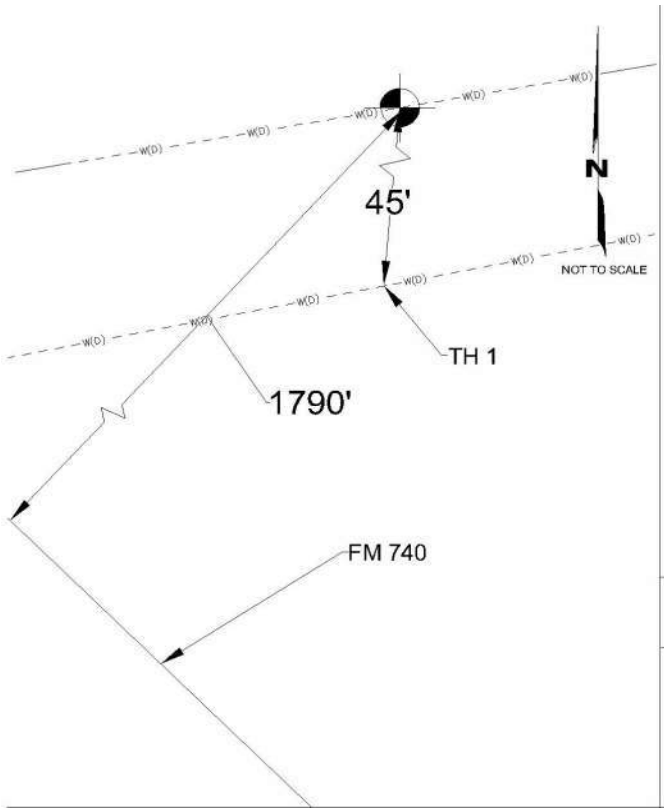
Comments

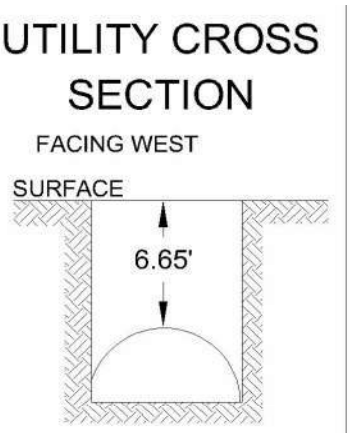
1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 2
84" RCP Water
City of Dallas

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**8/27/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	45' NE of TH 1 and 1790' to FM740	Field Conditions:	Thunderstorms H90°|L82°
		Soil Type:	Light Grey Silty Clay
Record Utility:	Water	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	City of Dallas		
Contact:	Dallas Water Utilities Vault	**Utility Found:**	**84" RCP Water**
Phone	(214) 948-4584	**Utility Condition:**	**Average**
Email	DWUVault@dallascityhall.com	**Depth of Cover:**	**6.65'**
Field Crew:	Stephen Frair | Benito Lopez	**Elevation of Utility:**	**399.1'**





LEGEND
-TEST HOLE

SURVEY MARK COORDINATES

Northing	**6973055.64'**
Easting	**2593034.32'**
Elevation	**405.7'**

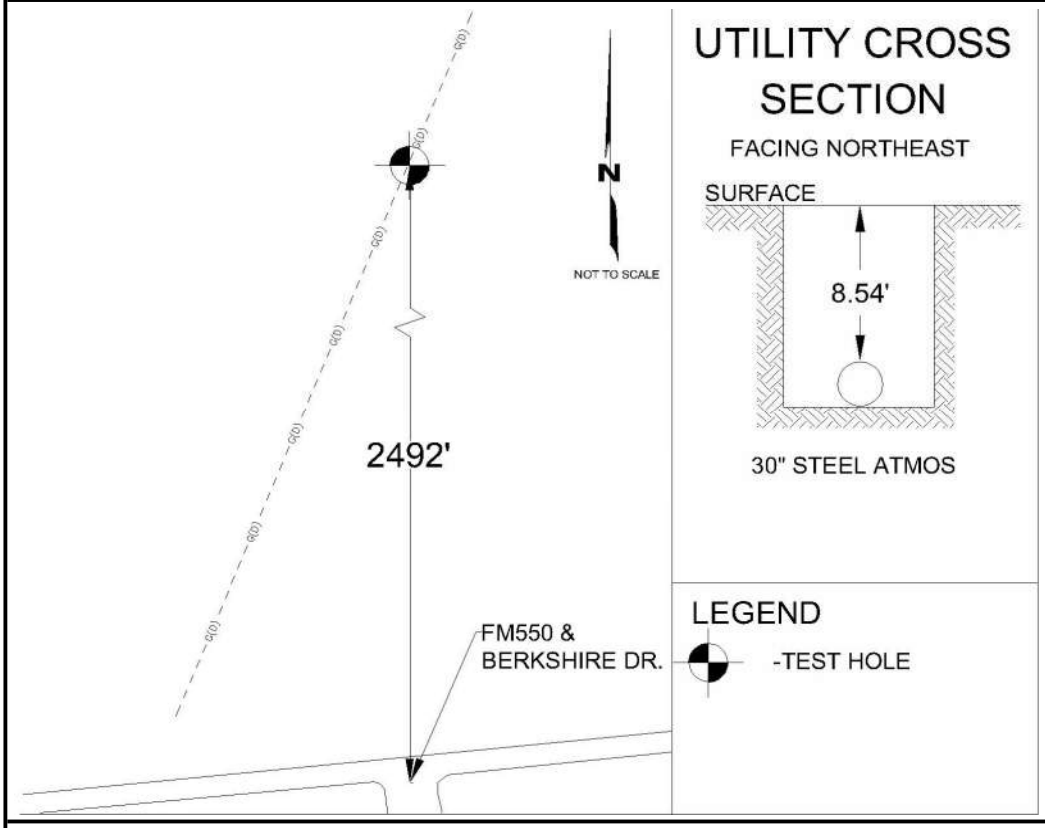
Comments

1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 3
30" per record Steel Pipe
Gas
Atmos

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**8/16/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	2492' North of the intersection of W FM550 and Berkshire Dr.	Field Conditions:	Mostly Sunny H100°|L81°
		Soil Type:	Light Grey Silty Clay
		Survey Mark:	1/2" Iron Rod w/cap
Record Utility:	Gas	**Utility Found:**	**30" per record Steel Pipe Gas**
Utility Owner:	Atmos	**Utility Condition:**	**Average**
Contact:	Atmos Map Request	**Depth of Cover:**	**8.54'**
Phone	N/A	**Elevation of Utility:**	**448.7'**
Email	Map.Requests@atmosenergy.com		
Field Crew:	Stephen Frair | Benito Lopez		



SURVEY MARK COORDINATES

Northing	**6996966.51'**
Easting	**2595748.86'**
Elevation	**457.2'**

Comments

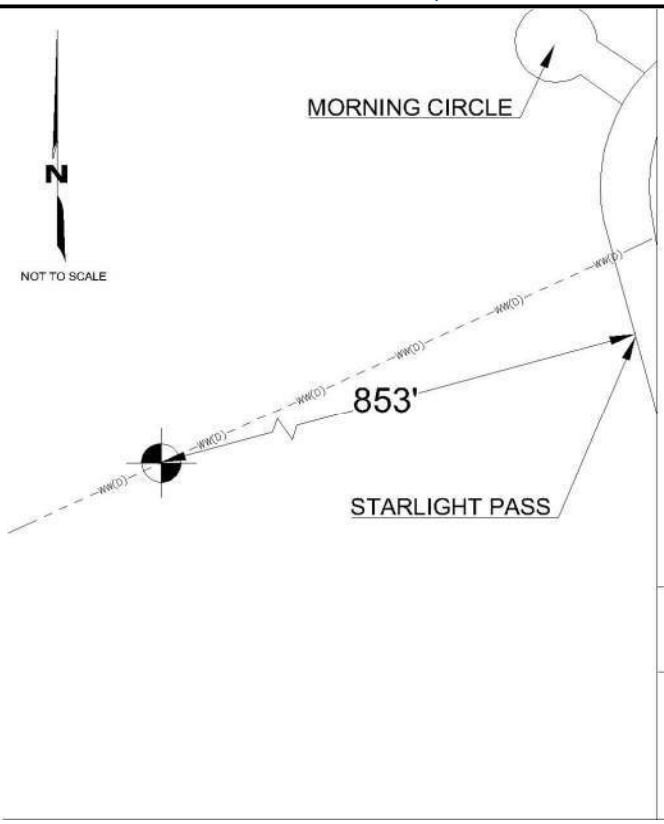
1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*
3. *Unable to get accurate pipe size due to ground water. Pipe size is shown per records*

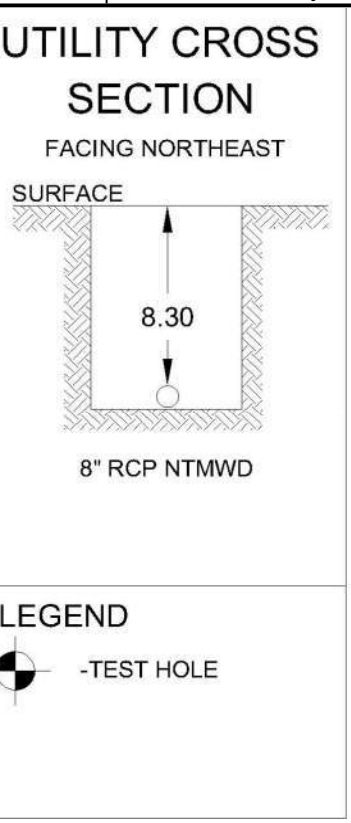
STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER
9/26/2019

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 5
8" per record RCP Sewer
NTMWD

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**4/24/2018**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	853' SW of Starlight Pass	Field Conditions:	Mostly Sunny H84°|L57°
		Soil Type:	Dark Grey Sandy Clay
Record Utility:	Sanitary Sewer	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	NTMWD		
Contact:	NTMWD	**Utility Found:**	**8" per record RCP Sewer**
Phone	(972) 442-5405	**Utility Condition:**	**Average**
Email	N/A	**Depth of Cover:**	**8.30'**
Field Crew:	James Sobol | Julian Dixon	**Elevation of Utility:**	**465.4'**





SURVEY MARK COORDINATES

Northing	**7003726.54'**
Easting	**2594987.99'**
Elevation	**473.7'**

Comments

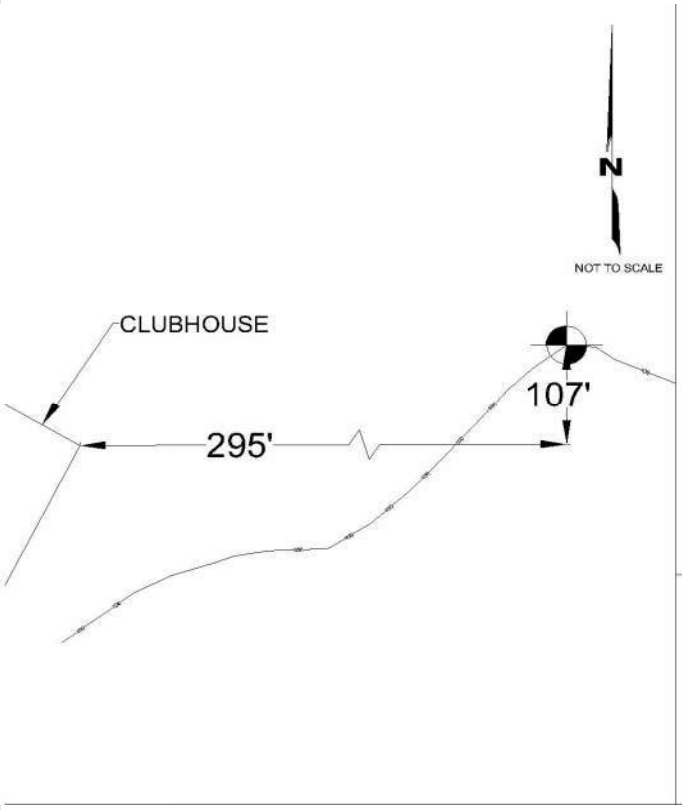
1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*
3. *Unable to get accurate pipe size due to ground water. Pipe size is shown per records*

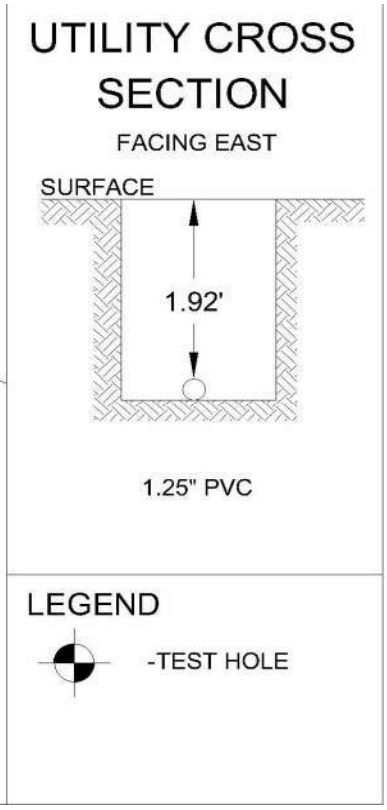
STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER
9/26/2019

SURVEYING AND MAPPING LLC
1341 W. Mockingbird Ln, DALLAS, TX 75247
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 6
1.25" PVC Electric
Unknown

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**10/21/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	295' E and 107' N of Eastern Clubhouse Corner	Field Conditions:	Mostly Sunny H79°|L54°
		Soil Type:	Strong Brown Clay
		Survey Mark:	1/2" Iron Rod w/cap
Record Utility:	N/A	**Utility Found:**	**1.25" PVC Electric**
Utility Owner:	Unknown	**Utility Condition:**	**Average**
Contact:	N/A	**Depth of Cover:**	**1.92'**
Phone	N/A	**Elevation of Utility:**	**481.2'**
Email	N/A		
Field Crew:	Dorsey Johnson|Stephen Frair		





SURVEY MARK COORDINATES

Northing	**7004816.33'**
Easting	**2594779.10'**
Elevation	**483.1'**

Comments

1. No other utilities were found in this Test Hole

2. All excavation was performed with hand tools.

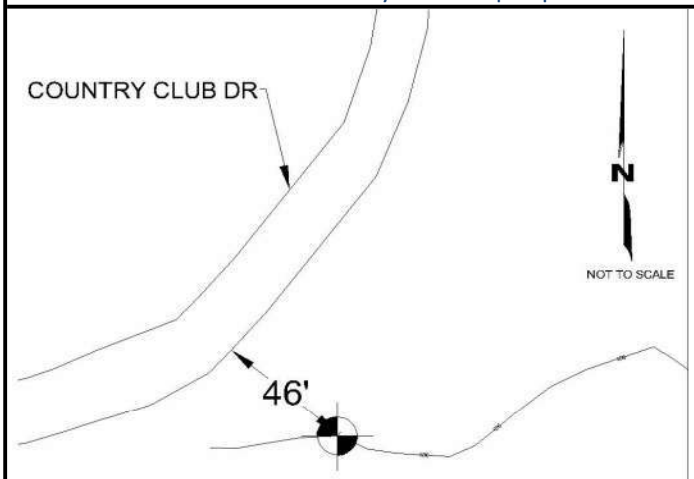
STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER

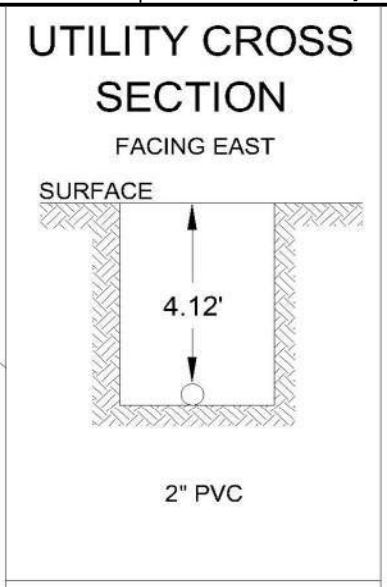
4/7/2020

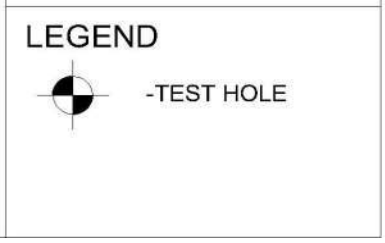
SURVEYING AND MAPPING LLC
1341 W. Mockingbird Ln, DALLAS, TX 75247
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 7
2" PVC Electric
Oncor

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**10/21/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	46' to Country Club Dr.	Field Conditions:	Mostly Sunny H79°|L54°
		Soil Type:	Light Grey Silty Clay
Record Utility:	N/A	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	Oncor	**Utility Found:**	**2" PVC Electric**
Contact:	Larry Baldwin	**Utility Condition:**	**Average**
Phone	(817) 215-6184	**Depth of Cover:**	**4.12'**
Email	larry.baldwin@oncor.com	**Elevation of Utility:**	**474.2'**
Field Crew:	Dorsey Johnson|Stephen Frair		







SURVEY MARK COORDINATES

Northing	**7005743.95'**
Easting	**2595391.88'**
Elevation	**478.3'**

4/7/2020

Comments

1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*

Appendix F

TxDOT Crossing Permit(s)

Approval Form
Online version 11/2005

APPROVAL

To Jeff Ray
North Texas Municipal Water District
505 East Brown Street
Wylie, TX 75098

Date 4/7/2020
Application No. DAL20200325111303
District App. No. DAL20200325111303
Highway FM 0550
Control Section 101403
Maintenance Section Kaufman/Rockwall County Maintenance
County Rockwall

TxDOT offers no objection to the location on the right-of-way of your proposed utility installation, as described by Notice of Proposed Utility Installation No. DAL20200325111303 (District Application No. DAL20200325111303) dated 4/7/2020 and accompanying documentation, except as noted below.

It is understood that it is the responsibility of the utility owner to contact TxDOT 48 hrs prior to the start of construction using the UIR System and by email or phone call to the area office Utility Coordinator. It is also the owners to responsibility to contact TxDOT once the construction is complete.

When installing utility lines on controlled access highways, your attention is directed to governing laws, especially to Texas Transportation Code, Title 6, Chapter 203, pertaining to Modernization of State Highways; Controlled Access Highways. Access for serving this installation shall be limited to access via (a) frontage roads where provided, (b) nearby or adjacent public roads or streets, (c) trails along or near the highway right-of-way lines, connecting only to an intersecting roads; from any one or all of which entry may be made to the outer portion of the highway right-of-way for normal service and maintenance operations. The Installation Owner's rights of access to the through-traffic roadways and ramps shall be subject to the same rules and regulations as apply to the general public except, however, if an emergency situation occurs and usual means of access for normal service operations will not permit the immediate action required by the Utility Installation Owner in making emergency repairs as required for the safety and welfare of the public, the Utility Owners shall have a temporary right of access to and from the through-traffic roadways and ramps as necessary to accomplish the required emergency repairs, provided TxDOT is immediately notified by the Utility Installation Owner when such repairs are initiated and adequate provision is made by the Utility Installation Owner for convenience and safety of highway traffic.

The installation shall not damage any part of the highway and adequate provisions must be made to cause minimum inconveniences to traffic and adjacent property owners. In the event the Installation Owner fails to comply with any or all of the requirements as set forth herein, the State may take such action as it deems appropriate to compel compliance.

It is expressly understood that the TxDOT does not purport, hereby, to grant any right, claim, title, or easement in or upon this highway; and it is further understood that the TxDOT may require the Installation Owner to relocate this line, subject to provisions of governing laws, by giving thirty (30) days written notice.

If construction has not started within six (6) months of the date of this approval, the approval will automatically expire and you will be required to submit a new application. You are also requested to notify this office prior to commencement of any routine or periodic maintenance which requires pruning of trees within the highway right-of-way, so that we may provide specifications for the extent and methods to govern in trimming, topping, tree balance, type of cuts, painting cuts and clean up. These specifications are intended to preserve our considerable investment in highway planting and beautification, by reducing damage due to trimming.

Special Provisions:
Bore water sewer lines General Trench Pit Location Backfill

You are required to notify TxDOT 48 hours (2 business days) before you start construction to allow for proper inspection and coordination of work days and traffic control plans. Use the UIR website for the 48-hour notification. DO NOT start construction until you have coordinated the construction start date and inspection with TxDOT. You are also required to keep a copy of this Approval, the Notice of Proposed Installation, and any approved amendments at the job site at all times.

Texas Department of Transportation
By Justin Braudrick
Title Utility Coordinator
District Dallas

Construction of Highway Crossing by Bore

1. **GENERAL** - WATER JETTING OR JACKING WILL NOT BE PERMITTED. All paved streets which are maintained by TxDOT must be bored & encased unless it is specifically stated on the permit that an exception for open cutting and/or no encasement is granted.

   At no time shall the boring operation interfere with the traveling public. The safety of the traveling public and maintaining the integrity of the roadway is the primary concern.

2. **BORE PIT LOCATIONS** - No excavations for bore pits will be allowed to be any closer to the edge of the pavement (travel lane) than as outlined in the "TRENCH EXCAVATIONS AND PIT LOCATION" specification. If the required clear zoned distance is closer than outlined in the above mentioned specification, then appropriate traffic control devices such as barricades, signs, barrel mounted guard fence and/or concrete traffic barriers will be required as deemed necessary by the TxDOT inspector.

   No excavated material will be stored closer to the traveled way than the bore pit. All pits and trenches shall be backfilled immediately after the encasement and carrier pipes have been installed. Upon completion of the backfill, all excess material will be removed from the right of way.

3. **METHOD OF INSTALLATION** - Crossings are to be installed by the AUGER or "DRY" BORE method and shall be accomplished by use of a laser sighted bore machine or a bore machine requiring a pilot hole. The pilot hole will serve as the centerline of the large diameter hole to be bored. The user of water or fluids in the boring operation will only be allowed for lubricating the cutting head.

   The boring operation shall be performed from the low or downstream end. Lateral or vertical variation of the encasement pipe from the proposed line and grade will be permitted only to the extent of one (1) inch in ten (10) feet, provided that such a variation shall be regular and only in one direction.

   The encasement pipe shall be approximately the same diameter as the bore hole. Over cutting in excess of one (1) inch shall be remedied by pressure grouting the entire length of the installation with a mixture consisting of two (2) sacks of cement per yard of sand.

4. **OPTIONAL WET BORE** - The utility or contractor may request installation by the Slurry or "Wet" bore method. The approval to wet bore is granted by the Area Engineer or his designated representative on an individual permit basis. If the area office allows wet bores in their designated area, approval will be based on bore size and soil conditions. Wet bores should be restricted to areas of rock or other suitable material which will prevent the sides of the bore hole from "caving in". A geotechnical report may be required prior to approval. In no instance will wet bores be allowed to exceed eighteen (18) inches in diameter.

   The amount of water used for creating the slurry will be such that little or no runoff is encountered. If, in the opinion of the TxDOT inspector, at any time during the boring operation inadequate conditions are encountered for performing the wet bore, the process will be stopped and the bore will be completed by Auger bore.

   The slurry material removed from the bore may not be used in the backfilling of the bore pit.

Water & Sanitary Sewer Lines

1. **GENERAL** - Longitudinal water and sanitary sewer pipelines shall be placed on uniform alignment three (3) to ten (10) feet from the right of way line. The minimum depth of cover shall be twenty-four (24) inches for non-plastic lines and thirty (30) inches for plastic lines. If a nonmetallic line is installed, a durable metal wire or other device shall be concurrently installed for detection purposes.

   Each line may be installed with enough vertical flexibility to prevent stresses; however, horizontal "snaking" of the line is prohibited.

   The utility agency shall place identification markers at the right of way line in sufficient number for longitudinal installations and at each highway crossing.

   All paved side streets crossed by a longitudinal line within TxDOT right of way must be installed as outlined in item #2 below.

2. **CROSSING** - Highway crossings are to be installed at or near right angles to highway and must be installed with an encasement pipe. Encasement pipe is also to be installed under normal center medians, extend from the top of back slope for cut sections, and five (5) feet beyond the toe of slope for fill sections, unless an additional length is required as outlined in the "TRENCH EXCAVATION AND PIT LOCATION" specification.

   All crossings under existing pavement must be installed as outlined in the "CONSTRUCTION OF HIGHWAY CROSSINGS BY BORE" specification.

   The depth of cover for crossings shall be twenty-four (24) inches for non-plastic pipe and thirty (30) inches for plastic pipe under ditches. The encasement pipe must be a minimum of eighteen (18) inches or ½ the diameter of the pipe, whichever is greater, below the bottom of the pavement structure.

   The encasement shall consist of a steel pipe around and outside the carrier pipe and support the load of the ground above the pipe, the highway, and the superimposed loads there on, including construction equipment. HDPE pipe with a SDR ratio of 11 or greater may be used for encasement of water service lines. The HDPE pipe must be a single continuous piece with no joints. The strength of the encasement pipe shall equal or exceed the structural requirements for highway drainage culverts covered under ASTM specifications.

3. **ABOVE GROUND APPURTENANCES** - Fire hydrants, air release valves, and other similar appurtenances should be located at or near the right of way line. All fire hydrants will be equipped with breakaway bases and should not be located in the sidewalk. Any appurtenances may not be located any closer than 3 ft from back of curb.

   Pumps, wells, and other structures associated with lift stations and pump stations will not be permitted within the limits of TxDOT right of way.

4. **MANHOLES** - The outside diameter of the manhole chimney at ground level shall not exceed thirty-six (36) inches. The inside diameter of the manhole for lines up to twelve (12) inches shall not exceed four (4) feet. For any increase in line size greater than twelve (12) inches the manhole may be increased a like amount. The manhole cover shall be installed flush with the ground, meet HS-20 load requirements, and weigh at least 175 pounds.

General Utility Installations

1. GENERAL - A copy of the approved notice must be kept onsite at all times during construction. Unless other arrangements are made with the designated Texas Department (TxDOT) inspector, no work will be performed on Saturday, Sunday, Holidays, or hours other than standard working hours. Utility lines shall be located to avoid or minimize the need for adjustments to accommodate future highway improvements.

All utility installations will be made without excavation or longitudinal placement being made any closer than three (3) feet from the back of curb. No pavement cuts are permitted unless specifically stated on the permit that approval is given to open cut the pavement.

No explosives shall be used within the limits of the TxDOT highway right of way for utility installations.

2. COORDINATION OF WORK - ***Prior to the start of construction the local TxDOT Office MUST BE NOTIFIED at the number listed on the approval notice. Traffic control plans must be approved by the Area Office before work can begin.*** If the installation is within the limits of an active highway construction project, the utility work must be coordinated with the TxDOT Contractor and Inspectors. The utility work shall not cause any delay or disruption to the TxDOT contractor or construction.

Location existing utility facilities and coordination with the owners is the responsibility of the utility agency.

3. TRAFFIC SAFETY, BARRICADES, WARNING DEVICES - Traffic control and protective devices shall be used and must conform to the TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES for streets and highways. All barricades, warning devices, signs, flashers, and flag persons shall be provided by the utility agency or contractor.

Traffic shall not be stopped at any time without the use of a flag person. Prior to beginning work, the traffic control plans must be approved by the Area Engineer or his designated representative. Lane closures for any utility work will not be permitted without prior approval of Area Engineer or his designated representative. Lane closures are not permitted during peak "rush hour" traffic times.

Vehicles, equipment, construction material and personnel not necessary to the timely installation of the facility shall be kept as far as possible from the traveling public. Any above ground obstruction or bore pit located closer than the clear zone distances outlined in the "Trench Excavation and Pit Locations" specification shall be protected by barricades, metal beam guard fence and/or concrete traffic barriers as deemed necessary by the TxDOT Inspector. At the end of every construction day, all equipment and materials shall be removed as far from the roadway edge as possible.

4. SURVEYING AND STAKING OF UTILITIES - All utility installations shall be staked by utility agency so that TxDOT may inspect the alignment prior to start of construction. The ROW line is to be staked and the utility installed based on a set distance from the ROW line. The utility is ultimately responsible for the accuracy of the installation.

5. TIME PERIOD ALLOWED FOR INSTALLATION - If the installation of the work covered by this utility permit has not started within twelve (12) months from the approval date, a written request for an extension must be submitted to the District Office. It is expected that the installation will progress to completion in an efficient manner. However, if the work is delayed or abandoned for a period of one (1) month or more, a written request must be submitted to continue under the authority of the original permit.

6. FULL TIME SUPERVISION and INSPECTION - The utility agency shall provide competent, full time inspectors or supervisors to be present on-site during the installation. Also, the utility may be required to provide a telephone number at which someone may be contacted 24 hours in case of an emergency. The utility construction may be delayed of stopped when it is observed by the TxDOT Inspector that there is not an agency inspector or supervisor present on the job site.

7. DEPARTMENT INTERVENTION - TxDOT has the right to take charge of an to remedy any immediate hazard to the traveling public when it is obvious the utility agency will not do so. Any costs associated with TxDOT's action will be charged to the utility agency.

8. UTILITY ACCOMMODATION RULES - Utility installations within the TxDOT Right of Way shall conform to the requirements contained in the TxDOT Utility Accommodation Rules, dated February 2, 2005, the Dallas District Utility Specifications and the following industry policies.

A. Safety rules for the installation and maintenance of electric and communication lines - National Electrical Safety Code.
B. Latest edition of the Rules and Regulations for Public Water Systems, published by the Texas Department of Health, Water Hygiene Division.
C. Gas Pipelines - Title 49, C.F.R., Part 195, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards and amendments.
D. Liquid Petroleum Pipelines - Title 49, C.F.R., Part 195, Transportation of Liquids by Pipelines and amendments.
E. Latest edition of the American Society for Testing and Materials (ASTM) Specifications.
F. Latest edition of the AASHTO policy entitled "A Policy on the Accommodations of Utilities within Freeway Right of Way".
G. Latest edition of the Occupational Safety and Health Administration (OSHA) Standards and Interpretations.

Trench Excavation and Pit Location

1. GENERAL - No dirt from a trench or pit excavation shall be placed on the roadway or shoulders. All equipment and stockpiled dirt shall meet the safety clear zone distances listed below or have adequate barricades and warning devices to protect the traveling public.

Topsoil shall be kept separate from other excavation material, and be replaced in accordance with "BACKFILLING" specification.

All pits and trenches shall be kept free from standing water. If trenches and/or bore pits are left open for extended periods of time without a continuous progression of work, the utility will be required to backfill the trench and/or bore pits. Any other pit will not be left open for more than a forty eight (48) hour period.

In all excavations where sloughing is likely to occur, shoring will be utilized to prevent damage to the highway structure(s). The utility agency or contractor shall be responsible for maintaining trench excavation protections as required by provisions of Part 1926, Subpart P - Excavations, Trenching and Shoring of OSHA Standards.

2. TRENCHING - Longitudinal installations must be placed as near a uniform alignment to the right of way line as possible. Trenching machine or backhoe may be used. A backhoe will be required if a uniform alignment can't be maintained by use of a trenching machine.

3. SAFETY CLEAR ZONE DISTANCES - Minimum clear zone distances required for trench excavations and bore pit locations are as follows:

For UNCURBED Highways

A. Thirty (30) ft. from the edge of pavement (traveled lane) of high-speed (more than 40 mph), high volume (more than 750 vehicles per day) highways.
B. Sixteen (16) ft* from edge of pavement of high-speed, low volume (less than 750 vehicles per day) highways.
C. Sixteen (16) ft* from ramps.
D. Ten (10) ft* for low-speed (40 mph or less) highways.
E. Ten (10) ft* for any paved intersections side streets.

* Five (5) ft MINIMUM from edge of any shoulder.

For CURBED Highways

A. Thirty (30) ft from the back of curb for high-speed highways
B. Five (5) ft from the back of curb, plus any additional distance to clear sidewalks, for low-speed highways
C. Five (5) ft from the back of curb for intersecting side street.

Backfill Specifications

1. **GENERAL** - As soon as practical, all portions of the excavation shall be backfilled. Trenches and pits shall be backfilled with the material obtained from the excavation or from other sources. Backfill material will be free from stones of such size as to interfere with compactions; free from large lumps which will not break down readily under compaction; and free from frozen lumps, wood or other extraneous material. The TxDOT inspector may reject any material containing more than twenty (20) percent by weight of material retained on a three (3) inch sieve.

   The portion of top soil removed from the original excavation shall be replaced, as nearly as feasible, in its original position.

2. **DEPTH OF LIFTS** - The portion of backfill below the top of pipe shall be placed in uniform layers not to exceed eight (8) inches in depth (loose measurement). Backfill above the top of the pipe shall be placed in layers not to exceed ten (10) inches in depth (loose measurement). If the backfill is to support a portion of roadway or embankment, then the material will be placed in uniform layers not to exceed eight (8) inches in depth (loose measurement).

3. **PROCEDURE FOR COMPACTION** - Each layer of backfill material, if dry, shall be wetted uniformly to the moisture content required to obtain a density comparable with the adjacent undisturbed soil and shall be compacted to that density by means of mechanical tampers or rammers. The use of rolling equipment of the type generally used in compacting embankments will be permitted on portions that are accessible to such equipment. Water jetting or ponding will not be permitted.

   Special care shall be taken to ensure thorough compaction of material placed under the haunches of the pipe.

   Cohesionless materials, such as sand, may be used for general backfilling purposes. Compaction of cohesionless materials shall be done with vibratory equipment.

4. **RESTORATION OF RIGHT OF WAY** - Prompt replacement of sod, removal of debris, and any other restoration necessary to restore the right of way to a condition equal to that which existed prior to the utility installation will be required. In areas of erosion, the use of stabilized backfill may be required. Should settlement or erosion occur within six (6) months of the utility installation, the utility agency will be required to reshape, reseed, and/or resod the area.

Approval Form
Online version 11/2005

APPROVAL

To Jeff Ray
North Texas Municipal Water District
505 East Brown Street
Wylie, TX 75098

Date 4/7/2020
Application No. DAL20200325133009
District App. No. DAL20200325133009
Highway FM 0549
Control Section 109104
Maintenance Section Kaufman/Rockwall County Maintenance
County Rockwall

TxDOT offers no objection to the location on the right-of-way of your proposed utility installation, as described by Notice of Proposed Utility Installation No. DAL20200325133009 (District Application No. DAL20200325133009) dated 4/7/2020 and accompanying documentation, except as noted below.

It is understood that it is the responsibility of the utility owner to contact TxDOT 48 hrs prior to the start of construction using the UIR System and by email or phone call to the area office Utility Coordinator. It is also the owners to responsibility to contact TxDOT once the construction is complete.

When installing utility lines on controlled access highways, your attention is directed to governing laws, especially to Texas Transportation Code, Title 6, Chapter 203, pertaining to Modernization of State Highways; Controlled Access Highways. Access for serving this installation shall be limited to access via (a) frontage roads where provided, (b) nearby or adjacent public roads or streets, (c) trails along or near the highway right-of-way lines, connecting only to an intersecting roads; from any one or all of which entry may be made to the outer portion of the highway right-of-way for normal service and maintenance operations. The Installation Owner's rights of access to the through-traffic roadways and ramps shall be subject to the same rules and regulations as apply to the general public except, however, if an emergency situation occurs and usual means of access for normal service operations will not permit the immediate action required by the Utility Installation Owner in making emergency repairs as required for the safety and welfare of the public, the Utility Owners shall have a temporary right of access to and from the through-traffic roadways and ramps as necessary to accomplish the required emergency repairs, provided TxDOT is immediately notified by the Utility Installation Owner when such repairs are initiated and adequate provision is made by the Utility Installation Owner for convenience and safety of highway traffic.

The installation shall not damage any part of the highway and adequate provisions must be made to cause minimum inconveniences to traffic and adjacent property owners. In the event the Installation Owner fails to comply with any or all of the requirements as set forth herein, the State may take such action as it deems appropriate to compel compliance.

It is expressly understood that the TxDOT does not purport, hereby, to grant any right, claim, title, or easement in or upon this highway; and it is further understood that the TxDOT may require the Installation Owner to relocate this line, subject to provisions of governing laws, by giving thirty (30) days written notice.

If construction has not started within six (6) months of the date of this approval, the approval will automatically expire and you will be required to submit a new application. You are also requested to notify this office prior to commencement of any routine or periodic maintenance which requires pruning of trees within the highway right-of-way, so that we may provide specifications for the extent and methods to govern in trimming, topping, tree balance, type of cuts, painting cuts and clean up. These specifications are intended to preserve our considerable investment in highway planting and beautification, by reducing damage due to trimming.

Special Provisions:
Bore water sewer lines General Trench Pit Location Backfill

You are required to notify TxDOT 48 hours (2 business days) before you start construction to allow for proper inspection and coordination of work days and traffic control plans. Use the UIR website for the 48-hour notification. DO NOT start construction until you have coordinated the construction start date and inspection with TxDOT. You are also required to keep a copy of this Approval, the Notice of Proposed Installation, and any approved amendments at the job site at all times.

Texas Department of Transportation
By Justin Braudrick
Title Utility Coordinator
District Dallas

Construction of Highway Crossing by Bore

1. GENERAL - WATER JETTING OR JACKING WILL NOT BE PERMITTED. All paved streets which are maintained by TxDOT must be bored & encased unless it is specifically stated on the permit that an exception for open cutting and/or no encasement is granted.

   At no time shall the boring operation interfere with the traveling public. The safety of the traveling public and maintaining the integrity of the roadway is the primary concern.

2. BORE PIT LOCATIONS - No excavations for bore pits will be allowed to be any closer to the edge of the pavement (travel lane) than as outlined in the "TRENCH EXCAVATIONS AND PIT LOCATION" specification. If the required clear zoned distance is closer than outlined in the above mentioned specification, then appropriate traffic control devices such as barricades, signs, barrel mounted guard fence and/or concrete traffic barriers will be required as deemed necessary by the TxDOT inspector.

   No excavated material will be stored closer to the traveled way than the bore pit. All pits and trenches shall be backfilled immediately after the encasement and carrier pipes have been installed. Upon completion of the backfill, all excess material will be removed from the right of way.

3. METHOD OF INSTALLATION - Crossings are to be installed by the AUGER or "DRY" BORE method and shall be accomplished by use of a laser sighted bore machine or a bore machine requiring a pilot hole. The pilot hole will serve as the centerline of the large diameter hole to be bored. The user of water or fluids in the boring operation will only be allowed for lubricating the cutting head.

   The boring operation shall be performed from the low or downstream end. Lateral or vertical variation of the encasement pipe from the proposed line and grade will be permitted only to the extent of one (1) inch in ten (10) feet, provided that such a variation shall be regular and only in one direction.

   The encasement pipe shall be approximately the same diameter as the bore hole. Over cutting in excess of one (1) inch shall be remedied by pressure grouting the entire length of the installation with a mixture consisting of two (2) sacks of cement per yard of sand.

4. OPTIONAL WET BORE - The utility or contractor may request installation by the Slurry or "Wet" bore method. The approval to wet bore is granted by the Area Engineer or his designated representative on an individual permit basis. It the area office allows wet bores in their designated area, approval will be based on bore size and soil conditions. Wet bores should be restricted to areas of rock or other suitable material which will prevent the sides of the bore hole from "caving in". A geotechnical report may be required prior to approval. In no instance will wet bores be allowed to exceed eighteen (18) inches in diameter.

   The amount of water used for creating the slurry will be such that little or no runoff is encountered. If, in the opinion of the TxDOT inspector, at any time during the boring operation inadequate conditions are encountered for performing the wet bore, the process will be stopped and the bore will be completed by Auger bore.

   The slurry material removed from the bore may not be used in the backfilling of the bore pit.

Water & Sanitary Sewer Lines

1. **GENERAL** - Longitudinal water and sanitary sewer pipelines shall be placed on uniform alignment three (3) to ten (10) feet from the right of way line. The minimum depth of cover shall be twenty-four (24) inches for non-plastic lines and thirty (30) inches for plastic lines. If a nonmetallic line is installed, a durable metal wire or other device shall be concurrently installed for detection purposes.

   Each line may be installed with enough vertical flexibility to prevent stresses; however, horizontal "snaking" of the line is prohibited.

   The utility agency shall place identification markers at the right of way line in sufficient number for longitudinal installations and at each highway crossing.

   All paved side streets crossed by a longitudinal line within TxDOT right of way must be installed as outlined in item #2 below.

2. **CROSSING** - Highway crossings are to be installed at or near right angles to highway and must be installed with an encasement pipe. Encasement pipe is also to be installed under normal center medians, extend from the top of back slope for cut sections, and five (5) feet beyond the toe of slope for fill sections, unless an additional length is required as outlined in the "TRENCH EXCAVATION AND PIT LOCATION" specification.

   All crossings under existing pavement must be installed as outlined in the "CONSTRUCTION OF HIGHWAY CROSSINGS BY BORE" specification.

   The depth of cover for crossings shall be twenty-four (24) inches for non-plastic pipe and thirty (30) inches for plastic pipe under ditches. The encasement pipe must be a minimum of eighteen (18) inches or ½ the diameter of the pipe, whichever is greater, below the bottom of the pavement structure.

   The encasement shall consist of a steel pipe around and outside the carrier pipe and support the load of the ground above the pipe, the highway, and the superimposed loads there on, including construction equipment. HDPE pipe with a SDR ratio of 11 or greater may be used for encasement of water service lines. The HDPE pipe must be a single continuous piece with no joints. The strength of the encasement pipe shall equal or exceed the structural requirements for highway drainage culverts covered under ASTM specifications.

3. **ABOVE GROUND APPURTENANCES** - Fire hydrants, air release valves, and other similar appurtenances should be located at or near the right of way line. All fire hydrants will be equipped with breakaway bases and should not be located in the sidewalk. Any appurtenances may not be located any closer than 3 ft from back of curb.

   Pumps, wells, and other structures associated with lift stations and pump stations will not be permitted within the limits of TxDOT right of way.

4. **MANHOLES** - The outside diameter of the manhole chimney at ground level shall not exceed thirty-six (36) inches. The inside diameter of the manhole for lines up to twelve (12) inches shall not exceed four (4) feet. For any increase in line size greater than twelve (12) inches the manhole may be increased a like amount. The manhole cover shall be installed flush with the ground, meet HS-20 load requirements, and weigh at least 175 pounds.

General Utility Installations

1. GENERAL - A copy of the approved notice must be kept onsite at all times during construction. Unless other arrangements are made with the designated Texas Department (TxDOT) inspector, no work will be performed on Saturday, Sunday, Holidays, or hours other than standard working hours. Utility lines shall be located to avoid or minimize the need for adjustments to accommodate future highway improvements.

All utility installations will be made without excavation or longitudinal placement being made any closer than three (3) feet from the back of curb. No pavement cuts are permitted unless specifically stated on the permit that approval is given to open cut the pavement.

No explosives shall be used within the limits of the TxDOT highway right of way for utility installations.

2. COORDINATION OF WORK - ***Prior to the start of construction the local TxDOT Office MUST BE NOTIFIED at the number listed on the approval notice. Traffic control plans must be approved by the Area Office before work can begin.*** If the installation is within the limits of an active highway construction project, the utility work must be coordinated with the TxDOT Contractor and Inspectors. The utility work shall not cause any delay or disruption to the TxDOT contractor or construction.

Location existing utility facilities and coordination with the owners is the responsibility of the utility agency.

3. TRAFFIC SAFETY, BARRICADES, WARNING DEVICES - Traffic control and protective devices shall be used and must conform to the TEXAS MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES for streets and highways. All barricades, warning devices, signs, flashers, and flag persons shall be provided by the utility agency or contractor.

Traffic shall not be stopped at any time without the use of a flag person. Prior to beginning work, the traffic control plans must be approved by the Area Engineer or his designated representative. Lane closures for any utility work will not be permitted without prior approval of Area Engineer or his designated representative. Lane closures are not permitted during peak "rush hour" traffic times.

Vehicles, equipment, construction material and personnel not necessary to the timely installation of the facility shall be kept as far as possible from the traveling public. Any above ground obstruction or bore pit located closer than the clear zone distances outlined in the "Trench Excavation and Pit Locations" specification shall be protected by barricades, metal beam guard fence and/or concrete traffic barriers as deemed necessary by the TxDOT Inspector. At the end of every construction day, all equipment and materials shall be removed as far from the roadway edge as possible.

4. SURVEYING AND STAKING OF UTILITIES - All utility installations shall be staked by utility agency so that TxDOT may inspect the alignment prior to start of construction. The ROW line is to be staked and the utility installed based on a set distance from the ROW line. The utility is ultimately responsible for the accuracy of the installation.

5. TIME PERIOD ALLOWED FOR INSTALLATION - If the installation of the work covered by this utility permit has not started within twelve (12) months from the approval date, a written request for an extension must be submitted to the District Office. It is expected that the installation will progress to completion in an efficient manner. However, if the work is delayed or abandoned for a period of one (1) month or more, a written request must be submitted to continue under the authority of the original permit.

6. FULL TIME SUPERVISION and INSPECTION - The utility agency shall provide competent, full time inspectors or supervisors to be present on-site during the installation. Also, the utility may be required to provide a telephone number at which someone may be contacted 24 hours in case of an emergency. The utility construction may be delayed of stopped when it is observed by the TxDOT Inspector that there is not an agency inspector or supervisor present on the job site.

7. DEPARTMENT INTERVENTION - TxDOT has the right to take charge of an to remedy any immediate hazard to the traveling public when it is obvious the utility agency will not do so. Any costs associated with TxDOT's action will be charged to the utility agency.

8. UTILITY ACCOMMODATION RULES - Utility installations within the TxDOT Right of Way shall conform to the requirements contained in the TxDOT Utility Accommodation Rules, dated February 2, 2005, the Dallas District Utility Specifications and the following industry policies.

A. Safety rules for the installation and maintenance of electric and communication lines - National Electrical Safety Code.
B. Latest edition of the Rules and Regulations for Public Water Systems, published by the Texas Department of Health, Water Hygiene Division.
C. Gas Pipelines - Title 49, C.F.R., Part 195, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards and amendments.
D. Liquid Petroleum Pipelines - Title 49, C.F.R., Part 195, Transportation of Liquids by Pipelines and amendments.
E. Latest edition of the American Society for Testing and Materials (ASTM) Specifications.
F. Latest edition of the AASHTO policy entitled "A Policy on the Accommodations of Utilities within Freeway Right of Way".
G. Latest edition of the Occupational Safety and Health Administration (OSHA) Standards and Interpretations.

Trench Excavation and Pit Location

1. GENERAL - No dirt from a trench or pit excavation shall be placed on the roadway or shoulders. All equipment and stockpiled dirt shall meet the safety clear zone distances listed below or have adequate barricades and warning devices to protect the traveling public.

Topsoil shall be kept separate from other excavation material, and be replaced in accordance with "BACKFILLING" specification.

All pits and trenches shall be kept free from standing water. if trenches and/or bore pits are left open for extended periods of time without a continuous progression of work, the utility will be required to backfill the trench and/or bore pits. Any other pit will not be left open for more than a forty eight (48) hour period.

In all excavations where sloughing is likely to occur, shoring will be utilized to prevent damage to the highway structure(s). The utility agency or contractor shall be responsible for maintaining trench excavation protections as required by provisions of Part 1926, Subpart P - Excavations, Trenching and Shoring of OSHA Standards.

2. TRENCHING - Longitudinal installations must be placed as near a uniform alignment to the right of way line as possible. Trenching machine or backhoe may be used. A backhoe will be required if a uniform alignment can't be maintained by use of a trenching machine.

3. SAFETY CLEAR ZONE DISTANCES - Minimum clear zone distances required for trench excavations and bore pit locations are as follows:

For UNCURBED Highways

A. Thirty (30) ft. from the edge of pavement (traveled lane) of high-speed (more than 40 mph), high volume (more than 750 vehicles per day) highways.
B. Sixteen (16) ft* from edge of pavement of high-speed, low volume (less than 750 vehicles per day) highways.
C. Sixteen (16) ft* from ramps.
D. Ten (10) ft* for low-speed (40 mph or less) highways.
E. Ten (10) ft* for any paved intersections side streets.

* Five (5) ft MINIMUM from edge of any shoulder.

For CURBED Highways

A. Thirty (30) ft from the back of curb for high-speed highways
B. Five (5) ft from the back of curb, plus any additional distance to clear sidewalks, for low-speed highways
C. Five (5) ft from the back of curb for intersecting side street.

Backfill Specifications

1. **GENERAL** - As soon as practical, all portions of the excavation shall be backfilled. Trenches and pits shall be backfilled with the material obtained from the excavation or from other sources. Backfill material will be free from stones of such size as to interfere with compactions; free from large lumps which will not break down readily under compaction; and free from frozen lumps, wood or other extraneous material. The TxDOT inspector may reject any material containing more than twenty (20) percent by weight of material retained on a three (3) inch sieve.

   The portion of top soil removed from the original excavation shall be replaced, as nearly as feasible, in its original position.

2. **DEPTH OF LIFTS** - The portion of backfill below the top of pipe shall be placed in uniform layers not to exceed eight (8) inches in depth (loose measurement). Backfill above the top of the pipe shall be placed in layers not to exceed ten (10) inches in depth (loose measurement). If the backfill is to support a portion of roadway or embankment, then the material will be placed in uniform layers not to exceed eight (8) inches in depth (loose measurement).

3. **PROCEDURE FOR COMPACTION** - Each layer of backfill material, if dry, shall be wetted uniformly to the moisture content required to obtain a density comparable with the adjacent undisturbed soil and shall be compacted to that density by means of mechanical tampers or rammers. The use of rolling equipment of the type generally used in compacting embankments will be permitted on portions that are accessible to such equipment. Water jetting or ponding will not be permitted.

   Special care shall be taken to ensure thorough compaction of material placed under the haunches of the pipe.

   Cohesionless materials, such as sand, may be used for general backfilling purposes. Compaction of cohesionless materials shall be done with vibratory equipment.

4. **RESTORATION OF RIGHT OF WAY** - Prompt replacement of sod, removal of debris, and any other restoration necessary to restore the right of way to a condition equal to that which existed prior to the utility installation will be required. In areas of erosion, the use of stabilized backfill may be required. Should settlement or erosion occur within six (6) months of the utility installation, the utility agency will be required to reshape, reseed, and/or resod the area.

Texas Department of Transportation

Installation Application
Online version 4/2006

Notice of Proposed Installation
Utility Line On TxDOT Highway Right of Way

To the Texas Transportation Commission
c/o District Engineer
Texas Department of Transportation
Dallas District, Texas

Date 9/11/2020
Application No. DAL20200325133009

Formal notice is hereby given that North Texas Municipal Water District proposes to install a utility facility within the right-of-way of FM0549 in Rockwall County, Texas as follows: (details are shown on page 2)

Due to the continuing growth and development to the region, NTMWD is constructing an interceptor, parallel to the existing sewer main that was constructed in 2006. The proposed interceptor is at FM 549, northeast of Laurenee Drive.

The line will be constructed and maintained on the highway right-of-way as shown on the attached drawing and in accordance with the rules, regulations and policies of the Texas Department of Transportation (TxDOT), and all governing laws, including but not limited to the "Federal Clean Water Act," the "National Endangered Species Act," and the "Federal Historic Preservation Act." Upon request by TxDOT, proof of compliance with all governing laws, rules and regulations will be submitted to TxDOT before commencement of construction.

Our firm will use Best Management Practices to minimize erosion and sedimentation resulting from the proposed installation, and we will revegetate the project area as indicated under "Revegetation Special Provisions."

Our firm will ensure that traffic control measures complying with applicable portions of the Texas Manual of Uniform Traffic Control Devices will be installed and maintained for the duration of this installation.

The location and description of the proposed installation and appurtenances is more fully shown by 1 files containing drawings and other pertinent information uploaded to the website.

Construction will begin on or after August 1, 2020 and end on or before August 1, 2022 .

I certify that I am authorized to represent the Firm listed below, and that our Firm agrees to the conditions/provisions included in this notice.

Utility Installation Owner North Texas Municipal Water District
By Jeff Ray
Title
Address 505 East Brown Street
Wylie, TX 75098
Phone No. 469-626-4707
E-mail address jray@ntmwd.com

Texas Department of Transportation

Amendment Request Application
Online version 4/2006

Approved ____ **Rejected** ____

On 9/2/2020

By _____

Amendment Request #1

To : The Texas Transportation Commission
c/o District Engineer
Texas Department of Transportation
Dallas District, Texas

Date	9/2/2020
Application No.	DAL20200325133009
District App. No.	DAL20200325133009
Highway	FM 0549
Maintenance Section	Kaufman/Rockwall County Maintenance
County	Rockwall

We request to amend the proposed utility facility installation as described below:

Changed Item(s)	Old	Revised
Begin Date	8/1/2020	3/1/2021
Finish Date	8/1/2022	3/1/2022

All other requirements and provisions remain the same. If this amendment is approved, a copy will be kept at the job site at all times, along with the Notice of Proposed Installation and corresponding approval.

Utility Installation Owner	North Texas Municipal Water District
By	Jeff Ray
Title	
Address	505 East Brown Street
	Wylie, TX 75098
Phone No.	972-442-5405
E-mail address	jray@ntmwd.com

Texas Department of Transportation

Installation Application
Online version 4/2006

Notice of Proposed Installation
Utility Line On TxDOT Highway Right of Way

To the Texas Transportation Commission
c/o District Engineer
Texas Department of Transportation
Dallas District, Texas

Date 9/11/2020
Application No. DAL20200325111303

Formal notice is hereby given that North Texas Municipal Water District proposes to install a utility facility within the right-of-way of FM0550 in Rockwall County, Texas as follows: (details are shown on page 2)

Due to the continuing growth and development in the region, NTMWD is constructing an interceptor, parallel to the existing sewer main that was constructed in 2006 to serve the area. The proposed crossing is at FM 550, east of Berkshire Drive.

The line will be constructed and maintained on the highway right-of-way as shown on the attached drawing and in accordance with the rules, regulations and policies of the Texas Department of Transportation (TxDOT), and all governing laws, including but not limited to the "Federal Clean Water Act," the "National Endangered Species Act," and the "Federal Historic Preservation Act." Upon request by TxDOT, proof of compliance with all governing laws, rules and regulations will be submitted to TxDOT before commencement of construction.

Our firm will use Best Management Practices to minimize erosion and sedimentation resulting from the proposed installation, and we will revegetate the project area as indicated under "Revegetation Special Provisions."

Our firm will ensure that traffic control measures complying with applicable portions of the Texas Manual of Uniform Traffic Control Devices will be installed and maintained for the duration of this installation.

The location and description of the proposed installation and appurtenances is more fully shown by 1 files containing drawings and other pertinent information uploaded to the website.

Construction will begin on or after August 1, 2020 and end on or before August 1, 2022.

I certify that I am authorized to represent the Firm listed below, and that our Firm agrees to the conditions/provisions included in this notice.

Utility Installation Owner North Texas Municipal Water District
By Jeff Ray
Title
Address 505 East Brown Street
Wylie, TX 75098
Phone No. 469-626-4707
E-mail address jray@ntmwd.com

Texas Department of Transportation

Amendment Request Application
Online version 4/2006

Approved ____ **Rejected** ____

On 9/2/2020

By _____

Amendment Request #1

To : The Texas Transportation Commission
c/o District Engineer
Texas Department of Transportation
Dallas District, Texas

Date	9/2/2020
Application No.	DAL20200325111303
District App. No.	DAL20200325111303
Highway	FM 0550
Maintenance Section	Kaufman/Rockwall County Maintenance
County	Rockwall

We request to amend the proposed utility facility installation as described below:

Changed Item(s)	Old	Revised
Begin Date	8/1/2020	3/1/2021
Finish Date	8/1/2022	3/1/2022

All other requirements and provisions remain the same. If this amendment is approved, a copy will be kept at the job site at all times, along with the Notice of Proposed Installation and corresponding approval.

Utility Installation Owner	North Texas Municipal Water District
By	Jeff Ray
Title	
Address	505 East Brown Street Wylie, TX 75098
Phone No.	972-442-5405
E-mail address	jray@ntmwd.com

Appendix G

Texas Historical Commission – Buffalo Creek

Gulihur, Caitlin A

From: noreply@thc.state.tx.us
Sent: Tuesday, June 23, 2020 8:47 AM
To: Gulihur, Caitlin A; reviews@thc.state.tx.us; james.e.barrera@usace.army.mil
Subject: Project Review: 202013435

TEXAS HISTORICAL COMMISSION
real places telling real stories

Re: Project Review under Section 106 of the National Historic Preservation Act and/or the Antiquities Code of Texas Permit 8789
THC Tracking #202013435
Buffalo Creek Parallel Interceptor, Phase I
Horizon Road
Rockwall,TX 75032

Dear Caitlin Gulihur:
Thank you for your submittal regarding the above-referenced project. This response represents the comments of the State Historic Preservation Officer, the Executive Director of the Texas Historical Commission (THC), pursuant to review under Section 106 of the National Historic Preservation Act and the Antiquities Code of Texas.

The review staff led by Rebecca Shelton and Caitlin Brashear has completed its review and has made the following determinations based on the information submitted for review:

Above-Ground Resources

- No historic properties are present or affected by the project as proposed. However, if historic properties are discovered or unanticipated effects on historic properties are found, work should cease in the immediate area; work can continue where no historic properties are present. Please contact the THC's History Programs Division at 512-463-5853 to consult on further actions that may be necessary to protect historic properties.

Archeology Comments

- No identified historic properties, archeological sites, or other cultural resources are present or affected. However, if cultural materials are encountered during project activities, work should cease in the immediate area; work can continue where no cultural materials are present. Please contact the THC's Archeology Division at 512-463-6096 to consult on further actions that may be necessary to protect the cultural remains.
- This draft report is acceptable. Please submit a final report: one restricted version with any site location information (if applicable), and one public version with all site location information redacted. To facilitate review and make project information and final reports available through the Texas Archeological Sites Atlas, we appreciate submitting abstracts online at http://xapps.thc.state.tx.us/Abstract and e-mailing survey area shapefiles to archeological_projects@thc.texas.gov if this has not already occurred. Please note that these steps are required for projects conducted under a Texas Antiquities Permit.

We look forward to further consultation with your office and hope to maintain a partnership that will foster effective historic preservation. Thank you for your cooperation in this review process, and for your efforts to preserve the

irreplaceable heritage of Texas. If you have any questions concerning our review or if we can be of further assistance, please email the following reviewers: rebecca.shelton@thc.texas.gov, caitlin.brashear@thc.texas.gov

This response has been sent through the electronic THC review and compliance system (eTRAC). Submitting your project via eTRAC eliminates mailing delays and allows you to check the status of the review, receive an electronic response, and generate reports on your submissions. For more information, visit http://thc.texas.gov/etrac-system.

Sincerely,

For Mark Wolfe, State Historic Preservation Officer
Executive Director, Texas Historical Commission

Please do not respond to this email.

cc: james.e.barrera@usace.army.mil

Appendix H

ONCOR Encroachment Agreement

ENCROACHMENT ON EASEMENT

WHEREAS, **Oncor Electric Delivery Company LLC** (**"Oncor"**), is the owner of an easement in Rockwall County, Texas, which is recorded in Volume 69, Page 37 of the Deed Records of Rockwall County, Texas ("**Easement**"); and

WHEREAS, **North Texas Municipal Water District** ("**User**"), desires permission to construct, operate and maintain access for a forty-eight (48) inch sewer interceptor crossing ("**Encroaching Facility**") within the area or boundaries of the Easement ("**Easement Area**").

NOW, THEREFORE, in consideration of the mutual covenants contained herein, and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, Oncor and User do hereby agree as follows:

1. **Location of Encroaching Facility**. User may locate the Encroaching Facility in the Easement Area, but only as described and shown on the attached drawing marked **Exhibit "A"** and incorporated herein. User may not relocate the Encroaching Facility within the Easement Area without the consent and approval of Oncor, which consent and approval shall be at Oncor's sole discretion. User acknowledges and agrees that Oncor holds easement rights on the Easement Area; therefore, User shall obtain whatever rights and permission, other than Oncor's, that are necessary.

2. **Restrictions on Use of Easement Area**. User shall use only so much of the Easement Area as may be necessary to construct, maintain and repair the Encroaching Facility. User shall, at its own cost and expense, comply with all applicable laws, including but not limited to existing zoning ordinances, governmental rules and regulations enacted or promulgated by any governmental authority and shall promptly execute and fulfill all orders and requirements imposed by such governmental authorities for the correction, prevention and abatement of nuisances in or upon or connected with said Encroaching Facility. At the conclusion of any construction, User shall remove all debris and other materials from the Easement Area and restore the Easement Area to the same condition it was in prior to the commencement of User's construction thereon or in proximity thereto.

User shall not place trash dumpsters, toxic substances or flammable material in the Easement Area. Further, if the Easement Area has transmission or distribution facilities located thereon, User shall not place upon the Easement Area any improvements, including but not limited to, buildings, light standards, fences (excluding barriers installed around transmission towers, if applicable), shrubs, trees or signs unless approved in advance in writing by Oncor. Additional general construction limitations on encroachments are described and listed in **Exhibit "B"**, attached hereto and by reference made a part hereof.

3. **Maintenance of Encroaching Facility**. User, at User's sole expense, shall maintain and operate the Encroaching Facility. Oncor will not be responsible for any costs of construction, reconstruction, operation, maintenance or removal of User's Encroaching Facility.

4. **Risk and Liability**. User assumes all risks and liability resulting or arising from or relating to User's use, the existing condition or location, or existing state of maintenance, repair or operation of the Easement Area. It is further agreed that Oncor shall not be liable for any damage to the Encroaching Facility as a result of Oncor's use or enjoyment of its Easement. Any Oncor property damaged or destroyed by User or its agents, employees, invitees, contractors or subcontractors shall be repaired or replaced by Oncor at User's expense and payment is due upon User's receipt of an invoice from Oncor.

5. **Indemnification**. User agrees to defend, indemnify and hold harmless Oncor, its officers, agents and employees from and against any and all claims, demands, causes of action, loss, damage, liabilities, costs and expenses (including attorney's fees and court costs) of any and every kind or character, known or unknown, fixed or contingent, for personal injury (including death), property damage or other harm for which recovery of damages is sought or suffered by any person or persons, including claims based on strict liability, arising out of or in connection with User's actions or omissions or the actions or omissions of its officers, agents, associates, employees, contractors or subcontractors or the actions or omissions of any other person entering onto the Easement Area or the Encroaching Facility.

6. **High Voltage Restrictions**. Use of draglines or other boom-type equipment in connection with any work to be performed on the Easement Area by User, its employees, agents, invitees, contractors or subcontractors must comply with Chapter 752, Texas Health and Safety Code, the National Electric Safety Code and any other applicable safety or clearance requirements. Notwithstanding anything to the contrary herein, in no event shall any equipment be within fifteen (15) feet of the Oncor 138,000 volt or less power lines or within twenty (20) feet of the Oncor 345,000 volt power lines situated on the aforesaid property. User must notify the **Region Transmission Office at (972)564-7050** 48 hours prior to the beginning of any work on the Easement Area.

7. **Removal by Oncor**. If at any time in the future, the Encroaching Facility, in the sole judgment of Oncor, interferes with Oncor's use or enjoyment of its easement rights. Oncor shall work with User to determine a plan for the removal and relocation of the Encroaching Facility. Oncor shall notify User in writing that within 360 days the Encroaching Facility must be removed at User's sole cost. Oncor will not be responsible nor will compensation be paid for damages incurred by such removal. If the Encroaching Facility is removed, Oncor will not unreasonably withhold consent for User to relocate the Encroaching Facility within the Easement Area.

8. **Default and Termination**. It is understood and agreed that, in case of default by User or its agents in any of the terms and conditions herein stated and such default continues for a period of ten (**10**) days after Oncor notifies User of such default in writing, Oncor may at its election forthwith terminate this agreement and upon such termination all of User's rights hereunder shall cease and come to an end. This agreement shall also terminate upon the abandonment of the Encroaching Facility.

This agreement shall extend to and be binding upon User and its successors and assigns, and is not to be interpreted as a waiver of any rights held by Oncor under its Easement.

Executed this 11th day of June, 2020.

Oncor Electric Delivery Company LLC

By: _____

~~Dennis L. Patton~~ Jill L. Alvarez, P.E.
Attorney-In-Fact

North Texas Municipal Water District

By: _____

Name: MARK A SIMON

Title: ASST. DEPUTY ENGINEERING

STATE OF TEXAS §
§
COUNTY OF _____ §

BEFORE ME, the undersigned authority, on this day personally appeared _____, as the _____ of _____, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he/she executed the same for the purposes and consideration therein expressed, in the capacity therein stated and he/she is authorized to do so.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this _____ day of _____, A. D. 2020.

_____
Notary Public in and for the State of Texas

STATE OF TEXAS §
§
COUNTY OF TARRANT §

BEFORE ME, the undersigned authority, on this day personally appeared Jill L. Alvarez, as the Attorney-In-Fact of **Oncor Electric Delivery Company LLC**, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed, in the capacity therein stated and he is authorized to do so.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this 11th day of JUNE, A. D. 2020.

LARA S. DALE
Notary Public, State of Texas
Comm. Expires 03-11-2023
Notary ID 128354804

Lara S. Dale
Notary Public in and for the State of Texas

STATE OF TEXAS §
§
COUNTY OF Collin §

BEFORE ME, the undersigned authority, on this day personally appeared Mark Simon, as the Asst. Deputy Engineering of NTMWD, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he/she executed the same for the purposes and consideration therein expressed, in the capacity therein stated and he/she is authorized to do so.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this 1 day of June, A. D. 2020.

Maria G. Martinez
Notary Public in and for the State of Texas

STATE OF TEXAS §
§
COUNTY OF TARRANT §

MARIA GUADALUPE MARTINEZ
Notary Public, State of Texas
Comm. Expires 06-05-2021
Notary ID 129108883

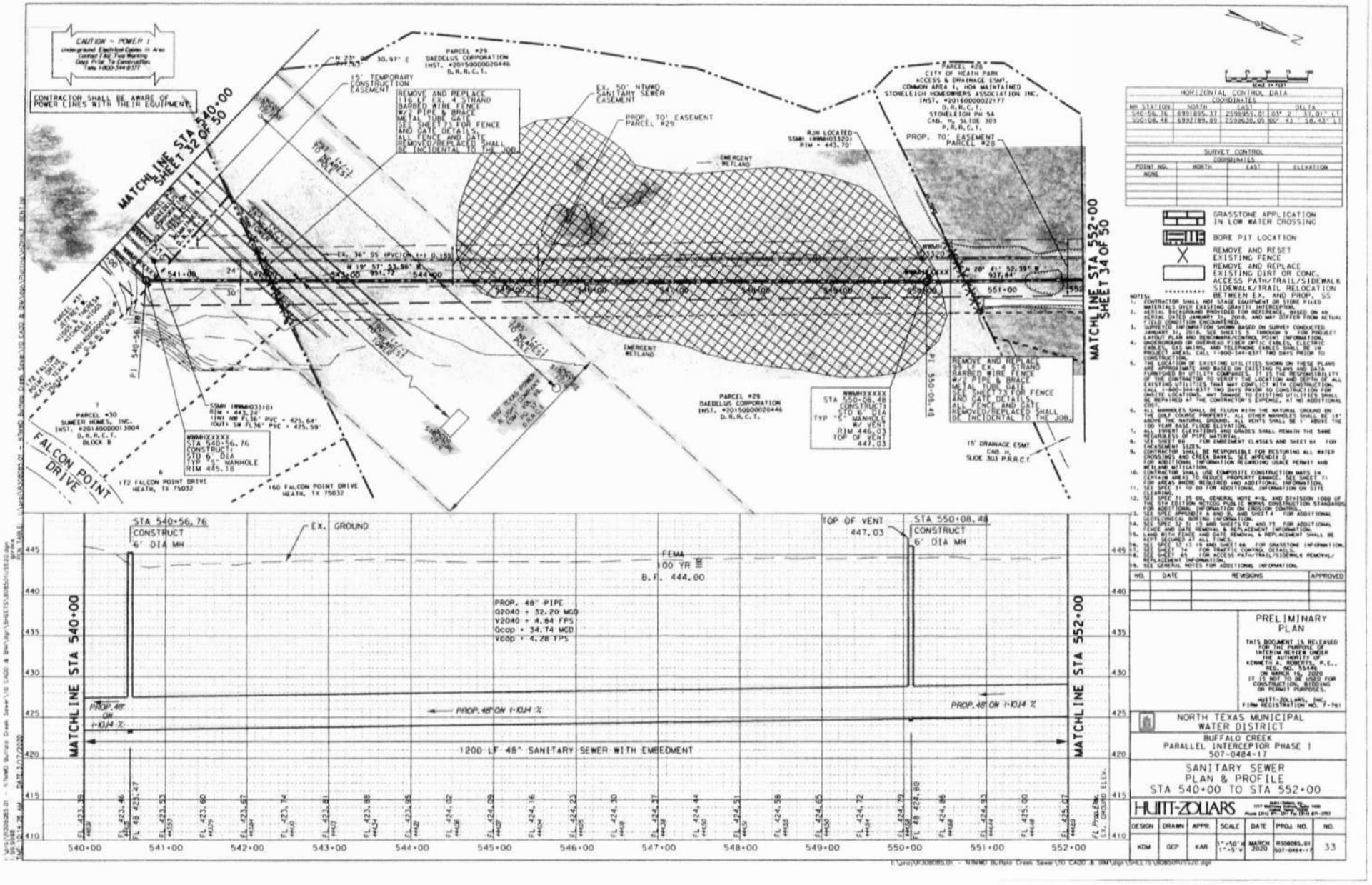
BEFORE ME, the undersigned authority, on this day personally appeared Dennis L. Patton, as the Attorney-In-Fact of **Oncor Electric Delivery Company LLC**, known to me to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that he executed the same for the purposes and consideration therein expressed, in the capacity therein stated and he is authorized to do so.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this 1 day of June, A. D. 2020.

Maria G. Martinez
Notary Public in and for the State of Texas

Encroachment on Easement

Exhibit A



HORIZONTAL CONTROL DATA
COORDINATES

NH STATION	NORTH	EAST	DELTA
540+56.76	6891895.37	2698955.01	03° 2' 31.01" LT
550+08.48	6892789.89	2698630.05	00° 43' 56.43" LT

SURVEY CONTROL
COORDINATES

POINT NO.	NORTH	EAST	ELEVATION
NONE			

GRASSTONE APPLICATION IN LOW WATER CROSSING

BORE PIT LOCATION

REMOVE AND RESET EXISTING FENCE

REMOVE AND REPLACE EXISTING DIRT OR CONC. ACCESS PATH/TRAIL/SIDEWALK

SIDEWALK/TRAIL RELOCATION BETWEEN EX. AND PROP. SS

NOTES:
1. CONTRACTOR SHALL NOT STAGE EQUIPMENT OR STORE PIPE MATERIALS OVER EXISTING GRAVITY INTERCEPTOR.
2. AERIAL BACKGROUND PROVIDED FOR REFERENCE ONLY, BASED ON AN AERIAL DATED JANUARY 31, 2018, AND MAY DIFFER FROM ACTUAL FIELD CONDITIONS ENCOUNTERED.
3. SURVEYED INFORMATION SHOWN BASED ON SURVEY CONDUCTED JANUARY 12th, 2018. SEE SHEETS 2 THROUGH 5 FOR PROJECT LAYOUT PLAN AND BENCHMARK/CONTROL POINT INFORMATION.
4. UNDERGROUND OR OVERHEAD PIPES OR CABLES, ELECTRIC (CABLES CAN MARK), AND TELEPHONE CABLES SHALL BE TO BE LOCATED BY TEXAS 811. CALL 1-800-344-8377 TWO DAYS PRIOR TO CONSTRUCTION.
5. THE LOCATIONS OF EXISTING UTILITIES (EU) SHOWN ON THESE PLANS ARE APPROXIMATE AND BASED ON EXISTING PLANS AND DATA FURNISHED BY UTILITY COMPANIES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND DEPTH OF ALL EXISTING UTILITIES THAT MAY CONFLICT WITH CONSTRUCTION. CALL 1-800-344-8377 TWO DAYS PRIOR TO CONSTRUCTION FOR UNMARKED LOCATIONS, ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, AT NO ADDITIONAL COST.
6. ALL MANHOLES SHALL BE FLUSH WITH THE NATURAL GROUND ON ALL GOLF COURSE PROPERTY. ALL OTHER MANHOLES SHALL BE 18" ABOVE THE NATURAL GROUND. ALL VENTS SHALL BE 1' ABOVE THE 100 YEAR BASE FLOOD ELEVATION.
7. ALL SWEET EXTENTIONS AND GRADES SHALL REMAIN THE SAME REGARDLESS OF PIPE MATERIAL.
8. SEE SHEET 61 FOR EMBEDMENT CLASSES AND SHEET 61 FOR EMBEDMENT TABLE.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORING ALL WATER CROSSING AND CREEK BANKS. SEE APPENDIX E FOR ADDITIONAL INFORMATION REGARDING USACE PERMIT AND WETLAND MITIGATION.
10. CONTRACTOR SHALL USE COMPOSITE CONSTRUCTION MATS IN CERTAIN AREAS TO REDUCE PROPERTY DAMAGE. SEE SHEET 71 FOR AREAS WHERE REQUIRED AND ADDITIONAL INFORMATION.
11. SEE SPEC 31 10 00 FOR ADDITIONAL INFORMATION ON SITE CLEARING.
12. SEE SPEC 01 25 00, GENERAL NOTE #16, AND DIVISION 1000 OF THE 5TH EDITION NCTCOG PUBLIC WORKS CONSTRUCTION STANDARDS FOR ADDITIONAL INFORMATION ON EROSION CONTROL.
13. SEE SPEC APPENDIX A AND B, AND SHEET 4 FOR ADDITIONAL GEOTECHNICAL BORING INFORMATION.
14. SEE SPEC 32 31 13 AND SHEETS 72 AND 73 FOR ADDITIONAL FENCE AND GATE REMOVAL & REPLACEMENT INFORMATION.
15. ANY AND WITH FENCE AND GATE REMOVAL & REPLACEMENT SHALL BE KEPT SECURED AT ALL TIMES.
16. SEE SPEC 32 31 13 AND SHEETS 72 AND 73 FOR ADDITIONAL FENCE AND GATE REMOVAL & REPLACEMENT INFORMATION.
17. SEE SHEET 66 FOR GRASSTONE INFORMATION.
18. SEE SHEET 54 FOR TRAFFIC CONTROL DETAILS.
19. SEE SHEET 65 FOR ACCESS PATH/TRAIL/SIDEWALK REMOVAL/REPLACEMENT INFORMATION.
20. SEE GENERAL NOTES FOR ADDITIONAL INFORMATION.

NO.	DATE	REVISIONS	APPROVED

PRELIMINARY PLAN

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF KENNETH A. ROBERTS, P.E., REG. NO. 55445 ON MARCH 19, 2020 IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

HUITT-ZOLLARS, INC. F-(Firm Registration No. 7-761)

NORTH TEXAS MUNICIPAL WATER DISTRICT

BUFFALO CREEK PARALLEL INTERCEPTOR PHASE 1
507-0484-17

SANITARY SEWER PLAN & PROFILE STA 540+00 TO STA 552+00

HUITT-ZOLLARS

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJ. NO.	NO.
KDM	GCP	KAR	1"=50' H 1"=5' V	MARCH 2020	R308085.01 507-0484-17	33

CONSTRUCTION LIMITATIONS ON

Oncor ELECTRIC DELIVERY COMPANY RIGHT OF WAY

EXHIBIT "B"

1. You are notified, and should advise your employees, representatives, agents, and contractors, who enter the property that they will be working in the vicinity of high voltage electrical facilities and should take proper precautions, included but not limited to the following stipulations and in compliance, at all times, with Chapter 752, V.T.C.A., Health & Safety Code.

2. Blasting is not to be permitted on Oncor right-of-way or under Oncor lines.

3. Construction on electric transmission line easements acquired by Oncor after January 1, 2003 shall comply with the requirements of Public Utility Commission Substantive Rules §25.101, as amended from time to time.

4. No crossing less than 45 degrees to the centerline of the right-of-way.

5. Grading will be done in order to leave the right-of-way as near as possible to present condition. Spoil dirt will be removed from the right-of-way and no trash is to be left on right-of-way. Slopes shall be graded so that trucks can go down the right-of-way when required and such that the slopes can be mechanically maintained.

6. Equipment and materials will not be stored on the right-of-way during construction without written approval of the Supervisor of Regional Transmission.

7. Street or road crossings are to be based on drawings submitted. Any change in alignment or elevation will be resubmitted for approval.

8. No signs, lights or guard lights will be permitted on the right-of-way.

9. Power line safety equipment operations: hazard assessment and precautions inside the work zone area must be performed and in compliance with OSHA Standard §1926.1408 at all times. Equipment shall not be placed within fifteen (15) feet of the Oncor 138,000 volt or less power lines or within twenty (20) feet of the Oncor 345,000 volt power lines.

10. Any pre-approved fencing will not exceed eight (8) feet in height, and if metal in nature, will be grounded, at ten (10) feet intervals, with an appropriate driven ground. Gates should be at least sixteen (16) feet in width to allow Oncor access to the right-of-way.

11. No dumpsters will be allowed on Oncor right-of-way or fee owned property.

12. Draglines will not be used under the line or on Oncor right-of-way.

13. The existing grade shall not be disturbed, excavated or filled within 25 feet of the nearest edge of any Oncor transmission structure (tower, pole, guy wire, etc...).

14. Right-of-way will be protected from washing and erosion by Oncor approved method before any permits are granted. No discharging of water will be allowed within any portion of the right of way. Drainage facilitation will not be allowed to discharge into/onto Oncor right-of-way.

15. No obstruction shall be installed on the right-of-way that would interfere with access to Oncor structures or prevent mechanical maintenance.

16. Before any work is done under Oncor lines or by Oncor structures notify the Region Transmission Department, (972)564-7050.

17. No hazardous materials will be stored on the right of way.

18. For purposes of this document, "Hazardous Materials" means and includes those substances, including, without limitation, asbestos-containing material containing more than one percent (1%) asbestos by weight, or the group of organic compounds known as polychlorinated biphenyls, flammable explosives, radioactive materials, chemicals known to cause cancer or reproductive toxicity and includes any items included in the definition of hazardous or toxic waste, materials or substances under any Hazardous Material Law. "Hazardous Material Laws" collectively means and includes any present and future local, state and federal law relating to the environment and environmental conditions including, without limitation, the Resource Conservation and Recovery Act of 1976 ("RCRA"), 42 U.S.C. §6901 et seq., the Comprehensive Environmental Response, Compensation and Liability Act of 1980, ("CERCLA"), 42 U.S.C. §§9601-9657, as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA"), the Hazardous Material Transportation Act, 49 U.S.C.

§6901 et seq., the Federal Water Pollution Control Act, 33 U.S.C. §1251, et seq., the Clean Air Act, 42 U.S.C. §741 et seq., the Clean Water Act, 33 U.S.C. §7401 et seq., the Toxic Substances Control Act, 15 U.S.C. §§2601-2629, the Safe Drinking Water Act, 42 U.S.C. §§300f-330j, and all the regulations, orders, and decrees now or hereafter promulgated thereunder.

19. Brush and cut timber is not to be piled or stacked on Oncor right-of-way nor is it allowed to be burned upon or in close proximity to the conductors or towers.

20. No structures or obstructions, such as buildings, garages, barns, sheds, swimming pools, playground equipment, guard houses, etc., will be permitted on the right-of-way.

21. Landscaping on Oncor right-of-way is permitted when Oncor approves landscaping plans in writing. No lighting or sprinkler systems are allowed on the right-of-way.

22. No park or park designation will be permitted on the right-of-way.

23. Gas Pipeline Protective Barrier; Grantee, at Grantee's sole expense, shall provide one of the following protective barriers; **1)** a concrete protective barrier between the surface and the pipe that is a minimum of one (1) foot thick by one (1) foot wide, if pipe is wider than one (1) foot, then width of pipe, with the top of the concrete barrier to be at least one (1) foot below the surface or final grade, **2)** construct the gas pipeline inside of a proper protective steel casing, **3)** where electric facilities are located above ground, install the pipeline a minimum of ten (10) feet below the ground surface, or **4)** where electric facilities are located below ground, install the pipeline at a depth that provides for a minimum of a ten (10) foot clearance between the pipeline and the underground electric facilities.

24. No fire hydrants or manholes will be permitted within the right-of-way.

25. Any drainage feature that allows water to pond, causes erosion, directs stormwater toward the right-of-way or limits access to or around Oncor's facilities is prohibited. Drainage facilitation will not be allowed to discharge into/onto Oncor right-of-way.

26. No boring pits or other type of pits will be permitted within the right-of-way.

Appendix I

Wetlands Management Agreement

MITIGATION CREDIT SALES AGREEMENT

This Mitigation Credit Sales Agreement (the "Agreement") is entered into by and between Wetlands Management, L.P., a Texas limited partnership ("Wetlands"), and North Texas Municipal Water District, (the "Purchaser").

RECITALS:

A. This Agreement is entered into pursuant to that certain Mitigation Banking Instrument Agreement dated April 30, 2008, (the "MBI") between, among others, Wetlands Management, L.P., a Texas limited partnership ("Wetlands"), as the sponsor, and the U.S. Army Corp of Engineers ("USACE") which established the Bunker Sands Mitigation Bank (BSMB) under Permit Number SWF-2004-00420 (the "Bank").

B. Pursuant to the terms of the MBI, Wetlands intends to develop, restore, enhance, create and preserve wetlands, and open water habitat on certain real property described in the MBI in exchange for mitigation bank credits authorized by USACE (the "Credits").

C. The Purchaser is developing certain real property, and in conjunction with such development, USACE has required that the Purchaser provide off-site wetland mitigation to compensate for impacts to USACE jurisdictional wetlands.

D. The Purchaser desires to purchase 2.1 credits (the "Credits") to satisfy the Purchaser's mitigation obligation for permanent impacts to 1.65 acres of medium quality wetlands and temporary impacts to 1.17 acres of low-quality wetlands habitat. The Purchaser's Permit Number is SWF-2019-00031.

AGREEMENT:

NOW, THEREFORE, for good and valuable consideration described in this Agreement, the receipt and sufficiency of which are hereby acknowledged, the Purchaser and Wetlands agree as follows:

1. Sale of the Credits. Wetlands hereby agrees to sell and assign, and does hereby sell, assign, transfer and convey to the Purchaser, and the Purchaser hereby agrees to purchase and accept, and does hereby purchase, accept, acquire and receive from Wetlands, 2.1 credits (the "Credits").

2. Payment for Credits. In consideration of the delivery of the Credits, the Purchaser agrees to pay to Wetlands the sum of Sixty-Eight Thousand Four Hundred Dollars and No/100 ($68,400.00) for all of the Credits purchased pursuant to this Agreement.

3. Representations.

(a) Representations of Wetlands. Wetlands represents to the Purchaser the following:

(i.) The Credits are free and clear of all liens, pledges, security interests or other encumbrances other than those imposed by the MBI;
(ii.) Wetlands has duly taken all action necessary to authorize its execution and delivery of this Agreement and to authorize the consummation and performance of the transactions contemplated by this Agreement;
(iii.) Wetlands shall issue to Purchaser such documentation as is required by USACE to show the purchase of 2.1 Credits was consummated by Purchaser in accordance with the MBI;
(iv.) this Agreement, and all other agreements executed in connection with this Agreement, are the legal, valid and binding obligations of Wetlands, enforceable in accordance with their terms except as such enforcement may be limited by bankruptcy, insolvency or similar laws of general application relating to the enforcement of creditors' rights; and
(v.) Wetlands is operating and will continue to operate the Bank in accordance with all applicable USACE laws, regulations, orders, permit requirements, agreements and guidance, including, without limitation, the MBI and Permit Number SWF-2004-00420.

Other than as expressly set forth above, Wetlands does not make any representations or warranties to Purchaser, including, without limitation, the suitability of the Credits or whether or not the Credits will satisfy, in whole or part, any mitigation obligation of the Purchaser.

(b) Representations of Purchaser. The Purchaser represents to Wetlands the following:

(i.) The Purchaser has duly taken all action necessary to authorize its execution and delivery of this Agreement and to authorize the consummation and performance of the transactions contemplated by this Agreement; and
(ii.) This Agreement, and all other agreements executed in connection with this Agreement, are the legal, valid and binding obligations of the Purchaser, enforceable in accordance with their terms except as such enforcement may be limited by bankruptcy, insolvency or similar laws of general application relating to the enforcement of creditors' rights.

Other than as expressly set forth above, Purchaser does not make any representations or warranties to Wetlands.

4. Confidentiality. The Purchaser shall keep absolutely confidential the existence of this Agreement, its terms, and all information regarding the MBI, Wetlands, the Credits and the Bank that the Purchaser learned, was provided or was otherwise disclosed to Purchaser in connection with the negotiation, execution and consummation of this Agreement, except for the disclosure of those items that are already in the public domain, where disclosure is otherwise required by law, or the disclosure is approved by Wetlands in writing.

5. Notices. Notices or other communications under this Agreement by either party to the other shall be given or delivered sufficiently if they are in writing and are delivered personally, or are dispatched by registered or certified mail, postage pre-paid, or facsimile, addressed or delivered to the other party as set forth on the signature pages to this Agreement.

6. Binding Agreement; Assignment. This Agreement, and its benefits and obligations, shall inure to and bind the respective heirs, executors, administrators, successors and assigns of the parties hereto. This Agreement may not be assigned by Wetlands or the Purchaser without the written consent of the other.

7. Attorney's Fees. If there is a dispute between the Purchaser and Wetlands under this Agreement, the prevailing party shall be entitled to recover all costs incurred, including reasonable attorney's fees, paralegal's fees and appellate and post-judgment proceedings and all costs thereof.

8. Final Agreement. This Agreement embodies the whole agreement of the Purchaser and Wetlands. This Agreement shall supersede all previous communications, discussions, representations, advertisements, proposals or agreements either verbal or written, between the Purchaser and Wetlands not otherwise contained in this Agreement.

9. Captions. The captions in this Agreement are included for convenience only and shall be given no legal effect whatsoever.

10. Modification. This Agreement may not be modified except by written instrument executed by both the Purchaser and Wetlands.

11. Choice of Laws: Venue. This Agreement shall be governed by the laws of the State of Texas, and the venue for all disputes with respect to this Agreement shall be in Dallas, Dallas County, Texas.

12. Partial Invalidity. Should any part of this Agreement be rendered void, invalid or unenforceable by any court of law for any reason, such a determination shall not render void, invalid or unenforceable any other part of this Agreement, provided, however, that the parties receive the full consideration bargained for hereunder.

13. Counterparts. This Agreement may be executed in multiple counterparts, each of which shall constitute an original, and all of which shall constitute one and the same agreement.

(the remainder of this page intentionally left blank)

IN WITNESS WHEREOF, the Purchaser and Wetlands have executed this Agreement effective for all purposes as of the _____ day of _____, 2020.

WETLANDS:

WETLANDS MANAGEMENT, L.P.

DocuSigned by:
John M. Dziminski
F47BB0CA7173471...

By:_____
John M. Dziminski
Its: President

Address: 2101 Cedar Springs Road
Suite 1600
Dallas, TX 75201

Telephone: 214-849-9144

THE PURCHASER:

North Texas Municipal Water District

DocuSigned by:
Cesar Baptista
A2FBFFB3035E404...

By: _____
Name: Cesar Baptista
Title: Deputy Director

Address: 501 E. Brown Street
P.O. Box 2408
Wylie, TX 75098

Telephone: 972-442-5405

Wetlands Management, L.P.

Attn: John Dziminski
2101 Cedar Springs Road, Suite 1600
Dallas, Texas 75201

Phone 214-849-9145 Fax 214-849-9194

INVOICE #020420
DATE: FEBRUARY 4, 2020

TO:

North Texas Municipal Water District
501 E. Brown Street
P.O. Box 2408
Wylie, TX 75098

FOR:

SWF-2019-00031
484 Buffalo Creek Parallel Interceptor, Phase 1

DESCRIPTION		Total	AMOUNT Due
2.1 Mitigation Credits Payment due upon execution of the Mitigation Credit Sales Agreement.			$68,400.00
		TOTAL	$68,400.00

Wetlands Management, L.P. – Tax I.D. #20-1440600

Appendix J

ATMOS Gas Encroachment Agreement – Sta. 600+00 to 624+00

Brouwer, Darwin

From: Stewart, Jacob H <Jacob.Stewart@atmosenergy.com>
Sent: Monday, June 29, 2020 1:06 PM
To: Ho, John
Subject: FW: 484 Buffalo Creek Parallel Interceptor Phase 1
Attachments: ATMOS Encroachment App Executed 4.pdf; ATMOS Encroachment App Executed 5.pdf

Mr. Ho,

Please see the informal response from our engineering team allowing you to move forward with your water line crossing.

Please let me know if you have any questions or concerns.

Thank you,

Jacob Stewart

Jacob Stewart, Right of Way Agent 1, Atmos Energy Corporation, 214-206-2616,Jacob.Stewart@atmosenergy.com

---

From: Snell, Hannah
Sent: Thursday, June 11, 2020 2:43 PM
To: Stewart, Jacob H
Subject: RE: 484 Buffalo Creek Parallel Interceptor Phase 1

Jacob,
After reviewing these plans and performing load calculations, I am good with this crossing.
Please see my informal response below:

Because the North Texas Municipal Water District is meeting our minimum 24" separation and crossing below our gas line at a 90 degree angle, engineering has approved the proposed crossing as shown in attached drawings and from your email dated 6/2/2020.
If the design of the water line is modified, they will need to provide me with updated drawings before construction.
The contact info for our Damage Prevention Specialist is Justin Kirk and can be reached at 469-261-2133.
Let me know if you have any other questions.

Thanks,

Hannah Snell, P.E.
469-994-8630

From: Ostrovich, Ed <Ed.Ostrovich@atmosenergy.com>
Sent: Tuesday, June 2, 2020 10:59 AM
To: Snell, Hannah <Hannah.Snell@atmosenergy.com>
Cc: Stewart, Jacob H <Jacob.Stewart@atmosenergy.com>
Subject: FW: 484 Buffalo Creek Parallel Interceptor Phase 1

Hannah, please handle. Thanks.

Ed Ostrovich
214-206-2715

From: Stewart, Jacob H <Jacob.Stewart@atmosenergy.com>
Sent: Tuesday, June 2, 2020 10:42 AM
To: Ostrovich, Ed <Ed.Ostrovich@atmosenergy.com>
Subject: FW: 484 Buffalo Creek Parallel Interceptor Phase 1

Good Morning Mr. Ostrovich,

Please assign this project for review. Water district is looking to cross us with a pipeline. All we will need is a letter of approval. This project is in Heath, Tx, crossing line D17 near fm 549. Please let me know if you have any questions or concerns.

Thank you,

Jacob Stewart

Jacob Stewart, Right of Way Agent 1, Atmos Energy Corporation, 214-206-2616,Jacob.Stewart@atmosenergy.com

---

From: Winn, Toby E <Toby.Winn@atmosenergy.com>
Sent: Tuesday, April 28, 2020 11:08 AM
To: Stewart, Jacob H <Jacob.Stewart@atmosenergy.com>
Cc: Wright, Chad D <Chad.Wright@atmosenergy.com>; Conley, Hayden <Hayden.Conley@atmosenergy.com>
Subject: Fwd: 484 Buffalo Creek Parallel Interceptor Phase 1

Jacob,

Please handle!

Toby Winn
Operations Supervisor- Right or Way
469-475-4521

Sent from my iPhone

Begin forwarded message:

> **From:** "Conley, Hayden" <Hayden.Conley@atmosenergy.com>
> **Date:** April 28, 2020 at 8:47:35 AM CDT
> **To:** "Stewart, Jacob H" <Jacob.Stewart@atmosenergy.com>, "Wright, Chad D" <Chad.Wright@atmosenergy.com>
> **Cc:** "Robinson, LJ J" <LJ.Robinson@atmosenergy.com>, "Winn, Toby E" <Toby.Winn@atmosenergy.com>
> **Subject: FW: 484 Buffalo Creek Parallel Interceptor Phase 1**
>
> Good Morning Jacob and Chad,

This project will be in your region right by Heath, TX. It looks like it will be a simple letter of approval, I just asked the developer to add the clearance distance on the plans so it is more clear.

Attached is everything I have on this, it was sent to me yesterday by someone over at NTMWD.

Thanks,

Hayden Conley | Right of Way Agent 1 | Atmos Energy Corporation | 214-206-2735 O | 214-536-0187 C | Hayden.conley@atmosenergy.com

---

From: Conley, Hayden
Sent: Tuesday, April 28, 2020 8:43 AM
To: Ho, John <jho@Huitt-Zollars.com>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>; Proce, Gabriela <gproce@Huitt-Zollars.com>; Sharon M. Miller <smiller@NTMWD.COM>; Robinson, LJ J <LJ.Robinson@atmosenergy.com>
Subject: RE: 484 Buffalo Creek Parallel Interceptor Phase 1

Good Morning John,

Thank you for sending that over. It looks like everything is meeting Atmos Guidelines. I will ask that you include the separation ft. between the bottom of the Atmos Gas line/s and the top of the newly installed pipe.

Thank you,

Hayden Conley | Right of Way Agent 1 | Atmos Energy Corporation | 214-206-2735 O | 214-536-0187 C | Hayden.conley@atmosenergy.com

---

From: Ho, John <jho@Huitt-Zollars.com>
Sent: Monday, April 27, 2020 11:59 AM
To: Conley, Hayden <Hayden.Conley@atmosenergy.com>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>; Proce, Gabriela <gproce@Huitt-Zollars.com>; Sharon M. Miller <smiller@NTMWD.COM>
Subject: [EXT] 484 Buffalo Creek Parallel Interceptor Phase 1

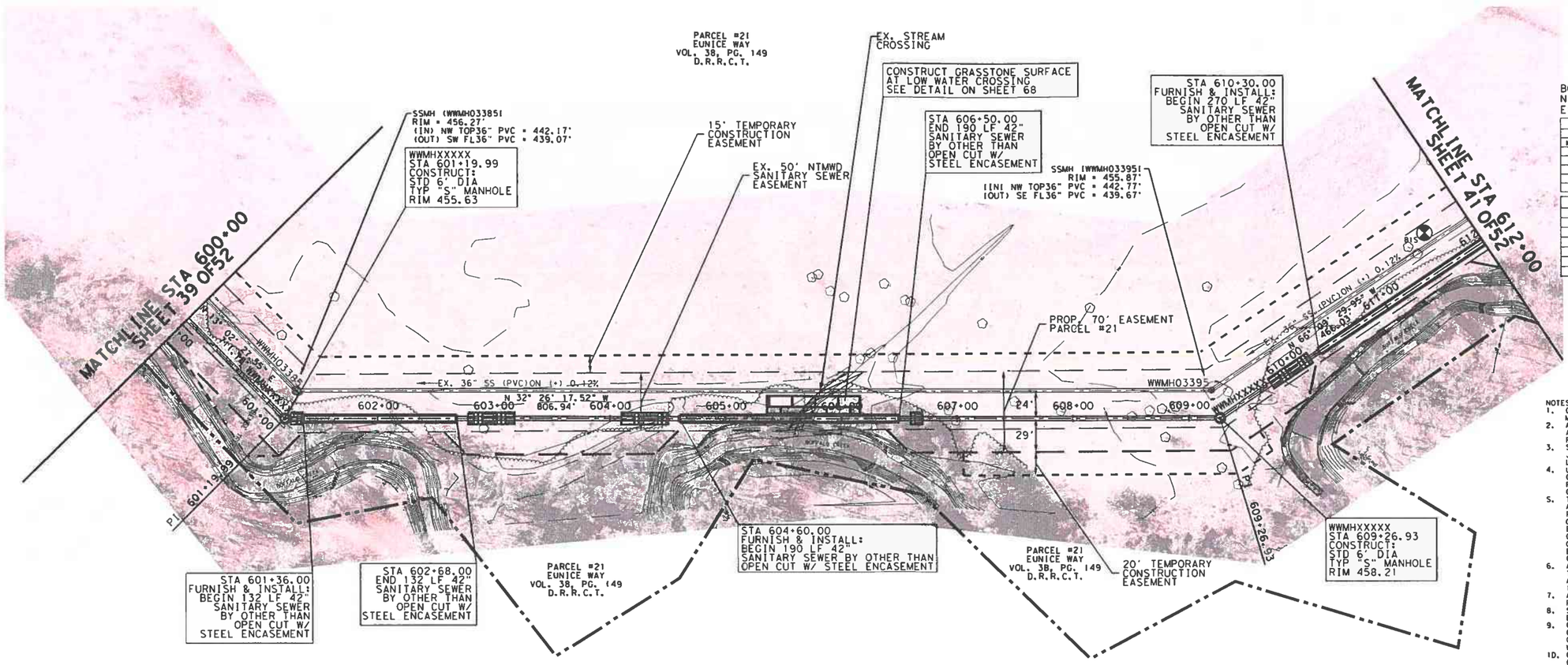
Hayden

Attached please find Atmos Encroachment application. I have provided a KMZ file for location map with a pin marked, approximately station 612+00. Please let me know if you have any questions. thank you.

john

John Ho, P.E., F.NSPE, Vice President I Huitt~Zollars, Inc. I
O: (214) 871-3311, Ext. 10174
C: (214) 934-5635

1717 McKinney Ave | Suite 1400 | Dallas TX 75202-1236
214.871.3311
jho@Huitt-Zollars.com
http://secure-web.cisco.com/1hbRRdrKp9cFTIR97jjc-Tugy5Z83TmPpOvD_HltDbdZChyHVAQklTunZiwHDLN7fDxsvqRTi3NtHSX51XOCFRaLH4Xw5teASr9ltB1lV0wysQFImuNjr6cxrITMkd6Vkx-CsGgK68cXf2HjQXhPnLUp1UKJU4-frh3zwQrt3dNPZzVJu-E4P-WIK3-jsndADyG20Yrt-ZO408OWM-649hw/http%3A%2F%2Fwww.huitt-zollars.com



BORING #15(B15)
N: 6997731.69
E: 2596129.24

SCALE IN FEET: 0 25 50 75 100

HORIZONTAL CONTROL DATA COORDINATES			
MH STATION	NORTH	EAST	DELTA
601+19.99	6996987.26	2596791.42	16° 23' 49.97" LT
609+26.93	6997668.29	2596358.58	33° 43' 12.43" LT

SURVEY CONTROL COORDINATES			
POINT NO.	NORTH	EAST	ELEVATION
NONE			

GRASSTONE APPLICATION IN LOW WATER CROSSING

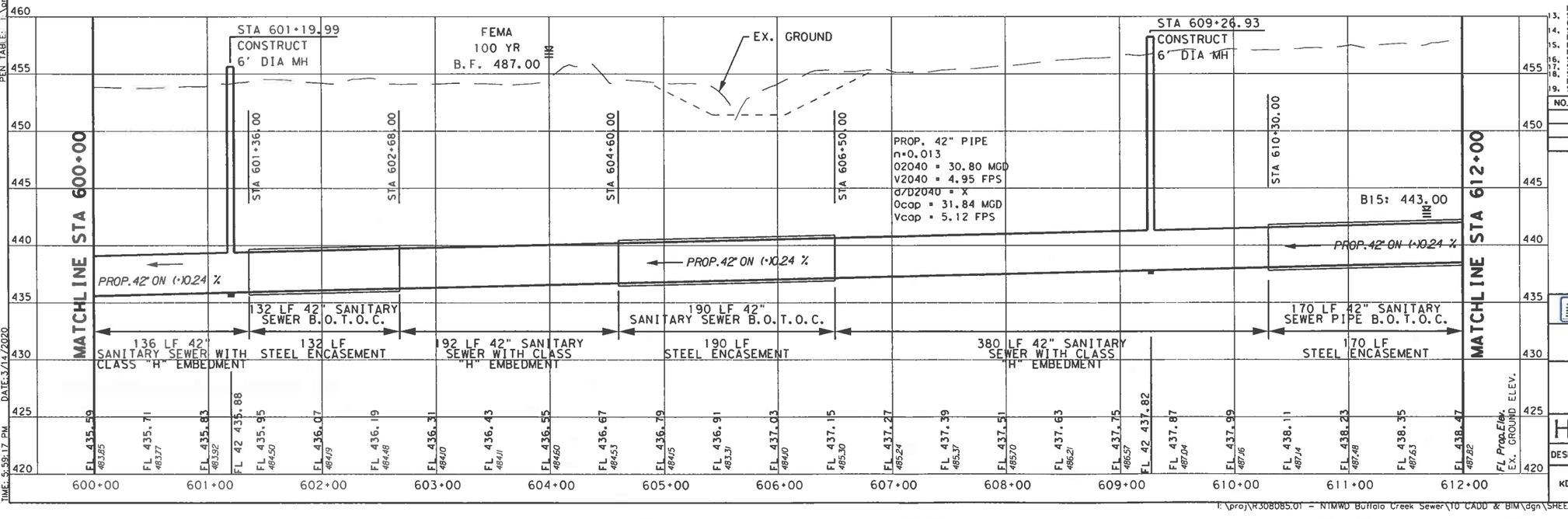
BORE PIT LOCATION

REMOVE AND RESET EXISTING FENCE

REMOVE AND REPLACE EXISTING DIRT ACCESS PATH/TRAIL/SIDEWALK

SIDEWALK/TRAIL RELOCATION BETWEEN EX. AND PROP. SS

NOTES:
1. CONTRACTOR SHALL NOT STAGE EDUIPMENT OR STORE PILED MATERIALS OVER EXISTING GRAVITY INTERCEPTOR.
2. AERIAL BACKGROUND PROVIDED FOR REFERENCE, BASED ON AN AERIAL DATED JANUARY 31, 2018, AND MAY DIFFER FROM ACTUAL FIELD CONDITION ENCOUNTERED.
3. SURVEYED INFOURMATION SHOWN BASED ON SURVEY CONDUCTED JANUARY 31, 2018. SEE SHEETS 5 THRDUGH 5 FOR PROJECT LAYOUT PLAN AND BENCHMARK/CONTROL POINT INFORMATION.
4. UNDERGROUND OR OVERHEAD FIBER OPTIC CABLES, ELECTRIC CABLES, GAS MAINS, AND TELEPHONE CABLES SHALL BE IN PROJECT AREAS. CALL 1-800-344-8377 TWO DAYS PRIOR TO CONSTRUCTION.
5. THE LOCATIDN OF EXISTING UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE AHD BASED ON EXISTING PLANS AND DATA FURNISHED BY UTILITY COMPANIES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND DEPTH OF ALL EXISTING UTILITIES THAT MAY CONFLICT WITH CONSTRUCTION. CALL 1-800-344-8371 TWO DAYS PRIOR TO CONSTRUCTION FOR ONSITE LOCATIONS. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIREO AT THE CONTRACTOR'S EXPENSE, AT NO ADDITIONAL COST.
6. ALL MANHOLES SHALL BE FLUSH WITH THE NATURAL GROUND ON THE GOLF COURSE PROPERTY. ALL OTHER MANHOLES SHALL BE 18" ABOVE THE NATURAL GROUND. ALL VENTS SHALL BE 1' ABOVE THE 100 YEAR BASE FLOOD ELEVATION.
7. ALL INVERT ELEVATIONS AND GRADES SHALL REMAIN THE SAME REGARDLESS OF PIPE MATERIAL.
8. SEE SHEET 62 FOR EMBEDMENT CLASSES AND SHEET 63 FOR ENCASEMENT SIZES.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORING ALL WATER CROSSINGS AND CREEK BANKS. SEE SPEC XX XX XX AND APPENDIX O FOR ADDITIONAL INFORMATION REGARDING US ACE PERMIT AND WETLAND MITIGATION.
10. CONTRACTOR SHALL USE COMPOSITE CONSTRUCTION MATS IN CERTAIN AREAS TO REDUCE PROPERTY DAMAGE. SEE SHEET 73 FOR AREAS WHERE REQUIREO AND ADDITIONAL INFORMATION.
11. SEE SPEC 31 10 00 FOR ADDITIONAL INFORMATION ON SITE CLEARING.
12. SEE SPEC 31 25 00, GENERAL NOTE #16, AND DIVISION 1000 OF THE 5TH EDITION NCTCOG PUBLIC WORKS CONSTRUCTION STANDARDS FOR ADDITIONAL INFORMATION DH ERDSION CONTROL.
13. SEE SPEC APPENDIX A AND B, AND SHEET 4 FOR ADDITIONAL GEOTECHNICAL BORING INFORMATION.
14. SEE SPEC 32 31 13 AND SHEETS 74 AND 75 FOR ADDITIONAL FENCE AND GATE REMOVAL & REPLACEMENT INFORMATION.
15. LAND WITH FENCE AND GATE REMOVAL & REPLACEMENT SHALL BE KEPT SECURED AT ALL TIMES.
16. SEE SPEC 32 13 19 AND SHEET 68 FOR GRASSTONE INFORMATION.
17. SEE SHEET 76 FOR TRAFFIC CONTROL DETAILS.
18. SEE SHEET 61 FOR ACCESS PATH/TRAIL/SIDEWALK REMOVAL/ REPLACEMENT INFORMATION.
19. SEE GENERAL NOTES FOR ADDITIONAL INFORMATION.



NO.	DATE	REVISIONS	APPROVED

PRELIMINARY PLAN

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF KENNETH A. ROBERTS, P.E., REG. NO. 55446 ON MARCH 16, 2020 IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

HUITT-ZOLLARS, INC. FIRM REGISTRATION NO. F-761

NORTH TEXAS MUNICIPAL WATER DISTRICT

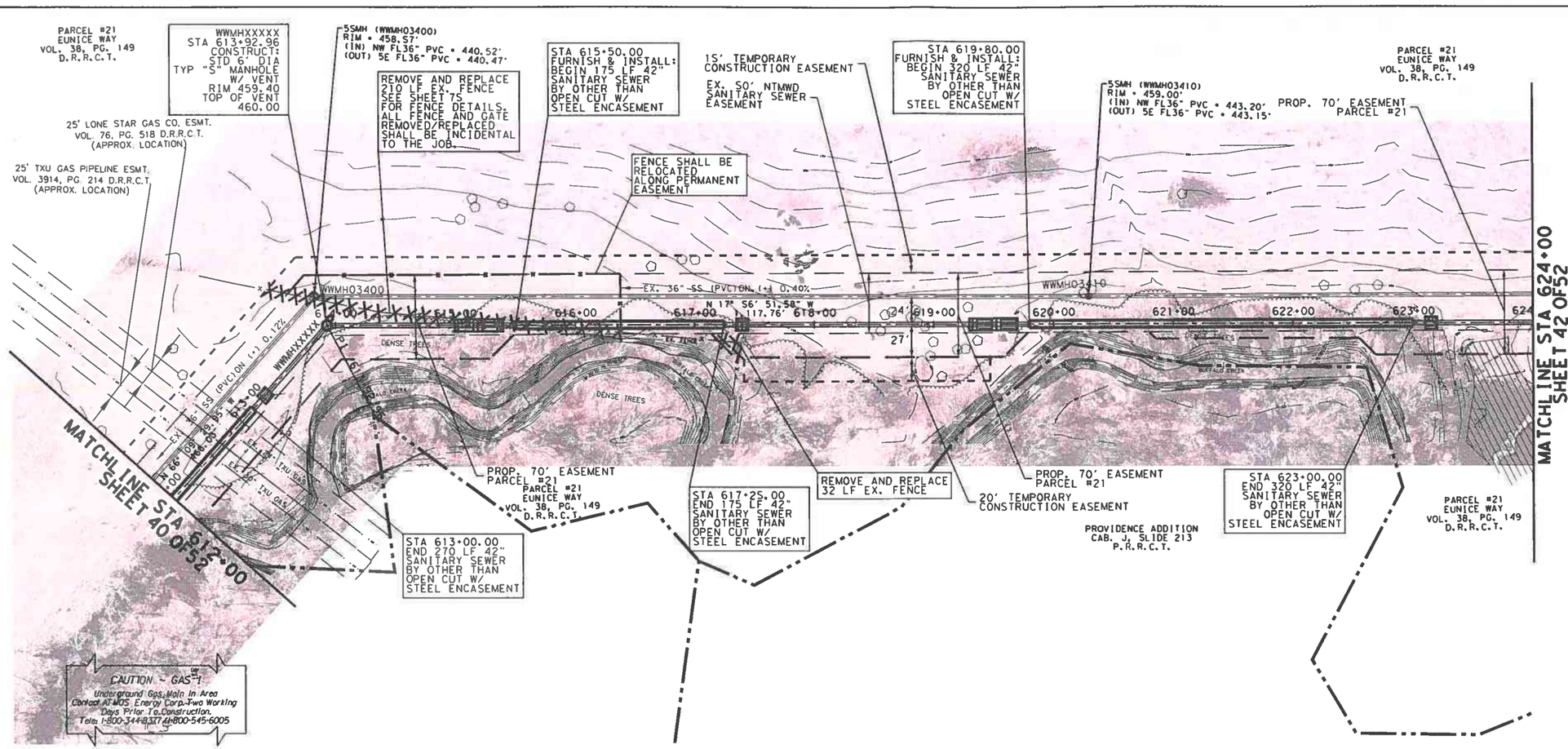
BUFFALO CREEK
PARALLEL INTERCEPTOR PHASE I
507-0484-17

SANITARY SEWER
PLAN & PROFILE
STA 600+00 TO STA 612+00

HUITT-ZOLLARS
Huitt-Zollars, Inc.
1717 McKinney Avenue, Suite 1400
Dallas, Texas 75202
Phone (214) 871-3311 Fax (214) 871-0757

DESIGN	DRAWN	APPR.	SCALE	DATE	PROJ. NO.	NO.
KDM	GCP	KAR	1"=50'H 1"=5'V	MARCH 2020	R30B085.01 SD7-04B4-17	40

I:\proj\R308085.01 - NTMWD Buffalo Creek Sewer\10 CADD & BIM\dgn\SHEETS\808501US25.dgn
gproce
PEN TABLE: I:\proj\R308085.01 - NTMWD Buffalo Creek Sewer\10 CADD & BIM\dgn\SHEETS\808501US25.dgn
1:99.9998
DATE: 3/14/2020
TIME: 5:59:17 PM



HORIZONTAL CONTROL DATA			
COORDINATES			
MH STATION	NORTH	EAST	DELTA
613+92.96	6997856.67	2595932.32	48° 12 ' 38.37" RT

SURVEY CONTROL			
COORDINATES			
POINT NO.	NORTH	EAST	ELEVATION
NONE			

GRASSTONE APPLICATION IN LOW WATER CROSSING

BORE PIT LOCATION

REMOVE AND RESET EXISTING FENCE

REMOVE AND REPLACE EXISTING DIRT ACCESS PATH/TRAIL/SIDEWALK

SIDEWALK/TRAIL RELOCATION BETWEEN EX. AND PROP. SS

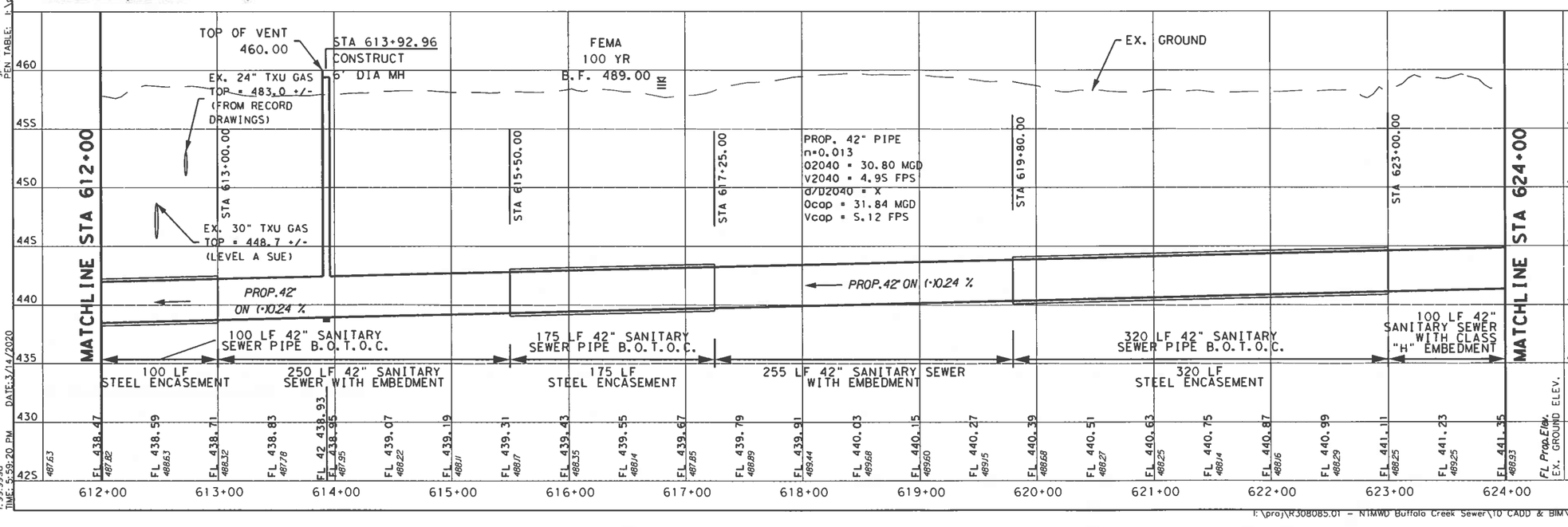
NOTES:
1. CONTRACTOR SHALL NOT STAGE EDUIPMENT OR STORE PILED MATERIALS OVER EXISTING GRAVITY INTERCEPTOR.
2. AERIAL BACKGROUND PROVIDED FOR REFERENCE, BASED ON AH AERIAL DATED JANUARY 31, 2018, AND MAY DIFFER FROM ACTUAL FIELD CONDITION ENCOUNTERED.
3. SURVEYED INFOURMATION SHOWN BASED ON SURVEY CONDUCTED JANUARY 31, 2018. SEE SHEETS 5 THROUGH 5 FOR PROJECT LAYOUT PLAN AND BENCHMARK/CONTROL POINT INFORMATION.
4. UNDERGROUND OR OVERHEAD FIBER OPTIC CABLES, ELECTRIC CABLES, GAS MAINS, AND TELEPHONE CABLES SHALL BE IN PROJECT AREAS. CALL 1-800-344-8377 TWO DAYS PRIOR TO CONSTRUCTION.
5. THE LOCATION OF EXISTING UTILITIES SHOWN ON THESE PLANS ARE APPROXIMATE AND BASED ON EXISTING PLAHS AND DATA FURNISHED BY UTILITY COMPANIES. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE LOCATION AND DEPTH OF ALL EXISTING UTILITIES THAT MAY CONFLICT WITH CONSTRUCTION. CALL 1-800-344-8377 TWO DAYS PRIOR TO CONSTRUCTION FOR ONSITE LOCATIONS. ANY DAMAGE TO EXISTING UTILITIES SHALL BE REPAIREO AT THE CONTRACTOR'S EXPENSE, AT HO ADDITIONAL COST.
6. ALL MANHOLES SHALL BE FLUSH WITH THE NATURAL GROUND ON THE GOLF COURSE PROPERTY. ALL OTHER MANHOLES SHALL BE 18" ABOVE THE NATURAL GROUND. ALL VENTS SHALL BE 1' ABOVE THE 100 YEAR BASE FLOOD ELEVATION.
7. ALL INVERT ELEVATIONS AHD GRADES SHALL REMAIN THE SAME REGARDLESS OF PIPE MATERIAL.
8. SEE SHEET 62 FOR EMBEDMENT CLASSES AND SHEET 63 FOR ENCASEMENT SIZES.
9. CONTRACTOR SHALL BE RESPONSIBLE FOR RESTORING ALL WATER CROSSINGS AHD CREEK BANKS. SEE SPEC XX XX XX AND APPENDIX D FOR ADDITIONAL INFORMATIOH REGARDING US ACE PERMIT AHD WETLAND MITIGATION.
10. CONTRACTOR SHALL USE COMPOSITE CONSTRUCTION MATS IN CERTAIN AREAS TO REDUCE PROPERTY DAMAGE. SEE SHEET 73 FOR AREAS WHERE REDUIRED AHD ADDITIONAL INFORMATIOH.
11. SEE SPEC 31 10 DD FOR ADDITIONAL INFORMATION ON SITE CLEARING.
12. SEE SPEC 31 25 OD, GENERAL NOTE #16, AND DIVISION 1DDO OF THE 5TH EDITION NCTCOG PUBLIC WORXS CONSTRUCTION STANDARDS FOR ADDITIONAL INFORMATIOH ON EROSION CONTROL.
13. SEE SPEC APPENDIX A AND B, AHO SHEET 4 FOR ADDITIONAL GEOTECHNICAL BORING INFORMATION.
14. SEE SPEC 32 31 13 AND SHEETS 74 AHD 75 FOR ADDITIONAL FENCE AND GATE REMOVAL & REPLACEMENT INFORMATION.
15. LAND WITH FENCE AHD GATE REMOVAL & REPLACEMENT SHALL BE XEPT SECURED AT ALL TIMES.
16. SEE SPEC 32 13 19 AND SHEET 68 FOR GRASSTONE INFORMATION.
17. SEE SHEET 76 FOR TRAFFIC CONTROL DETAILS.
18. SEE SHEET 67 FOR ACCESS PATH/TRAIL/SIDEWALX REMOVAL/ REPLACEMENT INFORMATION.
19. SEE GEHERAL NOTES FOR ADDITIONAL INFORMATION.

NO.	DATE	REVISIONS	APPROVED

PRELIMINARY PLAN

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF INTERIM REVIEW UNDER THE AUTHORITY OF KENNETH A. ROBERTS, P.E., REG. NO. 85446 ON MARCH 16, 2020 IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING OR PERMIT PURPOSES.

HUITT-ZOLLARS, INC. FIRM REGISTRATION NO. F-761



NORTH TEXAS MUNICIPAL WATER DISTRICT						
BUFFALO CREEK PARALLEL INTERCEPTOR PHASE I 507-0484-17						
SANITARY SEWER PLAN & PROFILE STA 612+00 TO STA 624+00						
HUITT-ZOLLARS Huitt-Zollars, Inc. 1717 McKinney Avenue, Suite 1400 Dallas, Texas 75202 Phone (214) 871-3311 Fax (214) 871-0757						
DESIGN	DRAWN	APPR.	SCALE	DATE	PROJ. NO.	NO.
KDM	GCP	KAR	1"=50'H 1"=5'V	MARCH 2020	R308085.01 507-0484-17	41

I:\proj\R308085.01 - NTMWD Buffalo Creek Sewer\10 CADD & BIM\dgn\SHEETS\808501US526.dgn
gpr/oce
PEN TABLE:
DATE:3/14/2020
TIME: 5:59:20 PM
1:99.999B
I:\proj\R308085.01 - NTMWD Buffalo Creek Sewer\10 CADD & BIM\dgn\SHEETS\808501US526.dgn

Appendix K

South Kings Road - Rockwall County Road Crossing Permit

Ok per Pat 8/4/20

THE STATE OF TEXAS §
§
COUNTY OF ROCKWALL §

COUNTY ROAD RIGHT-OF-WAY
CROSSING AGREEMENT

CROSSING ON COUNTY ROAD South Kings Road

- ☐ Blacktop
- ☐ xxxCaliche
- ☐ Dirt
- ☐ Gas
  - Purpose _____
  - Pressure PSI _____
  - Type (natural, LP, anhydrous, etc.) _____
  - Casing Size _____ OD
- ☐ Water
  - Purpose _____
  - Casing Size _____ OD
- ☐ Overhead Line
  - Purpose and Detail _____
- ☐ Oil
  - Purpose _____
  - Casing Size _____ OD
  - Other Wastewater

Sketch or survey of pipeline or utility location is attached by applicant. Please use full legal descriptions here and below.

APPLICANT North Texas Municipal Water District
PIPELINE OWNER North Texas Municipal Water District
PROPERTY ONE: (legal description) A Rodriguez Survey, Abstract No.231
OWNER OF PROPERTY ONE _____
PROPERTY TWO: (legal description) _____
OWNER OF PROPERTY TWO _____

This agreement entered into as of the____day of_____, 20____, by and between Applicant and the County of Rockwall ("County").

1. The owner of the project and the contractor shall each have an obligation to secure authorization from the County. The County does hereby agree to grant Applicant permission to construct, maintain, and operate a pipeline according to the specifications on page one of this Crossing Agreement over, along, and across the public roads and highways in the County. Said pipeline or pipelines are to be used for the transportation of the materials set out in this application. The County shall be notified if the use of the pipelines changes from the original purpose set forth herein. Throughout the duration of the construction of the pipelines, the traffic on the roads or highways shall not be interfered with and such roads or highways shall be properly restored to their former condition of usefulness. The restoration is subject to the supervision of the Rockwall County Road and Bridge Administrator.

2. The pipeline or lines shall be constructed between or along Property One and Property Two pursuant to the sketch attached hereto.

3. The rights hereby granted for the construction, operation and maintenance of the pipeline or pipelines to be constructed by Applicant shall be at all times subject to the superior rights of the public for highway purposes. The Applicant shall be responsible for obtaining the easement or consent from the owner(s) of the land on which the lines shall be constructed. The permission for the crossing by the County pertains only to the rights of the County by virtue of its easement for the county road.

4. The owner of the pipeline and the contractor shall each have an obligation to secure authorization from the County and shall each have a separate liability for failure to secure authorization to cut a county easement with a pipeline trench and lay a pipeline. Failure by the owner or by the contractor to secure authorization shall invoke an additional $75 per foot charge each as liquidated damages (a total of $150.00 per foot if both should fail to secure authorization).

5. ~~No underground crossing of a paved surface shall be made by open cut. Roads of any surface shall be drilled or bored and cased under road base according to State Highway specifications.~~

6. All pressure lines shall be cased with welded steel casing. Electrical lines can be cased with heavy-duty PVC pipe. All pressure lines shall be vented at each end of the right-of-way. No parallel lines will be installed in county right-of-way without special permission and a separate written agreement of the Rockwall County Commissioners Court. All lines, where practicable, shall be located to cross roadbed at approximately right angles thereto. No lines are to be installed under or within 50 feet of either end of any bridge. No lines shall be placed in any culvert or within 20 feet of same.

7. An annular void left as a result of oversized boring shall be filled with cement or other hardening slurry.

8. Depth of coverage – Gas, liquid petroleum, water and sanitary sewer lines shall be covered at a depth of at least forty-eight inches (48") below the lowest part of the bar ditch at point of crossing. Underground lines running longitudinally within the right-of-way shall be installed as close to the right-of-way boundary as practical but not more than three feet (3') within the right-of-way, and at depth below the back slope of forty-eight inches (48").

9. The permit and right-of-way for constructing pipelines hereunder shall cease and terminate upon the expiration of six months from the date ~~hereof~~ when authorization is granted to the Contractor; but the right and privilege hereby granted to owner of the pipeline to operate, maintain and remove and replace pipelines shall continue as to each and every pipeline in use. Where the words "public roads", "highways" or "roads" are used herein reference is to roads and highways in the County, not including State Highways.

10. The pipeline shall be placed to a depth required by law, beneath any county road now in existence. In the event a change is needed in existing roads in the future, the pipeline or lines shall be lowered or changed in any manner in order to comply with State laws or rulings of the State Highway Department, or the County, then and in such event any change required shall be by Applicant and at his own expense.

11. Culverts placed in the ditches running beside any county road shall be of appropriate width and length as determined by the County Road and Bridge Administrator. The owner or contractor shall furnish the culvert. The County will be notified as to the paving, if any, to be applied to the

surface. Future maintenance, unless otherwise agreed shall be assumed by the County. The County may remove a culvert after notification of the owner or after 5 years of open and obvious non-use.

12. Variation from these rules may be accepted if approved by the Commissioners Court. This Agreement is subject to any State Law, Regulation, and any Federal Law or Regulation pertaining to the type of installation involved.

North Texas Municipal Water District
Owner of Pipeline/Utility Line

Cesar Baptista
Signature & Printed Name

Deputy Director
Title or Position

501 E. Brown Street
Mailing Address

Wylie, Texas 75098
City, State and Zip

David Sweet, County Judge

Cliff Sevier, Commissioner Pct. 1

Lee Gilbert, Commissioner Pct. 2

Dennis Bailey, Commissioner Pct. 3

David Magness, Commissioner Pct. 4

Appendix L

SAM – Surveying and Mapping, LLC

Subsurface Utility Engineering (SUE)

Exhibits

SURVEYING AND MAPPING LLC
1341 W. Mockingbird Ln, DALLAS, TX 75247
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole Summary

Project HZ-NTMWD (Buffalo Creek)

State *Texas* **City** *Heath*

SAM, LLC Project # 41026 **Prepared By:** Dallas Office SUE

Client *Huitt-Zollars*

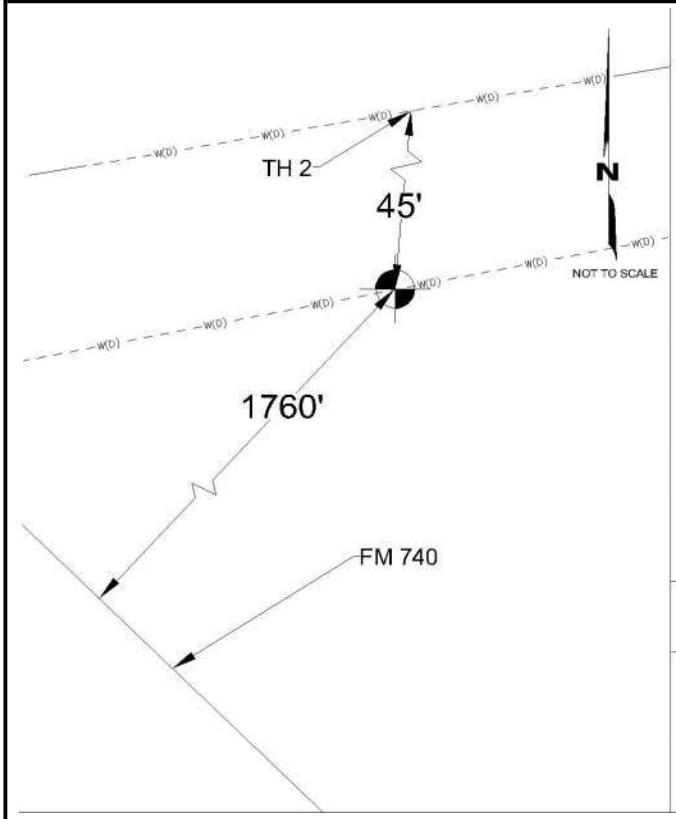
Test Hole#	Utility Type	Utility Owner	Date Completed	Northing	Easting	Elevation Existing Ground	Elevation Top of Utility	Depth of Cover	Material Type, Outside Diameter, and Comments	Surface Material and Thickness
1	Water	City of Dallas	8/26/2019	6973013.02'	2593020.60'	405.5'	400.1'	5.41'	RCP, 72"	Natural Ground
2	Water	City of Dallas	8/27/2019	6973055.64'	2593034.32'	405.7'	399.1'	6.65'	RCP, 84"	Natural Ground
3	Gas	Atmos	8/16/2019	6996966.51'	2595748.86'	457.2'	448.7'	8.54'	Steel Pipe, 30" per record	Natural Ground
5	Sewer	NTMWD	4/24/2018	7003726.54'	2594987.99'	473.7'	465.4'	8.30'	RCP, 8" per record	Natural Ground
6	Electric	Private	10/21/2019	7004816.33'	2594779.10'	483.1'	481.2'	1.92'	PVC, 1.25"	Natural Ground
7	Electric	Oncor	10/21/2019	7005743.95'	2595391.88'	478.3'	474.2'	4.12'	PVC, 2"	Natural Ground

Note: Test Hole 4 was not performed since the target utility did not exist after field investigation.

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

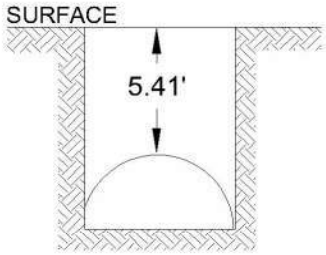
Test Hole # 1
72" RCP Water
City of Dallas

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**8/26/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	45' SW of TH 2 and 1760' to FM740	Field Conditions:	Mostly Sunny H102°|L82°
		Soil Type:	Light Grey Silty Clay
Record Utility:	Water	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	City of Dallas		
Contact:	Dallas Water Utilities Vault	**Utility Found:**	**72" RCP Water**
Phone	(214) 948-4584	**Utility Condition:**	**Average**
Email	DWUVault@dallascityhall.com	**Depth of Cover:**	**5.41'**
Field Crew:	Stephen Frair | Benito Lopez	**Elevation of Utility:**	**400.1'**



UTILITY CROSS SECTION

FACING EAST



72" RCP CITY OF DALLAS

LEGEND

-TEST HOLE

SURVEY MARK COORDINATES

Northing	**6973013.02'**
Easting	**2593020.60'**
Elevation	**405.5'**

STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER
9/26/2019

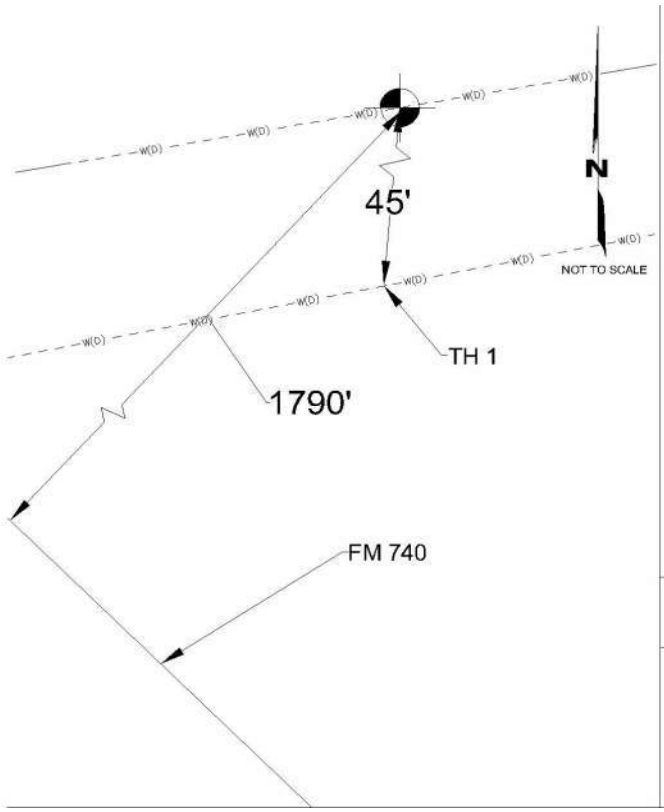
Comments

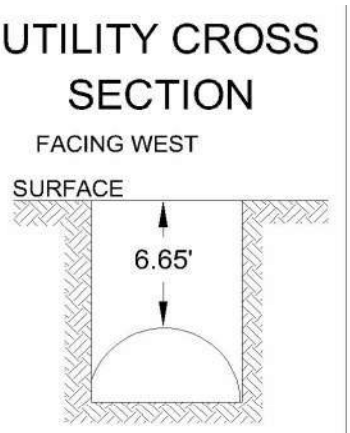
1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 2
84" RCP Water
City of Dallas

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**8/27/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	45' NE of TH 1 and 1790' to FM740	Field Conditions:	Thunderstorms H90°|L82°
		Soil Type:	Light Grey Silty Clay
Record Utility:	Water	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	City of Dallas		
Contact:	Dallas Water Utilities Vault	**Utility Found:**	**84" RCP Water**
Phone	(214) 948-4584	**Utility Condition:**	**Average**
Email	DWUVault@dallascityhall.com	**Depth of Cover:**	**6.65'**
Field Crew:	Stephen Frair | Benito Lopez	**Elevation of Utility:**	**399.1'**





LEGEND
-TEST HOLE

SURVEY MARK COORDINATES

Northing	**6973055.64'**
Easting	**2593034.32'**
Elevation	**405.7'**

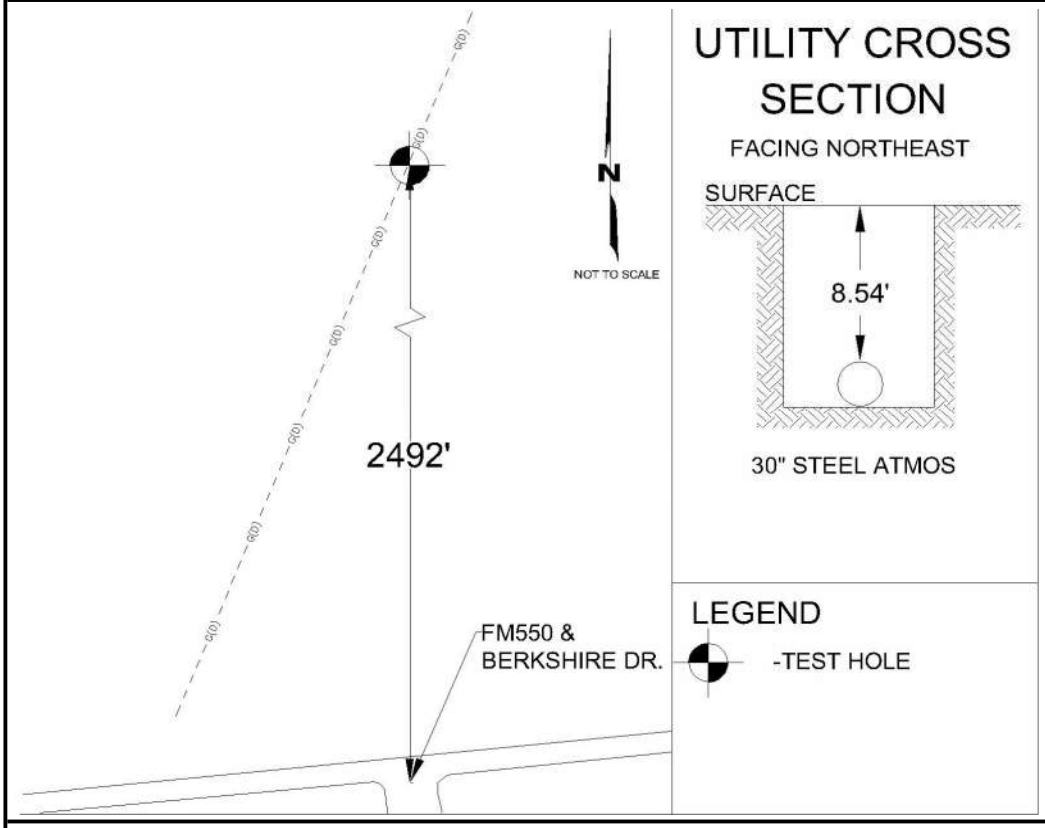
Comments

1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 3
30" per record Steel Pipe
Gas
Atmos

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**8/16/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	2492' North of the intersection of W FM550 and Berkshire Dr.	Field Conditions:	Mostly Sunny H100°|L81°
		Soil Type:	Light Grey Silty Clay
		Survey Mark:	1/2" Iron Rod w/cap
Record Utility:	Gas	**Utility Found:**	**30" per record Steel Pipe Gas**
Utility Owner:	Atmos	**Utility Condition:**	**Average**
Contact:	Atmos Map Request	**Depth of Cover:**	**8.54'**
Phone	N/A	**Elevation of Utility:**	**448.7'**
Email	Map.Requests@atmosenergy.com		
Field Crew:	Stephen Frair | Benito Lopez		



SURVEY MARK COORDINATES

Northing	**6996966.51'**
Easting	**2595748.86'**
Elevation	**457.2'**

Comments

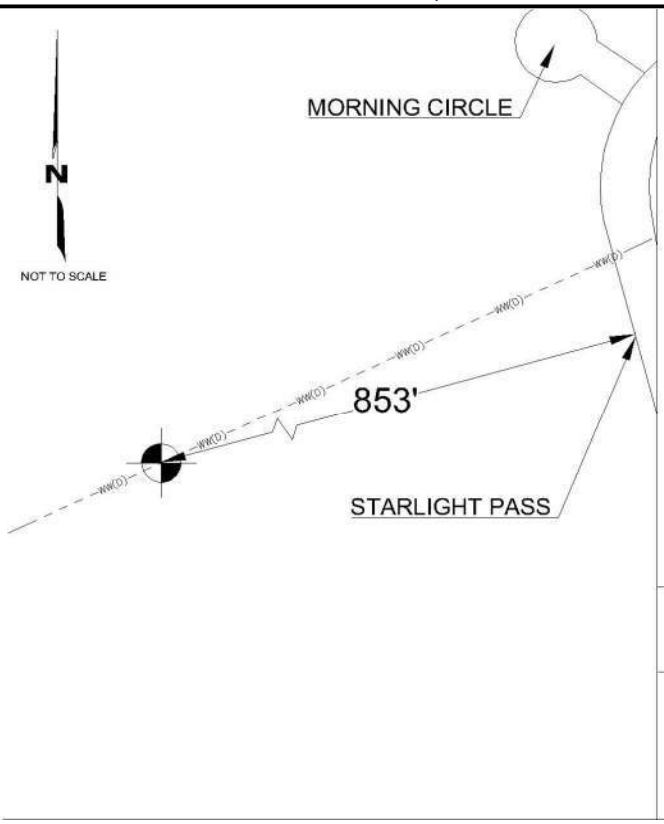
1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*
3. *Unable to get accurate pipe size due to ground water. Pipe size is shown per records*

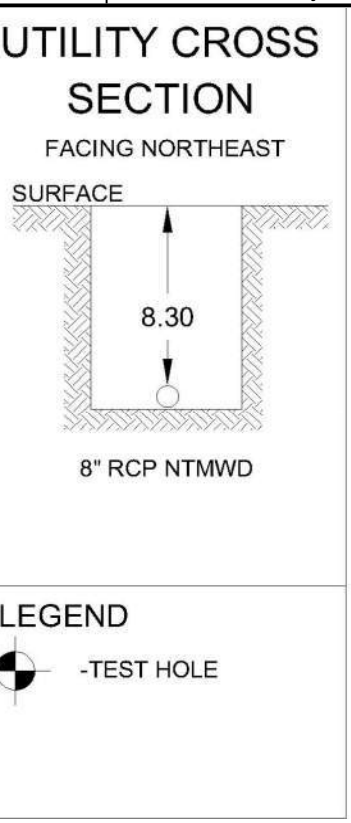
STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER
9/26/2019

SURVEYING AND MAPPING LLC
7101 ENVOY COURT, DALLAS, TX 752472
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 5
8" per record RCP Sewer
NTMWD

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**4/24/2018**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	853' SW of Starlight Pass	Field Conditions:	Mostly Sunny H84°|L57°
		Soil Type:	Dark Grey Sandy Clay
Record Utility:	Sanitary Sewer	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	NTMWD		
Contact:	NTMWD	**Utility Found:**	**8" per record RCP Sewer**
Phone	(972) 442-5405	**Utility Condition:**	**Average**
Email	N/A	**Depth of Cover:**	**8.30'**
Field Crew:	James Sobol | Julian Dixon	**Elevation of Utility:**	**465.4'**





SURVEY MARK COORDINATES

Northing	**7003726.54'**
Easting	**2594987.99'**
Elevation	**473.7'**

Comments

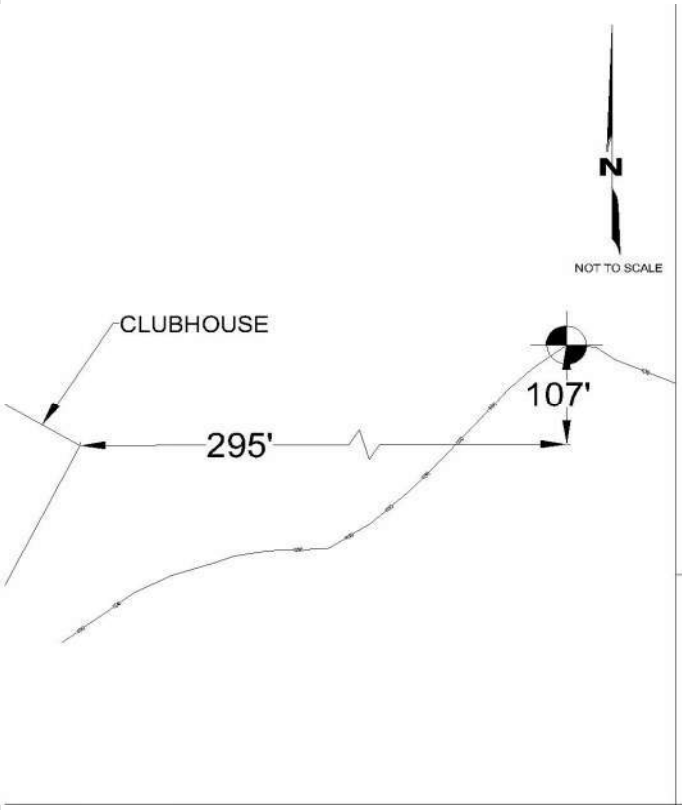
1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*
3. *Unable to get accurate pipe size due to ground water. Pipe size is shown per records*

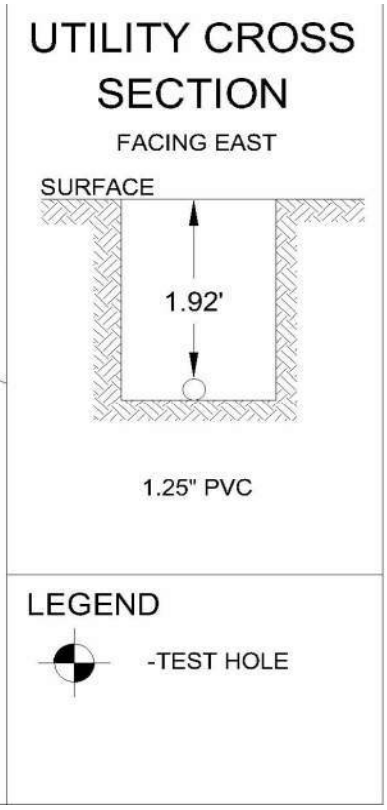
STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER
9/26/2019

SURVEYING AND MAPPING LLC
1341 W. Mockingbird Ln, DALLAS, TX 75247
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 6
1.25" PVC Electric
Unknown

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**10/21/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	295' E and 107' N of Eastern Clubhouse Corner	Field Conditions:	Mostly Sunny H79°|L54°
		Soil Type:	Strong Brown Clay
		Survey Mark:	1/2" Iron Rod w/cap
Record Utility:	N/A	**Utility Found:**	**1.25" PVC Electric**
Utility Owner:	Unknown	**Utility Condition:**	**Average**
Contact:	N/A	**Depth of Cover:**	**1.92'**
Phone	N/A	**Elevation of Utility:**	**481.2'**
Email	N/A		
Field Crew:	Dorsey Johnson|Stephen Frair		





SURVEY MARK COORDINATES

Northing	**7004816.33'**
Easting	**2594779.10'**
Elevation	**483.1'**

Comments

1. No other utilities were found in this Test Hole

2. All excavation was performed with hand tools.

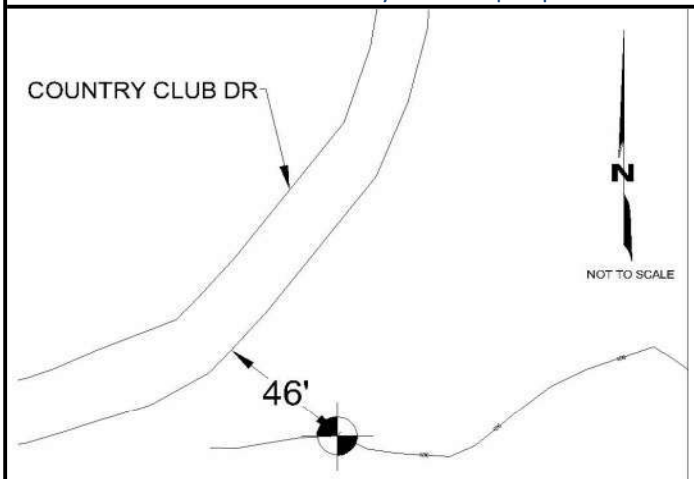
STATE OF TEXAS
GARRET W. STAPP
131000
LICENSED PROFESSIONAL ENGINEER

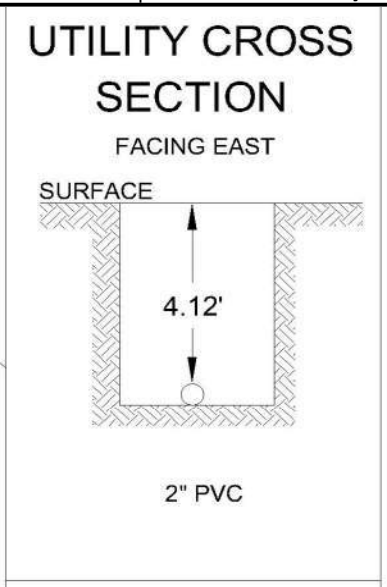
4/7/2020

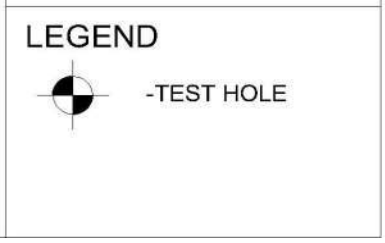
SURVEYING AND MAPPING LLC
1341 W. Mockingbird Ln, DALLAS, TX 75247
PH. 214-631-7888 FAX 214-631-7103
TBPLS FIRM #10064300 / TBPE FIRM # F-1937

Test Hole # 7
2" PVC Electric
Oncor

Project:	**HZ-NTMWD (Buffalo Creek)**	**Date Performed:**	**10/21/2019**
SAM, LLC Project #:	**41026**	**Client:**	**Huitt-Zollars**
Project Location:	Heath, Texas	Surface Material:	Natural Ground
Test Hole Location:	46' to Country Club Dr.	Field Conditions:	Mostly Sunny H79°|L54°
		Soil Type:	Light Grey Silty Clay
Record Utility:	N/A	Survey Mark:	1/2" Iron Rod w/cap
Utility Owner:	Oncor	**Utility Found:**	**2" PVC Electric**
Contact:	Larry Baldwin	**Utility Condition:**	**Average**
Phone	(817) 215-6184	**Depth of Cover:**	**4.12'**
Email	larry.baldwin@oncor.com	**Elevation of Utility:**	**474.2'**
Field Crew:	Dorsey Johnson|Stephen Frair		







SURVEY MARK COORDINATES

Northing	**7005743.95'**
Easting	**2595391.88'**
Elevation	**478.3'**

4/7/2020

Comments

1. *No other utilities were found in this Test Hole*
2. *All excavation was performed with pneumatic excavation equipment.*

Name: H-Z Buffalo Creek

Project #: 41026
Phase #: 30
Date - 10/18/2019

Name: H-Z Buffalo Creek

Project #: 41026
Phase #: 30
Date - 10/18/2019

Appendix M

Farmers Electric

Permission to Cross Email

Brouwer, Darwin

From: Ho, John
Sent: Friday, August 28, 2020 4:13 PM
To: Jason Snyder
Cc: Andrew Stevens; Roberts, Ken; Proce, Gabriela; Brouwer, Darwin
Subject: FW: NTMWD

Farmersville approval email. no formal letter coming.

Ms. Gabby, please upload to projectmate.
DJ, please include this email in specs

Thanks everyone!

John Ho, P.E., F.NSPE
Vice-President
Ext. 10174
C: (214) 934-5635

From: Chuck Gilley <cgilley@farmerselectric.coop>
Sent: Friday, August 28, 2020 4:06 PM
To: Ho, John <jho@Huitt-Zollars.com>
Cc: Proce, Gabriela <gproce@Huitt-Zollars.com>; Roberts, Ken <kar@Huitt-Zollars.com>
Subject: RE: NTMWD

John,

No, we are not going to send a letter you should be good to cross between the two poles. Just keep us informed when working at this location.

Chuck

From: Ho, John <jho@Huitt-Zollars.com>
Sent: Friday, August 28, 2020 10:20 AM
To: Chuck Gilley <cgilley@farmerselectric.coop>
Cc: Proce, Gabriela <gproce@Huitt-Zollars.com>; Roberts, Ken <kar@Huitt-Zollars.com>
Subject: RE: NTMWD

Thanks Chuck, will we get an official letter of something from Farmersville?

john

John Ho, P.E., F.NSPE
Vice-President
Ext. 10174
C: (214) 934-5635

From: Chuck Gilley <cgilley@farmerselectric.coop>
Sent: Friday, August 28, 2020 10:17 AM
To: Ho, John <jho@Huitt-Zollars.com>
Cc: Proce, Gabriela <gproce@Huitt-Zollars.com>; Roberts, Ken <kar@Huitt-Zollars.com>
Subject: RE: NTMWD

John,

You should be fine crossing under Farmers Electric overhead power line. If you need anything else please email me.

Thank you,
Chuck Gilley
Senior Project Coordinator,
Engineering
Farmers Electric Cooperative
2000 IH-30 East
Greenville, Tx 75403
Office: 903-453-0584
Mobile: 903-461-2455
Fax: 903-453-0684
cgilley@farmerselectric.coop

From: Ho, John <jho@Huitt-Zollars.com>
Sent: Friday, August 28, 2020 9:18 AM
To: Chuck Gilley <cgilley@farmerselectric.coop>
Cc: Proce, Gabriela <gproce@Huitt-Zollars.com>; Roberts, Ken <kar@Huitt-Zollars.com>
Subject: RE: NTMWD

Chuck

Hope all is well. just wanted to follow up to see if you have any needs or questions and status of the review. thanks.

john

John Ho, P.E., F.NSPE
Vice-President
Ext. 10174
C: (214) 934-5635

From: Chuck Gilley <cgilley@farmerselectric.coop>
Sent: Tuesday, August 18, 2020 11:11 AM
To: Ho, John <jho@Huitt-Zollars.com>
Cc: Proce, Gabriela <gproce@Huitt-Zollars.com>
Subject: RE: NTMWD

John,

Yes, I am get with the legal team tomorrow to go over this project. I will get back with you on Friday this week.

Thank you,
Chuck Gilley
Senior Project Coordinator,
Engineering
Farmers Electric Cooperative
2000 IH-30 East
Greenville, Tx 75403
Office: 903-453-0584
Mobile: 903-461-2455
Fax: 903-453-0684
cgilley@farmerselectric.coop

From: Ho, John
Sent: Tuesday, August 18, 2020 11:04 AM
To: Chuck Gilley
Cc: Proce, Gabriela
Subject: RE: NTMWD

Chuck

Wanted to confirm you received this. thanks

John Ho, P.E., F.NSPE
Vice-President
Ext. 10174
C: (214) 934-5635

From: Proce, Gabriela <gproce@Huitt-Zollars.com>
Sent: Monday, August 17, 2020 2:27 PM
To: Ho, John <jho@Huitt-Zollars.com>; Chuck Gilley <cgilley@farmerselectric.coop>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>
Subject: RE: NTMWD

Attached are two pdfs:

1. "Street Reference View": project area with road names, featuring a red circle referencing the second pdf
2. "Electric-SS Crossing View": area of concern (electric/SS crossing)

Gabriela (Gabby) Proce, EIT
office | 214.871.3311
extension | 10014

From: Ho, John
Sent: Monday, August 17, 2020 2:16 PM
To: Chuck Gilley
Cc: Roberts, Ken ; Proce, Gabriela
Subject: RE: NTMWD

Gabby, can you please provide a location map to Chuck. Thanks.

John Ho, P.E., F.NSPE
Vice-President
Ext. 10174
C: (214) 934-5635

From: Chuck Gilley <cgilley@farmerselectric.coop>
Sent: Monday, August 17, 2020 2:15 PM
To: Ho, John <jho@Huitt-Zollars.com>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>; Proce, Gabriela <gproce@Huitt-Zollars.com>
Subject: RE: NTMWD

John,

I could not open the KMZ file, and can you send me a site map with road names please, the Pdf is not very clear.

Thank you,
Chuck Gilley

From: Ho, John <jho@Huitt-Zollars.com>
Sent: Monday, August 17, 2020 2:04 PM
To: Chuck Gilley <cgilley@farmerselectric.coop>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>; Proce, Gabriela <gproce@Huitt-Zollars.com>
Subject: RE: NTMWD

Chuck

Attached is a kmz file showing the general location of the facilities. As mentioned, we are working on behalf of NTMWD and proposing to construct a new sewer interceptor parallel to an existing that was constructed around 2005. We are proposing to bore the proposed sewer thru your easement, so there will be no above ground construction to minimize any interruption to your operation. Please let me know if you have any questions. thanks.

john

John Ho, P.E., F.NSPE
Vice-President
Ext. 10174
C: (214) 934-5635

From: Chuck Gilley <cgilley@farmerselectric.coop>
Sent: Monday, August 17, 2020 1:31 PM
To: Ho, John <jho@Huitt-Zollars.com>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>; Proce, Gabriela <gproce@Huitt-Zollars.com>
Subject: RE: NTMWD

John,

You can send me the plans for me to review, then I will forward them to the right person that will help you on this project.

Thank you,
Chuck Gilley
Senior Project Coordinator,
Engineering
Farmers Electric Cooperative
2000 IH-30 East
Greenville, Tx 75403
Office: 903-453-0584
Mobile: 903-461-2455
Fax: 903-453-0684
cgilley@farmerselectric.coop

From: Ho, John <jho@Huitt-Zollars.com>
Sent: Thursday, August 13, 2020 2:34 PM
To: Chuck Gilley <cgilley@farmerselectric.coop>
Cc: Roberts, Ken <kar@Huitt-Zollars.com>; Proce, Gabriela <gproce@Huitt-Zollars.com>
Subject: NTMWD

Chuck

Hope all is well. We are designing a wastewater interceptor for NTMWD, this line parallels to an existing interceptor that crosses your overhead facilities near Heath Texas. Wanted to see if you are the person we will be working with. Thanks.

john

John Ho, P.E., F.NSPE, Vice President I Huitt~Zollars, Inc. I
O: (214) 871-3311, Ext. 10174
C: (214) 934-5635

This email and any files transmitted with it are Farmers Electric Cooperative property, are confidential, and are intended solely for the use of the individual or entity to whom this email is addressed. If you are not one of the named recipient(s) or otherwise have reason to believe that you have received this message in error, please notify the sender and delete this message immediately from your computer. Any other use, retention, dissemination, forwarding, printing, or copying of this email is strictly prohibited.

CAUTION: This email originated from outside Huitt-Zollars. Treat all links and attachments with appropriate caution. Verify with sender if unexpected.

This email and any files transmitted with it are Farmers Electric Cooperative property, are confidential, and are intended solely for the use of the individual or entity to whom this email is addressed. If you are not one of the named recipient(s) or otherwise have reason to believe that you have received this message in error, please notify the sender and delete this message immediately from your computer. Any other use, retention, dissemination, forwarding, printing, or copying of this email is strictly prohibited.

CAUTION: This email originated from outside Huitt-Zollars. Treat all links and attachments with appropriate caution. Verify with sender if unexpected.