CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
ENGINEERING AND CONSTRUCTION DIVISION

PROJECT MANUAL
DR15 SWAT 4A NORTHSIDE/NORTHLINE
DRAINAGE AND PAVING IMPROVEMENTS
WBS No. M-420HUD-004A-3

VOLUME 1 of 1
Divisions 00 through 16
July 2018

HR Green, Inc.
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Houston, Texas 77042
713.965.9996
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*NOTE: Capitalized Specifications are included in: https://edocs.publicworks.houstontx.gov/engineering-and-construction/specifications.html; and are incorporated in Project Manuals by reference as if copied verbatim. Documents listed "for filing" are to be provided by Bidder and are not included in this Project Manual unless indicated for example only. The Document numbers and titles hold places for actual documents to be submitted by Contractor during Bid, post-bid, or construction phase of the Project. Specification Sections marked with an asterisk (*) are amended by a supplemental specification, printed on blue paper and placed in front of the Specification it amends. Documents in the 200, 300 and 400 series of Division 00, except for Document 00410B – Bid Form, Part B, are not part of the Contract.*

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### Northside/Northline Drainage and Paving Improvements

**WBS No. M-420HUD-004A-3**

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END OF DOCUMENT
List of Changes:
04-30-2004: Added List of Changes, Notice to Bidders Section. Defined new term (Code). Provided information on how errors in extending unit prices and totaling alternates would be handled. Changed document number for Notice of Intent to Award.
02-28-2006: Deleted Paragraphs 9.0.D and 9.0.J. Guidance on how to handle math errors in Bid Form is provided in tabular form in Document 00210 – Supplementary Instructions to Bidders.
08-10-2006: Added Small Business Enterprise (SBE) title and DBE to Paragraph 12.0 B.
04-12-2013: Added required no-contact/quiet period language as Paragraph 3.0 C., drawn from the City Procurement Manual.
02-26-2014: Add the updated no-contact/quiet period language as Paragraph 3.0 C., again drawn from the City Procurement Manual.

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INSTRUCTIONS TO BIDDERS

1.0 RELATED DOCUMENTS

A. Document 00210 – Supplementary Instructions to Bidders.
B. Document 00320 – Geotechnical Information.
C. Document 00330 – Existing Conditions.
D. Document 00410 – Bid Form, Parts A & B.
E. Document 00495 – Post-Bid Procedures.
F. Document 00520 – Agreement.
G. Document 00700 – General Conditions.
H. Document 00800 – Supplementary Conditions.

2.0 DEFINITIONS

A. Definitions set forth in Document 00700 – General Conditions and in other documents of Project Manual, are applicable to Bid Documents.
B. Addendum: Written or graphic instrument issued prior to Bid opening, which clarifies, modifies, corrects, or changes Bid Documents.
C. Alternate: The total amount bid for additions to work, as described in Section 01110 – Summary of Work. Each Alternate includes cost of effects on adjacent or related components, and Bidder’s overhead and profit.
D. Bid: A complete and properly signed offer to perform the Work in accordance with this Document and Document 00210 – Supplementary Instructions to Bidders.
E. Bid Date: Date and time set for receipt of Bids as stated in Document 00210 – Supplementary Instructions to Bidders, or as modified by Addenda.
G. Bid Supplement: A Bid submittal that is required in Document 00410 – Bid Form.
H. Bidder: Person or firm, identified in Document 00410B – Bid Form – Part B, including its successors, and its authorized representative.

J. Low Bidder: Apparent successful Bidder that qualifies as a responsible Bidder and that submits Bid with lowest Total Bid Price.
K. Project Manager: Person designated in Document 00100 – Advertisement for Bids and Document 00220 – Request for Bid Information to represent the City during bidding and post-bid periods.
M. Security Deposit: A certified check, cashier’s check, or bid bond in the amount of 10 percent of the Total Bid Price.
N. Total Bid Price: Total amount bid for performing the Work as identified by Bidder in Document 00410B – Bid Form – Part B, which amount includes:
   1. Stipulated Price;
   2. Total Base Unit Prices;
   3. Total Extra Unit Prices;
   4. Total Cash Allowances; and
   5. Total Alternates.

3.0 NOTICE TO BIDDERS

A. The City of Houston Fair Campaign Ordinance makes it unlawful for a Contractor to offer any contribution to a candidate for City elective office (including elected officers and officers-elect) during a certain period of time prior to and following the award of the Contract by the City Council. The term “Contractor” includes proprietors of proprietorships, all partners of partnerships, and all officers, directors, and holders of 10 percent or more of the outstanding shares of corporations. A statement disclosing the names and business addresses of each of those persons will be required to be submitted with each bid or proposal; for a City Contract. Bidder shall complete and submit Document 00452 – Form A, Contractor Submission List, City of Houston Fair Campaign Ordinance, with its Bid to comply with this requirement. See Chapter 18 of the Code for further information.
B. Chapter 15, Article VIII, of the City's Code provides that no contract shall be let, nor any other business transaction entered into, by the City with any person indebted to the City or a qualifying entity, if the contractor or transaction comes within the provisions of Section 15-1 (c) of the Code. Exceptions are provided in Section 15-126 of the Code. Bidder shall complete and submit Document 00455 – Affidavit of Ownership or Control, with its Bid to comply with this requirement.

C. Neither bidder(s) nor any person acting on bidder(s)’s behalf shall attempt to influence the outcome of the award by the offer, presentation or promise of gratuities, favors, or anything of value to any appointed or elected official or employee of the City of Houston, their families or staff members. All inquiries regarding the solicitation are to be directed to the designated City Representative identified on the first page of the solicitation. Upon issuance of the solicitation through the pre-award phase and up to the date the City Secretary publicly posts notice of any City Council agenda containing the applicable award, aside from bidder's formal response to the solicitation, through the pre-award phase, written requests for clarification during the period officially designated for such purpose by the City Representative, neither bidder(s) nor persons acting on their behalf shall communicate with any appointed or elected official or employee of the City of Houston, their families or staff through written or oral means in an attempt to persuade or influence the outcome of the award or to obtain or deliver information intended to or which could reasonably result in an advantage to any bidder. However, nothing in this paragraph shall prevent a bidder from making public statements to the City Council convened for a regularly scheduled session after the official selection has been made and placed on the City Council agenda for action, or to a City Council committee convened to discuss a recommendation regarding the solicitation.

4.0 BID DOCUMENTS

A. The Bid Documents may be obtained at location specified in Document 00210 – Supplementary Instructions to Bidders.

B. The Bid Documents are made available only for the purpose of bidding on the Work. Receipt of Bid Documents does not grant a license for other purposes.

C. On receipt of Bid Documents, Bidder shall verify that documents are legible and complete, compare contents of Project Manual with Document 00010 – Table of Contents, and compare Index of Drawings with Document 00015 – List of Drawings.

D. If City of Houston Standard Specifications or Standard Details are required by the Project Manual, Bidder shall refer to Document 00210 – Supplementary Instructions to Bidders for purchase information.

5.0 EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS

A. Bidder shall examine Project site, become familiar with local conditions under which the Work shall be performed, conduct appropriate investigations, and correlate personal observations with requirements of the Bid Documents before submitting a Bid.

B. Bidder shall make site investigations to the extent Bidder deems necessary to ascertain extent of subsurface conditions.

C. Failure of Bidder to perform the investigations prior to submitting a Bid does not relieve Bidder of responsibility for investigations, interpretations and proper use of available information in the preparation of its Bid.

D. Bidder shall observe limitations of access to occupied or restricted site as stated in Document 00210 – Supplementary Instructions to Bidders.

6.0 INTERPRETATIONS DURING BIDDING

A. Bidder shall immediately submit Document 00220 – Request for Bid Information to Project Manager upon finding errors, discrepancies, or omissions in Bid Documents. Confirmation of receipt of questions by the City is the responsibility of Bidder. Verbal discussions and answers are not binding.

B. Document 00220 – Request for Bid Information must be received at least 10 days before the Bid Date to allow issuance of Addenda in accordance with Paragraph 7.O.D. Replies, if issued, are by Addenda.

ADDENDA

A. Addenda that affect bidding requirements are applicable only during applicable only through issuance of the Notice to Proceed. Addenda that affect the Contract are a part of the Contract.

B. BIDDERS WHO SUBMIT A BID ON THIS PROJECT SHALL BE PRESUMED TO HAVE RECEIVED ALL ADDENDA AND TO HAVE INCLUDED ANY COST THEREOF IN THEIR BIDS. REGARDLESS OF WHETHER THEY ACKNOWLEDGE THE ADDENDA OR NOT.
C. The City will make Addenda available at same location where the Bid Documents may be obtained. The City will notify plan holders of record when Addenda are available. Bidders are responsible for obtaining Addenda after notification.

D. No Addendum will be issued later than noon on Monday before Bid Date, except Addenda with minor clarifications, withdrawing request for Bids, or postponing Bid Date.

8.0 SUBSTITUTION OF PRODUCTS

A. No substitutions of Products will be considered during the bidding period.

9.0 PREPARATION OF BIDS

A. Bidder shall fill in applicable blanks in Document 00410A&B – Bid Form – Parts A & B and Bid Supplements. In addition, Bidder shall bid all Alternates. Bidder shall properly sign Document 00410B - Bid Form.

B. Bidder shall initial all pages, except signature page, of Document 00410B – Bid Form – Part B.

C. Bidder is responsible for all costs incurred by the Bidder, associated with preparation of its Bid and compliance with Post-bid Procedures.

D. Bidder may not adjust preprinted price on line items stating "Fixed Unit Price" in the description on the Bid Form.

E. Bidder may increase preprinted price on line items stating "Minimum Bid Price" in the description on the Bid Form by crossing out the minimum and inserting revised price on the line above.

F. Bidder may decrease preprinted price on line items stating "Maximum Bid Price" in the description on the Bid Form by crossing out the maximum and inserting revised price on the line above.

G. Bidder shall insert a price no greater than the maximum preprinted range and no less than the preprinted range for line items stating "Fixed Range Unit Price" in the description on the Bid Form by crossing out prices noted and inserting revised price on the line above.

H. Bidder may not adjust Cash Allowance amounts.

10.0 BID SUBMISSION

A. City Secretary will receive Bids on Bid Date at location specified in Document 00210 – Supplementary Instructions to Bidders.
Price of the defaulting Bidder and the Total Bid Price of the Bidder awarded the Contract. If Security Deposit is a check, the City will reimburse any remaining balance to the defaulting Bidder.

12.0 SUBCONTRACTORS AND SUPPLIERS
A. The City may reject proposed Subcontractors or Suppliers.
B. Refer to Document 00800 – Supplementary Conditions, for MWBE/PDBE, DBE and SBE goals.

13.0 MODIFICATION OR WITHDRAWAL OF BID
A. A Bidder may modify or withdraw a Bid submitted before the Bid Date by written notice to the City Secretary. The notice may not reveal the amount of the original Bid and must be signed by the Bidder.
B. Bidder may not modify or withdraw its Bid by verbal, facsimile, or electronic means.
C. A withdrawn Bid may be resubmitted up to the time designated for receipt of Bids.

14.0 BID DISQUALIFICATION
A. The City may disqualify a Bid if the Bidder:
1. fails to provide required Security Deposit in the proper amount;
2. improperly or illegibly completes information required by the Bid Documents;
3. fails to sign Bid or improperly signs Bid;
4. qualifies its Bid; or
5. improperly submits its Bid.
B. When requested, Low Bidder shall present satisfactory evidence that Bidder has regularly engaged in performing construction work as proposed, and has the capital, labor, equipment, and material to perform the Work.

15.0 PREBID MEETING
A. A prebid meeting is scheduled to be held at the place, time, and date listed in Document 00210 – Supplementary Instructions to Bidders.
B. All Bidders, subcontractors, and suppliers are invited to attend.
C. Representatives of City Engineer will attend.

16.0 OPENING OF BIDS
A. Bids are opened by the City Secretary and publicly read in City Council Chambers on the Public Level in City Hall Annex at 11:00 a.m. on Bid Date.
B. Place and date of Bid opening may be changed in accordance with Sections 15-3(b)(5) and 15-3(b)(6) of the City Code.

17.0 EVALUATION AND CONSIDERATION OF BIDS
A. Project Manager will tabulate, record and evaluate Bids.
B. The City may reject all Bids or may reject any defective Bid.

18.0 ACCEPTANCE OF THE BID
A. The City will send to Low Bidder Document 00498 – Notice of Intent to Award. Acceptance by the City is conditioned upon Bidder's timely and proper submittal of documents required in Document 00495 – Post-Bid Procedures.
B. The Bid remains open to acceptance and is irrevocable for the period of time stated in Document 00410A – Bid Form – Part A.
List of Changes:

04-30-2004: Added List of Changes, new defined terms and verbiage for Certificated Paving Projects. Changed the method of obtaining PWE Standard Details & Specifications. Renumbered paragraphs to match renumbering in Instructions to Bidders (Notice to Bidders Section was added).

07-01-2004 Corrected three references to Document 00200 – Instructions to Bidders, precipitated by changes to that document. Deleted one Plan Room and added another. NAMC Plan Room information edited. Added email addresses.

08-03-2004 Added email address to Construction Information Network and alphabetized the list.


03-29-2005 Updated phone number for the plan room: Construction Information Network. Wc

04-11-2005 Updated phone number for the plan rooms. Wc

04-13-2005 Added paragraph 12.0.C. for DBE goal reference. Wc


03-13-2006 Updated info for the plan room: The Builders’ Exchange of Texas, Inc. Wc

03-24-2006 Modified Paragraph 9.0.I to include Contractor Bonus in guidelines to handle math errors. Wc

5/11/2006 Updated info for the plan room: Deleted Reed Construction Data and updated Houston Minority Business Development Center address and e-mail. Wc

10/30/06 Deleted Construction Information Network. Added note after 4.0, E. KAH

5/9/07 Updated plan room contact info for HCA-GHA. Deleted plan room service provider: Houston Minority business Development Center. Wc

5/23/11 Added Office of Business Opportunity (OBO) definition

10/11/11 Added Hire Houston First requirement as Section 3.0 C and 4.0 F.

07/20/16 Edited language in Paragraph 4.0 F regarding new procedure for Hire Houston First designation. Added new reference to Document 00455 in Paragraph 1.0. Fixed formatting and references.

02-01-2017 Deleted Paragraph 1.0, because new Document 00455 was deleted and replaced with the Documents it replaced in July of 2016. The previously deleted Documents 00452, 00453, and 00455 were updated and released as a replacement for the July 2016 Document 00455.

****************************************************************************************************
SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following Paragraphs modify Document 00200 - Instructions to Bidders. Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions, the unaltered portions of the Instructions to Bidders remains in effect.

PARAGRAPH 2.0 – DEFINITIONS:

Add the following sub-Paragraphs to this Paragraph:

MANDATORY

For ALL projects, add the following Paragraph 2.0 O. Remove instructions and brackets.

Office of Business Opportunity (OBO):

All references to Affirmative Action Contract Compliance Division (AACC) set forth in Document 00700 – General Conditions and in other documents of the Project Manual, shall refer to, and include, the Office of Business Opportunity.

OPTIONAL

Public Works Only: Add the following Paragraphs 2.0 P and 2.0 Q only if the Project is a certificated paving project. Remove instructions and brackets.

Certificate of Responsibility: An unexpired and unrevoked letter from the Director containing an identification number and stating that a Bidder has met the minimum qualifications to bid on street and bridge contracts within the amount and type of bidding capacity, based on Texas Department of Transportation (TxDOT) determination of Bidder’s capability and approval of financial stability.

Director: Director, Department of Public Works and Engineering, City of Houston.

PARAGRAPH 3.0 – NOTICE TO BIDDERS

MANDATORY

00210-2
02-01-2017
For ALL projects that do not have any State or Federal funding, add the following Paragraph 3.0 C. Remove instructions and brackets.

Add the following sub-Paragraph to this Paragraph:

C. The City will award this contract to a “Local Business”, as that term is defined in Section 15-176 of the City of Houston Code of Ordinances (“the Code”):

- If the bid of the Local Business is less than $100,000 and is the lowest responsible bid or is within 5% of the lowest bid received, or
- If the bid of the Local Business is more than $100,000 and is the lowest responsible bid or is within 3% of the lowest bid received, and
- Unless the Director determines that such an award would unduly interfere with contract needs, as provided in Section 15-181 of the Code.

If there is no bid of a Local Business that meets these criteria, the City will award the contract to the lowest responsible bidder.

PUBLIC WORKS ONLY: Add the following Paragraph 3.0 D if the Project is a certificated paving project. Remove instructions and brackets.

Add the following sub-Paragraph to this Paragraph:

D. This is a City Street and Bridge Construction or Improvement Contract which requires a current Certificate of Responsibility filed with the Director no later than three business days prior to Project Bid Date. A Certificate of Responsibility is a valid Prequalification Approval Letter issued by TxDOT stating that a Bidder is qualified to bid on State Highway improvement contracts pursuant to 43 Texas Administrative Code, Section 9.12, as it may be amended from time-to-time, and Chapter 15, Article IV of the Code of Ordinances, Houston, Texas (the “Ordinance”).

PARAGRAPH 4.0 – BID DOCUMENTS

Add the following sub-Paragraphs to this Paragraph:

A. Add the following Paragraph A.1:

1. Bid documents may only be obtained electronically at the City’s website: https://bidsets.publicworks.houstontx.gov/.
OPTIONAL

If Standard Specifications as published by Public Works are used, add Paragraph D.1. Remove instructions and brackets.

D. Add the following Paragraph D.1:

1. Copies of the City Standard Specifications and Details may be acquired at no cost on the City’s website
   https://edocs.publicworks.houstontx.gov/engineering-and-construction/specifications.html

OPTIONAL

Edit the following list of plan rooms to fit the Project and add Paragraph E to this Section, if required. Remove instructions and brackets.

E. The following plan rooms, whose names, addresses, phone and fax numbers were last updated on April 9, 2007, have been authorized by the City to display Bid Documents for examination:

(Note: The Bid Documents furnished to the plan rooms for examination can be in electronic format, in hard copies, or in any other formats pertaining to each City Contracting Division’s discretion.)

1. AMTEK Information Services, Inc., 4001 Sherwood Lane, Houston, TX 77092, 713-956-0100, Fax 713-956-5340, Email: planroom@amtekusa.com

2. Associated Builders & Contractors, Inc., (ABC), 3910 Kirby, Suite 131, Houston, TX 77098-4151, 713-523-6222, Fax 713-874-0747. Email: lori@abchouston.org

3. Associated General Contractors (AGC-BB) Building Branch, 3825 Dacoma, Houston, TX 77092-8717, 713-843-3700, Fax 713-843-3701. Email: karla.s@agchouston.org

4. Associated General Contractors, (AGC-HHUI), Highway, Heavy Utilities and Industrial Branch, 2400 Augusta St., Suite 180, Houston, TX 77057, 713-334-7100, Fax 713-334-7130. Email: houston@agctx.org (Attention: Mel Keyser)
5. Construction Information Network, 1225 North Loop West, Suite 550, Houston, TX 77008, 713-868-2233 ext. 329, Fax 866-852-2713. Email: paul.tilford@cnsx.com

6. F. W. Dodge Corporation, 4101 Greenbriar, Suite 320, Houston, TX 77098, 713-529-4895, Fax 713-524-7639. Email: terrie_harris@mcgraw-hill.com

7. Hispanic Contractors Association of Houston (HCA-GHA), 11 Parker Road, Suite 7, Houston, TX 77241, 713-699-2732 or 832-754-3705, Fax 713-695-1556, Email: hispaniccontractorsassociation@yahoo.com; or Randymagdaleno@yahoo.com

8. Houston Minority Business Development Center, 2900 Woodridge, Suite 124, Houston, TX 77087, 713-644-0821, Fax 713-644-3523. Email: gtamez@gacompanies.com

9. Reed Construction Data, 30 Technology Parkway South, Suite 100, Norcross, GA – 30092-8629. Tel. 1-800-424-3996 or 1-800-699-8640; Fax 1-800-317-0870 or 1-800-508-5370.

10. The Builders' Exchange of Texas, Inc., 3910 Kirby, Suite 131, Houston, TX 77098, 210-564-6900, Fax: 210-564-6921, Email: houston@btx.com

[11. Add additional plan rooms as needed.]

****************************************************************************************************
MANDATORY
****************************************************************************************************

Add the following Paragraph 4.0 F for ALL projects that do not have any State or Federal funding. Remove instructions and brackets.

F. Add the following sub-Paragraph F.1:

1. Designation as a Hire Houston First City Business (CB) or Local Business (LB)

To be designated as a City Business (“CB”) or as a Local Business (“LB”) for the purposes of the Hire Houston First Program, as set out in Article XI of Chapter 15 of the Houston City Code, a bidder or proposer must submit the Hire Houston First Application and Declaration to the Director of the Office of Business Opportunity and receive notice that the application has been processed and the appropriate designation (if any) is awarded, prior to the submission of a bid or proposal. Bidders must show evidence
of HHF designation (as applicable) prior to, or accompanying, the submission of a bid or proposal.

The absence of a Hire Houston First designation does not preclude a business from bidding on City of Houston contracts.

Download the HHF Application and Declaration from the Office of Business Opportunity Webpage at the City of Houston e-Government Website, located at:

http://www.houstontx.gov/obo/hirehoustonfirst.html

or, delivered to:

Office of Business Opportunity
611 Walker, 7th Floor
Houston, Texas 77002.
Phone: (832) 393-0951
Fax: (832) 393-0646
hirehoustonfirst@houstontx.gov

PARAGRAPH 5.0 – EXAMINATION OF DOCUMENTS, SITE, AND LOCAL CONDITIONS

Insert the following sub-Paragraph:

MANDATORY

Select one alternate sub-Paragraph D.1. Delete alternate sub-Paragraphs not used. Remove instructions and brackets. Use the first alternate sub-Paragraph D.1 for projects to be conducted in the Right-of-way. For projects where access is restricted, use the second alternate sub-Paragraph D.1. Otherwise use the third alternate sub-Paragraph D.1 and list name, telephone number of contact, and appointment times for access to the site.

D. Add the following sub-Paragraph D.1:

1. Work will be performed in public right-of-way. The site may be examined at any time during daylight hours.

[If sub-Paragraph 5.0.D.1 indicates restricted access to the site, then use the following appropriate instructions for access.]
1. Area within contract limits is currently restricted. Access for examination is restricted to times, durations, routes and presence of City authorities, occurring at the conclusion of the Prebid Meeting or as otherwise directed by City Engineer. See Paragraph 15.0 below.

***OR***

1. The site, or part of it, is currently occupied and access is limited. Premises will be open for examination by appointment, under admission by [Name, Telephone No.], only during the following periods:

a. [List days, times]

b. _____

PARAGRAPH 8.0 – SUBSTITUTION OF PRODUCTS

****************************************************************************************************

OPTIONAL

Use Paragraph 8.0 below if substitutions will be allowed during the Bid period. Remove brackets.

****************************************************************************************************

Delete the existing sub-Paragraph A in its entirety, and replace it with the following sub-Paragraphs A, B, C, and D:

A. Where Bid Documents specify a specific Product with provision for consideration of substitutions (or equal), requests for prebid approval of substitutions will be considered from Bidders only if received by Project Manager 10 days or more prior to Bid Date.

B. Requests for substitutions must provide complete information in order to determine acceptability of the Products, in accordance with provisions of Document 00700 - General Conditions.

C. The City will consider requests for substitutions and, if approved, will issue an Addendum. Bidder shall base its Bid only on substitutions approved in Addenda. Substitutions, not listed in an Addendum, are not allowed.

D. Bidder shall include in its Bid, costs of substitutions approved by Addenda.]

PARAGRAPH 9.0 – PREPARATION OF BIDS

Add the following sub-Paragraph I to this Paragraph:

00210-7

02-01-2017
MANDATORY

Insert the following sub-Paragraph and associated table for all Projects.

I. For math errors the City encounters in analyzing Bids, the following guidance will be used:

In the event of a conflict between:

1. Individual Unit Price and Individual Unit Price times Extension of that Unit Price Estimated Quantity
2. A Unit Price extension and Sum of all Individual Unit Price Extensions
total of Unit Price Extensions
3. Individual Alternate and Sum of all Individual Alternates
total of Alternates
4. Individual subtotals for Sum of Individual subtotals for Stipulated Price, Base Unit Prices, Extra Unit Prices,
Contractor Bonus, Contractor Bonus, Cash Allowances, Cash and Alternates; and the Total Allowances and Alternates
Bid Price

PARAGRAPH 10.0 – BID SUBMISSION

Add the following sub-Paragraph A.1 to this Paragraph:

MANDATORY

Add the following sub-Paragraph A.1. Insert information described within brackets. Remove brackets and these instructions.

A. Add the following sub-Paragraph A.1:

1. City Secretary will receive Bids at 900 Bagby, Room P101, Houston, Texas until 10:30 a.m., local time on «BidDate».

OPTIONAL

Public Works Only: Replace sub-Paragraph 10.0 D and add sub-Paragraph 10.0 E if the
D. Submit one copy of the executed offer on the bid forms provided, properly signed, with required Security Deposit, and other Supplements to Bid Forms, in a sealed, opaque envelope. On the outside of the envelope, clearly identify the Certificate of Responsibility number, Bidders name, Project name, and the City’s name. Bids submitted by mail shall be enclosed in a separate envelope addressed for mailing, and identifying the enclosure as a bid.

E. Bidders are responsible for obtaining a Certificate of Responsibility number for the class of contract indicated in Document 00210 – Supplementary Instructions to Bidders. TxDOT Certificate of Qualification letter must be filed with the Director not less than three days prior to Project Bid opening. Bidders who do not have a City of Houston Certificate of Responsibility will be notified by the City.

PARAGRAPH 12.0 – SUBCONTRACTORS AND SUPPLIERS

OPTIONAL

For all AIP Grant Funded Projects: Add the following sub-Paragraph 12.0.C. to the Section. If no AIP Fund involved, remove the sub-paragraph.

C. Refer to Document 00801 – Supplementary Conditions for Project Funded by AIP Grant, for DBE goals.

PARAGRAPH 15.0 – PREBID MEETING

Add the following sub-Paragraph A.1 to this Paragraph:

MANDATORY

Add the following sub-Paragraph A.1 after the Prebid Meeting information has been filled in and the brackets removed. Remove these instructions.

A. Add the following sub-Paragraph A.1:
1. A Prebid Meeting will be held at «PrebidTime» on «PrebidDayDate», in «PrebidFloor» Floor, Conference Room No. «ConferenceRoom» at «PrebidAdd».
REQUEST FOR BID INFORMATION

PROJECT: DR 15 SWAT 4A Northside/Northline Drainage and Paving Improvements

PROJECT No.: WBS No. M-420-HUD-004A-3

TO: Prakash Luetel, P.E
611 Walker Street
Houston, Texas 77002

Phone No. 832.395.2436
Fax No. PrjMgrFax
Email Addr. prakash.luetel@houstontx.gov

(Type or Print question legibly; use back if more space is needed)

This request relates to Drawing / Detail No. and/or Specification Section No.

Attachments to this request: ____________________________

__________________________

Signature Date

(Type or Print Name)

(Type or Print Company Name)

END OF DOCUMENT
1.0 DOCUMENT INCLUDES

A. Environmental Site Assessment, if applicable.

B. Asbestos and Lead Surveys, if applicable.

C. Bidder's responsibilities.

2.0 RELATED DOCUMENTS

A. Document 00320 - Geotechnical Information

3.0 SITE INVESTIGATION REPORTS

A. In the design and preparation of Contract documents for this Project, the City and Design Consultant have used information in environmental site assessment reports for the investigation and analysis of soils and subsurface conditions at the Project site.

B. In the design and preparation of Contract documents for this Project, the City and Design Consultant have relied upon information in surveys taken for Asbestos-containing Materials (ACMs) and lead at the Project site.

C. An electronic copy of each report for this project is included in a CD-Rom affixed to the inside front cover of the project manual.

D. Neither the City nor Design Consultant is responsible for accuracy or completeness of any information or data.

4.0 REPORTS

A. Environmental Assessment Surveys

1. Quadrant Project No. 43503.02, prepared by the firm of Quadrant Consultants Inc, entitled “Phase 1 Environmental Site Assessment DR15 SWAT 4A Northside-Northline Area Drainage & Paving Improvements”, dated June 27, 2017, consisting of 21 pages.
5.0  BIDDER RESPONSIBILITIES

A.  Bidder shall take full responsibility for interpretation and use of information contained in above listed reports for bidding and construction purposes.

B.  Bidder may perform additional investigations as Bidder deems appropriate.

END OF DOCUMENT
To: The Honorable Mayor and City Council of the City of Houston
City Hall Annex
900 Bagby Street
Houston, Texas 77002

Project: DR 15 SWAT 4A Northside/Northline Drainage and Paving Improvements
Project No.: WBS No. M-420-HUD-004A-3

Bidder: (Print or type full name of business entity, such as corporation, LLC, etc)

1.0 OFFER
A. Total Bid Price: Having examined the Project location and all matters referred to in Bid Documents for the Project, we, the undersigned, offer to enter into a Contract to perform the Work for the Total Bid Price shown on the signature page of this Document

B. Security Deposit: Included with the Bid is a Security Deposit in the amount of 10 percent of the Total Bid Price subject to terms described in Document 00200 – Instructions to Bidders.

C. Period for Bid Acceptance: This offer is open to acceptance and is irrevocable for 90 days from Bid Date. That period may be extended by mutual written agreement of the City and Bidder.

D. Addenda: All Addenda have been received. Modifications to Bid Documents have been considered and all related costs are included in the Total Bid Price.

E. Bid Supplements: The following documents are attached:
[X] Security Deposit (as defined in Document 00200 – Instructions to Bidders)
[X] Document 00450 - Bidder's Statement of MWSBE Status
[X] Document 00452 – Campaign Finance Ordinance
[X] Document 00453 – Bidder’s Statement of Residency
[X] Document 00454 - Affidavit of Non-interest
[X] Document 00455 – Affidavit of Ownership or Control
[X] Document 00456 - Bidder’s Certificate of Compliance with Buy American Program (required for AIP funded project)
[X] Document 00457 – Conflicts of Interest Questionnaire (CIQ)
[X] Document 00458 - Bidder’s Certificate Regarding Foreign Trade Restriction (required for AIP funded project)
[ ] Document 00459 - Contractor’s Statement Regarding Previous Contracts Subject to EEO (required for AIP funded project)
[X] Document 00460 – Pay or Play Acknowledgement Form (POP 1-A)
[X] Document 00470 – Bidder’s MWSBE Participation Plan (required unless no MWSBE participation goal is provided in Document 00800 (the “Goal”)).
[ ] Document 00471 – Bidder’s Record of Good Faith Efforts (required if the goal in Bidder’s Participation Plan–Document 00470 is lower than the Goal).

[ ] Document 00472 – Bidder’s Goal Deviation Request (required if the goal in Bidder’s Participation Plan–Document 00470 is lower than the Goal).

[ ] Others as listed: __________________________________________

2.0 CONTRACT TIME

A. If offer is accepted, Contractor shall achieve Date of Substantial Completion within «ContractDura» days after Date of Commencement of the Work, subject to adjustments of Contract Time as provided in the Contract.
1.0 TOTAL BID PRICE HAS BEEN CALCULATED BY BIDDER, USING THE FOLLOWING COMPONENT PRICES AND PROCESS (PRINT OR TYPE NUMERICAL AMOUNTS):

A. STIPULATED PRICE: $[N/A, if Unit Price Job]
   (Total Bid Price; minus Base Unit Prices, Extra Unit Prices, Cash Allowances and All Alternates, if any)

***********
Insert unit price items in table. Identify each unit price item by specification section number under the Item Description. Duplicate this page as needed to list required unit price items. Insert “TOTAL BASE UNIT PRICES” line from table on final page of unit price items. See Paragraph 9.0 in Document 00200 – Instructions to Bidders for guidance.
***********

B. BASE UNIT PRICE TABLE:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref.</th>
<th>Base Unit Short Title</th>
<th>Unit of Measure</th>
<th>Estimated Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>00800</td>
<td>Contractor Bonus for Early Completion</td>
<td>Day</td>
<td>_______</td>
<td>_______ (1)</td>
<td>[Insert Amount]</td>
</tr>
</tbody>
</table>

TOTAL BASE UNIT PRICES $_________
C. EXTRA UNIT PRICE TABLE:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref.</th>
<th>Extra Unit Short Title</th>
<th>Unit of Measure</th>
<th>Estimated Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td></td>
<td>[N/A, if no Extra Unit Prices used]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL EXTRA UNIT PRICES

$_________

REST OF PAGE INTENTIONALLY LEFT BLANK
D. CASH ALLOWANCE TABLE:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref.</th>
<th>Cash Allowance Short Title</th>
<th>Cash Allowance in figures (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>[N/A, if no Cash Allowances used]</td>
<td></td>
<td>[Insert Amount]</td>
</tr>
<tr>
<td>[2]</td>
<td>[e.g. Building Permit or Purchase Material or Equipment under separate Contract Number 0000]</td>
<td></td>
<td>[Insert Amount]</td>
</tr>
<tr>
<td>[3]</td>
<td>[e.g. Utility Reimbursement for moving power poles, underground lines, etc.]</td>
<td></td>
<td>[Insert Amount]</td>
</tr>
</tbody>
</table>

| TOTAL CASH ALLOWANCES |                                                                 | [Insert Total] |

REST OF PAGE INTENTIONALLY LEFT BLANK
Use this table to list Alternates (Section 01230), if any. Coordinate with Section 01110 - Summary of Work. Edit to apply to the Project. Remove brackets. Change color of remaining text to black.

E. ALTERNATES TABLE:

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref.</th>
<th>Alternate Short Title</th>
<th>Unit of Measure</th>
<th>Estimated Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total Price for Alternate in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>[N/A, if no Alternate used]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL ALTERNATES

$________

REST OF PAGE INTENTIONALLY LEFT BLANK
F.  TOTAL BID PRICE:  
(Add Totals for Stipulated Price, Base Unit Price, Extra Unit Price, Cash Allowance, and All Alternates, if any)

TOTAL BID PRICE: $

2.0 SIGNATURES: By signing this Document, I agree that I have received and reviewed all Addenda and considered all costs associated with the Addenda in calculating the Total Bid Price.

Bidder:
(Print or type full name of your proprietorship, partnership, corporation, or joint venture.*)

**By:
Signature  Date

Name:
(Print or type name)  Title

Address:
(Mailing)
(Street, if different)

Telephone and Fax Number:
(Print or type numbers)

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

** Bidder certifies that the only person or parties interested in this offer as principals are those named above. Bidder has not directly or indirectly entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding.

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

****************************************************************************************************
Use the following notes in Unit Price tables, as applicable. Insert the phrase “See Footnote (x)”, where “x” is one of the footnotes below, in “Item Description” column after describing the Unit Price item.

Footnotes for Tables B through E:
(1)  Fixed Unit Price determined prior to Bid. Cannot be adjusted by the Bidder.
(2)  Minimum Bid Price determined prior to Bid. Can be increased by the Bidder, but not decreased, by crossing out the Minimum and inserting revised price on the line above. Cannot be decreased by the Bidder.
(3)  Maximum Bid Price determined prior to Bid. Can be decreased by the Bidder, but not increased, by crossing out the Maximum and inserting revised price on the line above. A Bid that increases the Maximum Bid Price may be found non-conforming and non-responsive. Cannot be increased by the Bidder.
(4)  Fixed Range Bid Price determined prior to Bid. Unit Price can be adjusted by Bidder to any amount within the range defined by crossing out prices noted and noting revised price on the line above.

00410B-5
02-01-2017
# TOTAL BID PRICE HAS BEEN CALCULATED BY BIDDER, USING THE FOLLOWING COMPONENT PRICES AND PROCESS (PRINT OR TYPE NUMERICAL AMOUNTS):

### A. STIPULATED PRICE:
(Total Bid Price; minus Base Unit Prices, Extra Unit Prices, Cash Allowances and All Alternates, if any)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$ (N/A)</td>
<td></td>
</tr>
</tbody>
</table>

### B. BASE UNIT PRICE TABLE:

#### BASE UNIT PRICES FOR - GENERAL

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>01502</td>
<td>Mobilization</td>
<td>LS</td>
<td>1</td>
<td>$150,000.00(1)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>01555</td>
<td>Traffic Control and Regulation</td>
<td>LS</td>
<td>1</td>
<td>$65,000.00(2)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>01555</td>
<td>Flagmen</td>
<td>LS</td>
<td>1</td>
<td>$80,000.00(2)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>01562</td>
<td>Tree and plant protection</td>
<td>LS</td>
<td>1</td>
<td>$65,000.00(2)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>01570</td>
<td>Reinforced Filter fabric fence</td>
<td>LF</td>
<td>4800</td>
<td>$6.00</td>
<td>$28,800.00</td>
</tr>
<tr>
<td>6</td>
<td>01570</td>
<td>Stabilized Construction Exit</td>
<td>EA</td>
<td>4</td>
<td>$2,500.00</td>
<td>$10,000.00</td>
</tr>
<tr>
<td>7</td>
<td>02233</td>
<td>Clearing and Grubbing</td>
<td>AC</td>
<td>50</td>
<td>$6,000.00</td>
<td>$300,000.00</td>
</tr>
<tr>
<td>8</td>
<td>02921</td>
<td>Hydro Mulch Seeding</td>
<td>AC</td>
<td>55</td>
<td>$2,500.00</td>
<td>$137,500.00</td>
</tr>
</tbody>
</table>

**SUBTOTAL FOR GENERAL ITEMS**

|                |          |                             |              |               | $836,300.00                      |                 |

#### BASE UNIT PRICES FOR - STORM SEWER

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>02221</td>
<td>Remove/Dispose 12-inch RCP culvert pipe</td>
<td>LF</td>
<td>556</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>02221</td>
<td>Remove/Dispose 15-inch RCP culvert pipe</td>
<td>LF</td>
<td>2926</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>02221</td>
<td>Remove/Dispose 18-inch RCP culvert pipe</td>
<td>LF</td>
<td>27794</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>02221</td>
<td>Remove/Dispose 21-inch RCP culvert pipe</td>
<td>LF</td>
<td>18</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>02221</td>
<td>Remove/Dispose 24-inch RCP culvert pipe</td>
<td>LF</td>
<td>3442</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>02221</td>
<td>Remove/Dispose 30-inch RCP culvert pipe</td>
<td>LF</td>
<td>16</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>02221</td>
<td>Remove/Dispose Inlets all sizes/depth</td>
<td>EA</td>
<td>0</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>02221</td>
<td>Remove/Dispose Storm Manholes all Sizes/depth</td>
<td>EA</td>
<td>0</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
<td>Amount</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>--------------------------------------------------</td>
<td>-------</td>
<td>----------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>02260</td>
<td>Trench Safety System for Storm Sewer</td>
<td>LF</td>
<td>0</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>02631</td>
<td>24-inch diameter RCP Culvert by open cut</td>
<td>LF</td>
<td>0</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>30&quot;x19&quot; Elliptical RCP Culvert by Open Cut</td>
<td>LF</td>
<td>0</td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>
### BASE UNIT PRICES FOR - PAVING

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>02221</td>
<td>Remove/Dispose Driveway (all thicknesses and all types)</td>
<td>SY</td>
<td>$5610</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>02754</td>
<td>Concrete Driveways including Excavation 6-inch thick</td>
<td>SF</td>
<td>$33260</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>02741</td>
<td>Asphalt Driveways including Excavation 6-inch thick</td>
<td>SF</td>
<td>$1860</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>02221</td>
<td>Remove and Dispose of Asphalt Pavement surface (all thickness, including base &amp; subgrade, w/ or w/o curbs, all depths)</td>
<td>SY</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>02741</td>
<td>Asphalt mill and overlay - 2&quot; thick</td>
<td>SY</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>02711</td>
<td>Hot Mix Asphalitic Base Course (Type A/B)-6&quot; Thick</td>
<td>TON</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>02741</td>
<td>Hot Mix Asphalitic Concrete Surface Course-1-1/2&quot; Thick</td>
<td>TON</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>02336</td>
<td>Lime Stabilized Subgrade - 6&quot; Thick</td>
<td>SY</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>02336</td>
<td>Lime for Lime Stabilized Subgrade at #33/SY</td>
<td>TON</td>
<td>$</td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>

### SUBTOTAL FOR PAVING ITEMS

$00410-B3
04/08/2015
BIDDER'S INITIALS [ ]
<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>02511</td>
<td>3/4-inch to 1-inch diameter water taps and copper service line with meter box, short side</td>
<td>EA</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>02511</td>
<td>3/4-inch to 1-inch diameter water taps and copper service line with meter box, long side</td>
<td>EA</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>02086</td>
<td>Adjust existing valve box to proposed grade</td>
<td>EA</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>02520</td>
<td>Remove and salvage fire hydrant</td>
<td>EA</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>02520</td>
<td>Adjust exist fire hydrant and gate valve to proposed grade</td>
<td>EA</td>
<td></td>
<td>$</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>02520</td>
<td>Prop fire hydrant assembly - all depth including 6-inch dia. GV and box</td>
<td>EA</td>
<td></td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>

**SUBTOTAL FOR WATER ITEMS**

**BASE UNIT PRICES FOR - WASTEWATER**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>02534</td>
<td>Sanitary sewer service lines adjustment</td>
<td>EA</td>
<td>100</td>
<td>$</td>
<td></td>
</tr>
</tbody>
</table>
**C. EXTRA UNIT PRICE TABLE:**

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Spec Ref</th>
<th>Item Description</th>
<th>Unit Measure</th>
<th>Unit Quantity</th>
<th>Unit Price (this column controls)</th>
<th>Total in figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>02221</td>
<td>Remove and Dispose of Miscellaneous Concrete And Masonry</td>
<td>CY</td>
<td>100</td>
<td>$10.00(2)</td>
<td>$1,000.00(2)</td>
</tr>
<tr>
<td>42</td>
<td>02317</td>
<td>6&quot; Overexcavate trench bottom</td>
<td>LF</td>
<td>200</td>
<td>$5.00(2)</td>
<td>$1,000.00(2)</td>
</tr>
<tr>
<td>43</td>
<td>02318</td>
<td>Excavation around obstructions</td>
<td>CY</td>
<td>40</td>
<td>$10.00(2)</td>
<td>400.00(2)</td>
</tr>
<tr>
<td>44</td>
<td>02318</td>
<td>Extra hand excavation</td>
<td>CY</td>
<td>40</td>
<td>$12.00(2)</td>
<td>480.00(2)</td>
</tr>
<tr>
<td>45</td>
<td>02318</td>
<td>Extra machine excavation</td>
<td>CY</td>
<td>100</td>
<td>$10.00(2)</td>
<td>1,000.00(2)</td>
</tr>
<tr>
<td>46</td>
<td>02318</td>
<td>Extra placement of backfill material</td>
<td>CY</td>
<td>100</td>
<td>$5.00(2)</td>
<td>$500.00(2)</td>
</tr>
<tr>
<td>47</td>
<td>02318</td>
<td>Extra placement of granular fill</td>
<td>CY</td>
<td>20</td>
<td>$20.00(2)</td>
<td>40.00(2)</td>
</tr>
<tr>
<td>48</td>
<td>02318S</td>
<td>Extra cement-stabilized sand</td>
<td>CY</td>
<td>100</td>
<td>$20.00(2)</td>
<td>2,000.00(2)</td>
</tr>
<tr>
<td>49</td>
<td>02511</td>
<td>Extra water fittings in place</td>
<td>TON</td>
<td>1</td>
<td>$1,000.00(2)</td>
<td>1,000.00(2)</td>
</tr>
<tr>
<td>50</td>
<td>02317, 02317S</td>
<td>18&quot; Overexcavate trench bottom</td>
<td>LF</td>
<td>1170</td>
<td>$20.00(2)</td>
<td>61,600.00(2)</td>
</tr>
</tbody>
</table>

**D. CASH ALLOWANCE TABLE:**

<table>
<thead>
<tr>
<th>Cash Allowance No.</th>
<th>Cash Allowance Short Title</th>
<th>Cash Allowance in Figures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASH.01</td>
<td>NPDES Permits</td>
<td>$200.00</td>
</tr>
<tr>
<td>CASH.02</td>
<td>Street Cut Permit</td>
<td>$4,200.00</td>
</tr>
<tr>
<td>CASH.03</td>
<td>Centerpoint Street Light</td>
<td>$50,000.00</td>
</tr>
<tr>
<td>CASH.04</td>
<td>Flood Plain Management Office Development Permit</td>
<td>$7,000.00</td>
</tr>
</tbody>
</table>

**TOTAL CASH ALLOWANCES:** $61,400.00
Bidder’s Bond

That we, ____________________________ (Bidder) and the other subscriber hereeto, ____________________________, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of ___________________________________________ Dollars ($___________) (an amount equal to 10 percent of the Total Bid Price, including Cash Allowances and Alternates, if any, for the payment of which sum, well and truly to be made to the City of Houston and its successors, the Bidder and Surety do bind themselves, their heirs, executors, administrators, successors, and assigns, jointly and severally.

The conditions of this obligation are such that:

Whereas, the Bidder has submitted on or about this day a proposal offering to perform the following:

________________________________________________________________________________________
________________________________________________________________________________________

(Project Name, Location and Number) in accordance with the Drawings, Specifications, and terms and conditions related thereto to which reference is hereby made.

Now, therefore, if the Bidder’s offer as stated in the Document 00410 – Bid Form is accepted by the City, and the Bidder executes and returns to the City Document 00520 – Agreement, required by the City, on the forms prepared by the City, for the Work and also executes and returns the same number of the Performance, Payment and Maintenance Bonds (such bonds to be executed by a Corporate Surety authorized by the State Board of Insurance to conduct insurance business in the State of Texas, and having an underwriting limitation in at least the amount of the bond) and other submittals as required by Document 00495 - Post-Bid Procedures, in connection with the Work, within the Contract Time, then this obligation shall become null and void; otherwise it is to remain in full force and effect.

If Bidder is unable to or fails to perform the obligations undertaken herein, the undersigned Bidder and Surety shall be liable to the City for the full amount of this obligation which is hereby acknowledged as the amount of damages which will be suffered by the City on account of the failure of such Bidder to perform such obligations, the actual amount of such damages being difficult to ascertain.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving Party may hereafter prescribe by written notice to the sending Party.

In witness thereof, the Bidder and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

By:
Name: ____________________________
Title: ____________________________

ATTEST/SURETY WITNESS: (SEAL)

By:
Name: ____________________________
Title: ____________________________

End of Document
BIDDER’S STATEMENT OF MWBE/PDBE/DBE/SBE STATUS

This certifies that the status of the Bidder, ________________________, in regard to the City of Houston Code of Ordinances, Chapter 15, Article V, relating to City-wide percentage goals for contracting with Minority and Women-owned Business Enterprises (MWBE) and Disadvantaged Business Enterprises (DBE), Chapter 15, Article VI, relating to City-wide percentage goals for contracting with Persons with Disabilities Business Enterprises (PDBE) and Chapter 15, Article IX, relating to City-wide percentage goals for contracting with a Small Business Enterprise (SBE) is as follows:

1. Bidder (individual, partnership, corporation) is [   ] is not [   ] a Minority Business Enterprise as certified by the Affirmative Action and Contract Compliance Division.

2. Bidder (individual, partnership, corporation) is [   ] is not [   ] a Women-owned Business Enterprise as certified by the Affirmative Action and Contract Compliance Division.

3. Bidder (individual, partnership, corporation) does [   ] does not [   ] declare itself to be a Persons with Disabilities Business Enterprise as defined above.

4. Bidder (individual, partnership, corporation) does [   ] does not [   ] declare itself to be a Disadvantaged Business Enterprise as defined above.

5. Bidder (individual, partnership, corporation) does [   ] does not [   ] declare itself to be a Small Business Enterprise as defined above.

Signature: ____________________________________________________________________

Title: ________________________________________________________________________

Date: _________________________________________________________________________

END OF DOCUMENT
List of Changes:
04-30-2004: Minor edits to the instructions.
02-08-2013: Edits to include LLC as a corporate entity.
11-29-2016: Edited language in introduction, and renamed form to reflect changes in the applicable Code of Ordinance Chapter.
By submitting a bid or proposal to the City of Houston for a Contract in excess of $50,000 or for which a request is presented to City Council for approval, all respondents agree to comply with Chapter 18 of the Code of Ordinances.

Pursuant to Section 18-36 of the Code of Ordinances, it is unlawful either for any contractor to contribute or offer any contribution to a candidate, or for any candidate to solicit or accept any contribution from a contractor for a period commencing at the time of posting of the City Council Meeting Agenda including an item for the award of the Contract and ending upon the 30th day after the award of the Contract by City Council, or a determination by City Council of the Mayor that the contract will not be awarded to a contractor.

The term “contractor” means any person who has received the award of a contract, has submitted a bid or proposal in any form for the award of a contract, or has been proposed to be awarded the contract in an item placed upon the City Council agenda, including any other person who seeks the award of the contract and is contesting, appealing, or protesting the award of the contract as proposed.

This list is submitted under the provisions of Section 18-36(b) of the City of Houston Code of Ordinances in connection with the attached Bid/Proposal of:

Firm or Company Name: ________________________________

Firm or Company Address: ______________________________

The firm/company is organized as indicated below. Check one as applicable and attach additional pages if needed to supply the required names and addresses.

[ ] SOLE PROPRIETOR

Name ________________________________     Proprietor Address ________________________________

[ ] A PARTNERSHIP

LIST EACH PARTNER HAVING EQUITY INTEREST OF 10% OR MORE OF PARTNERSHIP (IF NONE STATE “NONE”)

Name ________________________________     Partner Address ________________________________
Northside/Northline Drainage and Paving Improvements  
WBS No. M-420HUD-004A-3  

CONTRACTOR SUBMISSION LIST  
CAMPAIGN FINANCE ORDINANCE  

[ ] A LIMITED LIABILITY COMPANY  

LIST EACH MEMBER OR MANAGER (IF NO MEMBERS) HAVING EQUITY INTEREST OF 10% OR MORE IN THE LIMITED LIABILITY COMPANY (IF NONE, STATE “NONE”)  

Name ___________________________________________  
Member/Manager  
Address  

Name ___________________________________________  
Member/Manager  
Address  

Name ___________________________________________  
Member/Manager  
Address  

[ ] A CORPORATION  

LIST ALL DIRECTORS OF THE CORPORATION (IF NONE STATE “NONE”)  

Name ___________________________________________  
Director  
Address  

Name ___________________________________________  
Director  
Address  

Name ___________________________________________  
Director  
Address  

LIST ALL OFFICERS OF THE CORPORATION (IF NONE STATE “NONE”)  

Name ___________________________________________  
Officer  
Address  

Name ___________________________________________  
Officer  
Address  

Name ___________________________________________  
Officer  
Address  

LIST ALL INDIVIDUALS OWNING 10% OR MORE OF OUTSTANDING SHARES OF STOCK OF THE CORPORATION (IF NONE STATE “NONE”)  

Name ___________________________________________  
Owner  
Address  

Name ___________________________________________  
Owner  
Address  

00452-3  
12-15-2016
I certify that I am duly authorized to submit this list on behalf of the firm, that I am associated with the firm in the capacity noted below, and that I have knowledge of the accuracy of the information provided herein.

______________________________
Signature

______________________________
Printed Name

______________________________
Title

Note: This list constitutes a government record as defined by § 37.01 of the Texas Penal Code.

END OF DOCUMENT
BIDDER'S STATEMENT OF RESIDENCY

The City may not award a contract for general construction, services, or purchases to a Nonresident Bidder unless Nonresident's Bid is lower than the lowest Bid submitted by a responsible Texas Resident Bidder by the same amount that a Texas Resident bidder would be required to underbid the Nonresident Bidder to obtain a comparable contract in the state in which Nonresident's principle place of business is located.

1. This certifies that the Bidder, ________________________________, is a State of Texas Resident Bidder as defined in TEX. GOVT. CODE ANN. § 2252.001(4) (Vernon 2016).

_________________________________________  __________________________
Signature                                      Title

"Texas Resident Bidder" means a bidder whose principal place of business is in this State, and includes a Contractor whose ultimate parent company or majority owner has its principal place of business in this State. *When bidder cannot sign 1, above, proceed to 2.*

2. a. __________________________________ is a resident of ________________________________ and is a Nonresident Bidder as defined in TEX. GOVT. CODE ANN. § 2252.001(3) (Vernon 2016).

_________________________________________  __________________________
Signature                                      Title

"Nonresident Bidder" means a bidder whose principal place of business is not in this State, but excludes a contractor whose ultimate parent company or majority owner has its principal place of business in this State.

b. The State of ________________________________ [does/does not] have a state statute giving preference to resident bidders.

_________________________________________  __________________________
Signature                                      Title

*If the answer to 2.b is that your state does have a statute giving preference to resident bidders, then you must provide a copy and proceed to 3. *

3. A copy of the State of ________________________________ statute is attached.

_________________________________________  __________________________
Signature                                      Title

_________________________________________  __________________________
Date
END OF DOCUMENT
Note to Specifier - Do not include this form if the Project will receive federal funding in whole or in part. If used, include reference in Document 00210 - Supplementary Instructions to Bidders.

States that currently penalize out-of-state bidders include, but may not be limited to, Colorado, Illinois, Iowa, Minnesota, Montana, North Dakota, Pennsylvania, and Wyoming. If Low Bidder is a resident of one of these states, consult the City of Houston Legal Department in adjusting the Bid Amount.
AFFIDAVIT OF NON-INTEREST

BEFORE ME, the undersigned authority, a Notary Public in and for the State of Texas, on

this day personally appeared ________________________________________,
who

Affiant

being by me duly sworn on his oath stated that he is ________________________________________, of ________________________________,

______________________________________________________________

Name of Firm

the firm named and referred to and in the foregoing; and that he knows of no officer, agent, or employee of the City of Houston being in any manner interested either directly or indirectly in such Contract.

______________________________________________________________

Affiant's Signature

SWORN AND SUBSCRIBED before me on ____________________________.

Date

______________________________________________________________

Notary Public in and for the State of TEXAS

______________________________________________________________

Print or type name

My Commission Expires: __________________

Expiration Date

END OF DOCUMENT
AFFIDAVIT OF
OWNERSHIP OR CONTROL

STATE OF §
§
COUNTY OF §

BEFORE ME, the undersigned authority, on this day personally appeared __________________________
______________________________ [FULL NAME] (the “Affiant”),
______________________________ [STATE TITLE/CAPACITY WITH CONTRACTING ENTITY] of __________________________
______________________________ [CONTRACTING ENTITY’S CORPORATE/LEGAL NAME] (“Contracting Entity”),
who being by me duly sworn on oath stated as follows:

1. Affiant is authorized to give this affidavit and has personal knowledge of the facts and matters herein stated.

2. Contracting Entity seeks to do business with the City in connection with __________________________

[DESCRIBE PROJECT OR MATTER] which is expected to be in an amount that exceeds $50,000.

3. The following information is submitted in connection with the proposal, submission or bid of Contracting Entity in connection with the above described project or matter.

4. Contracting Entity is organized as a business entity as noted below (check box as applicable).

FOR PROFIT ENTITY:

[ ] SOLE PROPRIETORSHIP
[ ] CORPORATION
[ ] PARTNERSHIP
[ ] LIMITED PARTNERSHIP
[ ] JOINT VENTURE
[ ] LIMITED LIABILITY COMPANY
[ ] OTHER (Specify type in space below)

NON-PROFIT ENTITY:

[ ] NON-PROFIT CORPORATION
[ ] UNINCORPORATED ASSOCIATION

5. The information shown below is true and correct for the Contracting Entity; and

6. All owners of 10% or more of the Contracting Entity and, where the Contracting Entity is a non-profit entity, the required information has been shown for each officer, i.e., president, vice-president, secretary,
treasurer, etc. [NOTE: In all cases, use full names, local business and residence addresses and telephone numbers. Do not use post office boxes for any address. Inclusion of e-mail addresses is optional, but recommended. Attach additional sheets as needed.]

Contracting Entity

Name: ____________________________________________

Business Address [No./Street] __________________________

[CITY/STATE/ZIP CODE] __________________________

Telephone Number (___) __________________________

Email Address [OPTIONAL] __________________________

Residence Address [No./Street] __________________________

[CITY/STATE/ZIP CODE] __________________________

Telephone Number (___) __________________________

Email Address [OPTIONAL] __________________________

10% Owner(s) or More (If none, state “None.”)

Name: ____________________________________________

Business Address [No./Street] __________________________

[CITY/STATE/ZIP CODE] __________________________

Telephone Number (___) __________________________

Email Address [OPTIONAL] __________________________

Residence Address [No./Street] __________________________

[CITY/STATE/ZIP CODE] __________________________

Telephone Number (___) __________________________

Email Address [OPTIONAL] __________________________
7. Optional Information

Contracting Entity and/or [NAME OF OWNER OR NON-PROFIT OFFICER] is actively protesting, challenging or appealing the accuracy and/or amount of taxes levied against [CONTRACTING ENTITY, OWNER OR NON-PROFIT OFFICER] as follows:

| Name of Debtor: | ______________________ |
| Tax Account Nos. | ______________________ |
| Case or File Nos. | ______________________ |
| Attorney/Agent Name | ______________________ |
| Attorney/Agent Phone No. | (_____)_________________ |
| Tax Years | ______________________ |

Status of Appeal [DESCRIBE] ______________________________________________________

Affiant certifies that he or she is duly authorized to submit the above information on behalf of the Contracting Entity, that Affiant is associated with the Contracting Entity in the capacity noted above and has personal knowledge of the accuracy of the information provided herein, and that the information provided herein is true and correct to the best of Affiant’s knowledge and belief.

________________________________________
Affiant

SWORN TO AND SUBSCRIBED before me this _____ day of ________________, 20___.

(Seal)

________________________________________
Notary Public

NOTE: This affidavit constitutes a **government record** as defined by Section 37.01 of the Texas Penal Code. Submission of a false government record is punishable as provided in Section 37.10 of the Texas Penal Code. Attach additional pages if needed to supply the required names and addresses.
Local Government Code Chapter 176 requires Bidders with the City of Houston ("City") to file a Conflict of Interest Questionnaire with the City Secretary of the City of Houston.

The Conflict of Interest Questionnaire is available for downloading on the Texas Ethics Commission's website at: [http://www.ethics.state.tx.us/forms/CIQ.pdf](http://www.ethics.state.tx.us/forms/CIQ.pdf). The completed Conflict of Interest Questionnaire will be posted on the City Secretary's website. Also you will find a list of the City Local Government Officers on the City Secretary's website.

For your convenience the CIQ form is attached as part of this document. Although the City has provided this document for the Bidders convenience, it is the Bidders responsibility to submit the latest version of the CIQ form as promulgated by the Texas Ethics Commission.

The Failure of any Bidder to comply with this law is a Class C misdemeanor.

END OF DOCUMENT
Northside/Northline  
Drainage and Paving Improvements  
WBS No. M-420HUD-004A-3  
CONTRACTOR'S STATEMENT REGARDING  
PREVIOUS CONTRACTS SUBJECT TO EEO

Document 00459

CONTRACTOR'S STATEMENT REGARDING PREVIOUS CONTRACTS SUBJECT TO EQUAL EMPLOYMENT OPPORTUNITY

Section 60-1.7(b) of the Regulations of the Secretary of Labor requires each bidder or prospective prime contractor and proposed subcontractor, where appropriate, to state in the bid or at the outset of negotiations for the contract whether it has participated in any previous contract or subcontract subject to the equal opportunity clause; and if so, whether it has filed with the Joint Reporting Committee, the Director, an agency, or the former President's Committee on Equal Employment Opportunity all reports due under the applicable filing requirements. In any case in which a bidder or prospective prime contractor or proposed subcontractor which participated in a previous contract subject to Executive Order 10925, 11114, or 11246 has not filed a report due under the applicable filing documents, no contract or subcontract shall be awarded unless such contractor submits a report covering the delinquent period or such other period specified by the FAA or the Director, OFCCP.

Contractor has __ has not __ participated in a previous contract subject to the equal opportunity clause prescribed by Executive Order 10925, or Executive Order 11114, or Executive Order 11246.

Contractor has __ has not __ submitted all compliance reports in connection with any such contract due under the applicable filing requirements; and that representations indicating submission of required compliance reports signed by proposed subcontractors will be obtained prior to award of subcontracts.

If Contractor has participated in a previous contract subject to the equal opportunity clause and has not submitted compliance reports due under applicable filing requirements, Contractor (Proposer) shall submit a compliance report on Standard Form 100, "Employee Information Report EEO-1" prior to the award of the Contract.

Standard Form 100 is normally furnished to contractors annually, based on a mailing list currently maintained by the Joint Reporting Committee. In the event Contractor has not received the form, Contractor may obtain it by writing to the following address:

Joint Reporting Committee  
1800 G Street  
Washington, DC 20506

(Printed or typed Name of Signatory)

Signature _______________________________ Date _______________________________

Title _______________________________

Contractor's Firm Name _______________________________

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

END OF DOCUMENT

00459-1  
02-01-2004
It has been determined that the project currently open for bidding meets the criteria of the City of Houston Pay or Play program. This form acknowledges your awareness of the Pay or Play program which is authorized by Ordinance 2007-534. Your signature below affirms that you will comply with the requirements of the program if you are the successful bidder/proposer, and ensure the same on behalf of subcontracts subject to the Pay or Play Program.

I declare under penalty of perjury under the laws of the State of Texas that if awarded this contract which meets the criteria for the City of Houston’s Pay or Play Program, I will comply with all requirements of the Pay or Play Program in accordance with Executive Order 1-7.

*Fill out all information below and submit this form with your bid/proposal packet.

Solicitation Number

Signature ___________________________ Date ___________________________

Print Name ___________________________ City Vendor ID ___________________________

Company Name ___________________________ Phone Number ___________________________

Email Address ___________________________

Note: For more information contact your POP Liaison or the POP Contract Administrator. All contact information can be found on www.houstontx.gov ➔Departments ➔Office of Business Opportunity ➔Pay or Play.
# BIDDER’S MWSBE PARTICIPATION PLAN

The Bidder or Proposer shall submit this completed form with the bid, to demonstrate the Bidder/Proposer’s plan to meet the contract-specific MWSBE goal(s) (“contract goal(s)”). If the Bidder or Proposer cannot meet the contract goal(s), the Bidder/Proposer has the burden to demonstrate “Good Faith Efforts”, which shall include correctly and accurately preparing and submitting this form, a Record of Good Faith Efforts (Document 00471), a Request for Deviation from the Goal (Document 00472), and providing supporting documentation evidencing their “Good Faith Efforts”, as required by the City of Houston’s Good Faith Efforts Policy (Document 00808). The City will review the Participation Plan and Good Faith Efforts at the time of bid opening. Visit [http://www.houstontx.gov/obo](http://www.houstontx.gov/obo) for more information.

<table>
<thead>
<tr>
<th>City Contract Goal</th>
<th>MBE</th>
<th>WBE</th>
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- MBE and WBE Goals are two separate Contract Goals.
- Any excess of one Goal cannot be applied to meet another Goal.
- An SBE can be applied to the MBE and/or WBE Goal, but not to exceed 4%.
- Only up to 50% of the Bidder’s Participation plan may be met using Suppliers.

<table>
<thead>
<tr>
<th>NAICS Code (6 digit)</th>
<th>Description of Work (Plan Sheet #, Unit Price #, Scope of Work #, as applicable)</th>
<th>% of Total Bid Price (2 decimal places, Example: 5.00 %)</th>
<th>Services or Supplier</th>
<th>Cert. Type for Goal: MBE, WBE, or SBE</th>
<th>Certified Firm Name</th>
<th>Firm Address</th>
<th>Contact Name</th>
<th>Phone No. and E-Mail</th>
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**Signature for Company:** ____________________________ *

**Printed Name:** ____________________________

**Company Name:** ____________________________

**Phone #:** ____________________________

**Date:** ____________________________

* I understand that supplying inaccurate information may violate Texas Penal Code Section 37.10 and lead to City sanctions.

00470-1
01-20-2017

<<Bidder or Proposer Name>>
## DOCUMENT 00470

### CONTINUATION PAGE

<table>
<thead>
<tr>
<th>NAICS Code (6 digit)</th>
<th>Description of Work (Plan Sheet #, Unit Price #, Scope of Work #, as applicable)</th>
<th>% of Total Bid Price (2 decimal places, Example: 5.00 %)</th>
<th>Services or Supplier</th>
<th>Cert. Type for Goal MBE, WBE, or SBE</th>
<th>Certified Firm Name</th>
<th>Firm Address</th>
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Signature for Company: _____________________________________________ * Date: _____________________

Print Name/Company Name: ___________________________ Phone: ____________

*I understand that supplying inaccurate information may violate Texas Penal Code Section 37.10 and lead to City sanctions.

00470-2
01-20-2017
<<Bidder or Proposer Name>>
Document 00471
PRE-BID GOOD FAITH EFFORTS

Bidder Name:  
Project Name:  

A Bidder or Proposer that may be unable to complete or follow a Participation Plan (Document 00470) to meet the Contract Goal in the Supplemental Conditions (Document 00800), must submit this completed form, Goal Deviation Request Form (Document 00472), providing supporting documentation evidencing their “Good Faith Efforts”, as required by the City of Houston’s Good Faith Efforts Policy (see Document 00808).

The Bidder or Prime Contractor has the burden to demonstrate “Good Faith Efforts” to meet the MWSBE goal, which includes correctly and accurately preparing and submitting this form and other efforts described in the City’s Good Faith Efforts Policy (Document 00808). The Office of Business Opportunity will review Good Faith Efforts and Participation Plan after selection of an apparent low bidder.

UNLESS THE BIDDER’S/PROPOSER’S PARTICIPATION PLAN MEETS THE CONTRACT GOAL, FAILURE TO SUBMIT THIS FORM MAY RESULT IN THE BID BEING FOUND NON-RESPONSIVE.

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Plan Item No.</th>
<th>MWSBE Type for Goal</th>
<th>Certified Firm Name, Address, Phone No., and E-Mail</th>
<th>Certified Firm Contact Person</th>
<th>Methods of Contact</th>
<th>Prime Contact Dates</th>
<th>Certified Firm Response</th>
<th>Results of Contact (why suitable or not suitable for work)</th>
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Authorized Signature:  
Date:  
Phone:  

Print Name:  
Email Address:  

Company Name:  

00471-1  
08-01-2015
### CONTINUATION PAGE

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Plan Item No.</th>
<th>MWSBE Type for Goal</th>
<th>Certified Firm Name Address, Phone No., and E-Mail</th>
<th>Certified Firm Contact Person</th>
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Authorized Signature: __________________________  Date: ____  Phone: __________________________

Print Name: __________________________  Email Address: __________________________

Company Name: __________________________
Document 00472  
BIDDER’S MWSBE GOAL DEVIATION REQUEST

Company Name:  
Project Name:  

<table>
<thead>
<tr>
<th>Department Approved Contract Goals</th>
<th>MBE</th>
<th>WBE</th>
<th>Total</th>
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<tr>
<th>Bidder’s Proposed Participation Plan</th>
<th>MBE</th>
<th>WBE</th>
<th>SBE (Max 4% for Credit)</th>
<th>Total</th>
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Justification: Please provide the reason the Bidder is unable to meet the Contract Goal in Document 00800.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Good Faith Efforts: Please list any efforts not listed in the Bidder’s Pre-Bid Good Faith Effort (Document 00471) and provide supporting documentation evidencing “Good Faith Efforts”, as required by the City of Houston’s Good Faith Efforts Policy (Document 808).

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Date: ___________________________ Company Name: ___________________________
Email: __________________________ Company Representative: _______________________
Phone Number: ___________________ Title: ________________________________

FOR OFFICIAL USE ONLY:  Approved [ ]  Not Approved [ ]
OBO Representative: __________________ Date: __________________________
Title: ___________________________
1.0 DOCUMENT ADDRESSES

A. Notice of Intent to Award.
B. Monitoring Authority.
C. Requirements of Bidder.
D. Failure of Bidder to comply with requirements.
E. Notice to Proceed.

2.0 NOTICE OF INTENT TO AWARD

A. The City will provide written Notice of Intent to Award to Low Bidder.

3.0 DEFINITIONS

A. The “Monitoring Authority” for this Project is:

   Director, Office of Business Opportunity Division
   City of Houston
   611 Walker Street, 7th Floor
   Houston, Texas 77002

B. The “Contracting Department” for this Project is:
   Director, Department of «DEPARTMENT»
   City of Houston
   611 Walker Street
   Houston, Texas 77002
   ATTN: «PrjMgrName».

4.0 REQUIREMENTS OF BIDDER

A. Within 10 days of receipt of Notice of Intent to Award, Low Bidder shall execute and deliver to «PrjMgrName», Project Manager and Monitoring Authority, for the City's approval, documents indicated by an "X" below:
   [ ] Document 00570 – Revised MWSBE Participation Plan (Do not submit if OBO Director approved Document 00470, Bidder’s Plan).
[ X ] Executed Subcontract(s), Letter(s) of Intent, or documentation of good faith efforts to meet the MWBE/PDBE/DBE/SBE goals.

[ ] Early Payment Discount Language Acceptance Form

B. Within 10 days of receipt of Notice of Intent to Award, Low Bidder shall execute and deliver to «PrjMgrName», Project Manager for the City's approval, documents indicated by an "X" below:

[ ] Document 00500 - Form of Business

[ X ] Document 00501 - Resolution of Contractor

[ X ] Document 00520 - Agreement

[ X ] Document 00600 - List of Proposed Subcontractors and Suppliers

[ X ] Document 00601 - Drug Policy Compliance Agreement

[ X ] Document 00602 - Contractor’s Drug-free Workplace Policy (Contractor creates this document.)


[ X ] Document 00605 - List of Safety Impact Positions (Contractor completes this list. Do not submit if submitting Document 00606.)

[ ] Document 00606 - Contractor's Certification of No Safety Impact Positions (Do not submit if submitting Document 00605.)

[ ] Document 00607 - Certification Regarding Debarment, Suspension, and Other Responsibility Matters

[ ] Document 00608 - Contractor’s Certification Regarding Non-segregated Facilities for Project Funded by AIP Grant

[ X ] Document 00610 - Performance Bond

[ X ] Document 00611 - Statutory Payment Bond

[ X ] Document 00612 - One-year Maintenance Bond

[ ] Document 00613 - One-year Surface Correction Bond

[ X ] Document 00620 - Affidavit of Insurance (with Certificate of Insurance attached)

[ X ] Document 00622 - Name and Qualifications of Proposed Superintendent (Contractor creates this document.)

[ ] Document 00623 - Contractor's Act of Assurance (SRF Form ED-103)

[ X ] Document 00624 - Affidavit Of Compliance with Affirmative Action Program

[ ] Document 00625 - SRF Participation Summary

[ ] Document 00626 - SRF Affirmative Steps Solicitation Report

[ ] Document 00627 - SRF Prime Contractor Affirmative Steps Certification and Goals

[ ] Document 00629 - Affidavit for FAA Form 7460-1

[ X ] Document 00630 - Certification of Compliance with Pay or Play Program

[ X ] Document 00631 - City of Houston Pay or Play Program – List of Subcontractors

[ X ] Document 00636 - Certificate of Interested Parties

[ ] Document 00809 – CDBG Requirements for Federally Funded Projects
C. Within 10 days of receipt of Notice of Intent to Award, Low Bidder shall execute the following forms and deliver them directly to the Monitoring Authority.

1. Original forms contained in Document 00805 – Equal Employment Opportunity Program Requirements:
   [ X ] Document 00805, EEO-3 - Certification by Bidder Regarding Equal Employment Opportunity
   [ X ] Document 00805, EEO-6 - Total Work Force Composition of the Company or in lieu thereof, a copy of the latest Equal Employment Opportunity Commission’s EEO-1 form (This information is required only if the Contractor has a work force of 50 or more people and the Contract is $50,000 or more.)
   [ X ] Document 00805, EEO-7 - Company’s Equal Employment Opportunity Compliance Program
   [ ] Document 00805, EEO-26 - Certification by Proposed Subcontractor Regarding Equal Employment Opportunity
   [ X ] Page 00812, Exhibit “A” – Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees

2. Original completed form Document 00633 - Certification by Proposed Material Suppliers, Lessors, and Professional Service Providers Regarding Equal Employment Opportunity, for each proposed material supplier and equipment supplier.

   [ X ] Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees, Exhibit “B”
   [ X ] Certificate from SubContractor Appointing Officer or Employee to Supervise Payment of Employees, Exhibit “C”
   [ ] Document 00812, Exhibit “A” – Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees

4. Original forms contained in Document 00821 – Wage Rate for Building Construction
   [ X ] Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees, Exhibit “B”
   [ X ] Certificate from SubContractor Appointing Officer or Employee to Supervise Payment of Employees, Exhibit “C”

D. Designations of Subcontractors and Suppliers, who have been selected by Bidder in Document 00600 - List of Proposed Subcontractors and Suppliers, and accepted by the City, may be changed only with prior notice and acceptance by Project Manager as provided in Conditions of the Contract. For each Product Supplier subsequently added or substituted, provide an original completed form, Document 00633 - Certification by Proposed Material Suppliers, Lessors, and Professional Service Providers Regarding Equal Employment
Opportunity, directly to the Monitoring Authority.

E. On Bidder's written request, «PriMgrName», Project Manager may grant an extension of time, not to exceed 5 days, to furnish documents specified in Paragraphs 4.0.A and 4.0.B. If Bidder is required to resubmit documents specified in Paragraph 4.0.A or 4.0.B, Bidder shall do so within time limits provided in the request for resubmission.

F. Designations of Subcontractors and Suppliers, who have been selected by Bidder in its Participation Plan, and accepted by the City, may be changed only with prior notice and acceptance by the Monitoring Authority as provided in Document 00808 – Bidder/Contractor Requirements for the City of Houston Minority, Women, and Small Business Enterprise (MWSBE), and Persons with Disabilities Business Enterprise (PDBE).

5.0 FAILURE OF BIDDER TO COMPLY WITH REQUIREMENTS

A. Should Bidder, on receipt of Notice of Intent to Award, fail to comply with requirements of this Document 00495 within stated time, the City may declare award in default and require forfeiture of the Security Deposit.

B. After the City's written notice of default to Low Bidder, the City may award the Contract to Bidder whose offer is the next lowest bid, and Security Deposit of Bidder in default shall be forfeited to the City in accordance with provisions of Document 00200 - Instructions to Bidders.

6.0 NOTICE TO PROCEED

A. Upon the City's execution of the Agreement and delivery to Contractor, City Engineer will give Document 00551 - Notice to Proceed to Contractor, which establishes Date of Commencement of the Work.

END OF DOCUMENT
Please mark the box describing your firm's form of business, fill in the requested information, and include the relevant attachments.

[ ] Corporation
Corporate Name: «LoBid1Name»
State of Incorporation: ________________________________
Mailing Address: «LoBid1Street», «LoBid1CtyStZp»
Type of Corporation: ________________________________

Certificate of Assumed Name, if operating under a name different than that on the corporate charter (the Certificate must have been issued within the past 10 years to be valid)

*Certificate of Good Standing

*Certificate of Existence (if non-Texas corporation, Certificate of Authority)

[ ] Partnership/Joint Venture
Partnership/Joint Venture Name: «LoBid1Name»
Mailing Address: «LoBid1Street», «LoBid1CtyStZp»
Type of Partnership/Joint Venture: ________________________________

Copy of the Partnership or Joint Venture Agreement, or Affidavit with the name of the partnership or joint venture, the names of the individual partners or participants in the joint venture, and a statement that the partnership or joint venture is in existence

Certificate of Assumed Name, (the Certificate must have been issued within the past 10 years to be valid)

If firm is a limited partnership, the Certificate of Limited Partnership

If any partner or joint venturer is a corporation, the above information relating to corporation must be included as to each sum partner or joint venturer.

[ ] Sole Proprietorship

Name: ________________________________
Mailing Address: ________________________________

Certificate of Assumed Name, if operating under a name different than that of the sole proprietor (the Certificate must have been issued within the past 10 years to be valid)

* Must be furnished upon request of the Director and must be less than 90 days old.

END OF DOCUMENT
Instructions:

Contractor must execute and deliver to the Project Manager a Resolution of Contractor for each individual authorized to sign Contract Documents related to this Contract. Contractor may rescind Resolutions of Contractor through a written document in similar form.
Document 00501

RESOLUTION OF CONTRACTOR

_________________________________________________________________________

(Name of Contractor, e.g., "Biz. Inc.", "Biz LLP")

is a __________________________________________________________________________,
(Type of Organization, e.g.: Corporation, Limited Partnership, Limited Liability Partnership, Limited Liability Company, etc.)

which is bound by acts of __________________________________________________________________________.

(Name and Form of Governing Entity, e.g., "Biz Inc. Board of Directors", "Bill Smith, GP", etc.)

(“Governing Entity”).

On the _____ day of ____________, 20____, the Governing Entity resolved, in accordance with all documents, rules, and laws applicable to the Contractor, that

_________________________________________________________________________,

is authorized to act as the

(Contractor’s Representative)

Contractor’s Representative in all business transactions (initial one) ___ conducted in the State of Texas OR ___ related to this Contract; and

The Governing Entity warrants that the above resolution (a) was entered into without dissent or reservation by the Governing Entity, (b) has not been rescinded or amended, and (c) is now in full force and effect; and

In authentication of the adoption of this resolution, I subscribe my name on this day of ____________, 20__.

_________________________________________________________________________

(Authorized Signature for Governing Entity) 
(Print or Type Name and Title of Authorized Signatory)

SWORN AND SUBSCRIBED before me on _____________________________
Date

Notary Public in and for the State of Texas

My Commission Expires: _____________________________
Expiration Date
(Print or Type Name of Notary Public)

00501-1
02-01-2010
List of Changes:
04-30-2004: Added List of Changes and changed name of City Engineer or Public Works.
09-01-2009: Amended “City Engineer” line, changed name of City Engineer for General Services and Houston Airport System.
            Added “City Employee” line
11-02-2009: Amended “City Employee” and “Fax Number” line.
09-07-2010: Amended City Employee line on Page 1.
11-01-2010: Amended City Engineer designations on Page 1. Removed "City Employee designated to represent City Engineer" line on Page 1.
02-26-2013: Edited Section 7.1.7 to include new DBE documents.
08-01-2013: Edited Section 7.1.3 to add “Division 01 –”.
09-01-2013: Edited Section 7.1.7 to correct the title of documents 630 and 631.
11-01-2013: Added General Condition Section 4.1.9 to City Engineer Responsibility.
05-04-2017: Changed the designated City Engineer, with respect to Sections 4.1.9 and 4.3 thru 4.5 of the General Conditions.
Document 00520

AGREEMENT

Project: «LegalPrjName»

Project Location: «PriLocation» (Key Map No. «KeyMapNo»)

Project No: WBS No. «WBSNo»

The City: THE CITY OF HOUSTON, 900 Bagby Street, Houston, Texas 77002 (the “City”) and

Contractor: «LoBid1Name»

(Address for Written Notice) «LoBid1Street»

«LoBid1CtyStZp»

Fax Number: __________________________

City Engineer, with respect to Sections 4.1.9 and 4.3 thru 4.5 of the General Conditions, is:

Lagnesh Varshney, P.E. (or his successor)

P. O. Box 1562, Houston, Texas 77251-1562 (Address for Written Notice)

City Engineer, with respect to all other terms of the General Conditions, is:

Joseph T. Myers, P.E.

Fax Number: (832) 395-2410

THE CITY AND CONTRACTOR AGREE AS FOLLOWS:

ARTICLE 1
THE WORK OF THE CONTRACT

1.1 Contractor shall perform the Work in accordance with the Contract.

ARTICLE 2
CONTRACT TIME

2.1 Contractor shall achieve Date of Substantial Completion within «ContractDura» days after Date of Commencement of the Work, subject to adjustments of Contract Time as provided in the Contract.

2.2 The Parties recognize that time is of the essence for this Agreement and that the City will suffer financial loss if the Work is not completed within the Contract Time. Parties also recognize delays, expense, and difficulties involved in proving in a legal or arbitration proceeding actual loss suffered by the City if the Work is not completed on time. Accordingly, instead of requiring any such proof, the Parties agree that as liquidated damages for delay (but not as a penalty), Contractor shall pay the City the amount stipulated in Document 00800 – Supplementary Conditions, for each day beyond Contract Time.
ARTICLE 3
CONTRACT PRICE

3.1 Subject to terms of the Contract, the City will pay Contractor in current funds for Contractor's performance of the Contract, Contract Price of $\text{LoBidAmt1}$ which includes Alternates, if any, accepted below.

3.2 The City accepts Alternates as follows:

Delete or add lines below to indicate all Alternates that were included in Request for Competitive Sealed Proposals. Remove brackets and instructions when done. Change color of remaining text to black.

<table>
<thead>
<tr>
<th>Alternate No.</th>
<th>[Accepted or Not Accepted]</th>
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<td>4</td>
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</tbody>
</table>

ARTICLE 4
PAYMENTS

4.1 The City will make progress payments to Contractor as provided below and in Conditions of the Contract.

4.2 The Period covered by each progress payment is one calendar month ending on the [___] 15th or [___] last day of the month.

4.3 The City will issue Certificates for Payment and will make progress payments on the basis of such Certificates as provided in Conditions of the Contract.

4.4 Final payment, constituting entire unpaid balance of Contract Price, will be made by the City to Contractor as provided in Conditions of the Contract.

ARTICLE 5
CONTRACTOR REPRESENTATIONS

5.1 Contractor represents:

5.1.1 Contractor has examined and carefully studied Contract documents and other related data identified in Request For Competitive Sealed Proposals.

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

5.1.3 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.

5.1.4 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 (except Underground Facilities) which have been identified in Contract documents and (2) reports and drawings of a hazardous environmental condition, if any, at the site which has been identified in Contract documents.
5.1.5 Contractor has obtained and carefully studied (or assumes responsibility for having done so) all additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (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 applying specific means, methods, techniques, sequences, and procedures of construction, if any, expressly required by the Contract to be employed by Contractor, and safety precautions and programs incident thereto.

5.1.6 Contractor does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for performance of the Work at Contract Price, within Contract Time, and in accordance with the Contract.

5.1.7 Contractor is aware of general nature of work to be performed by the City and others at the site that relates to the Work as indicated in Contract documents.

5.1.8 Contractor has correlated information known to Contractor, information and observations obtained from visits to the site, reports and drawings identified in the Contract, and all additional examinations, investigations, explorations, tests, studies, and data with the Contract.

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

5.1.10 Contract documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

ARTICLE 6
MISCELLANEOUS PROVISIONS

6.1 The Contract may be terminated by either Party as provided in Conditions of the Contract.

6.2 The Work may be suspended by the City as provided in Conditions of the Contract.

ARTICLE 7
ENUMERATION OF CONTRACT DOCUMENTS

7.1 The following documents are incorporated into this Agreement:

7.1.1 Document 00700 - General Conditions.

7.1.2 Document 00800 - Supplementary Conditions.

7.1.3 Division 01 - General Requirements.

7.1.4 Divisions 02 through 16 of Specifications.

7.1.5 Drawings listed in Document 00015 - List of Drawings. Drawing No. «DrawingNo» and bound separately.

7.1.6 Addenda [and Riders] which apply to the Contract, are as follows:
Northside/Northline Drainage and Paving Improvements

WBS No. M-420HUD-004A-3

AGREEMENT

Addendum No. 1, dated "Addendum1"
Addendum No. 2, dated "Addendum2"
Addendum No. 3, dated "Addendum3"
Rider No. [ ], dated "Rider"

7.1.7 Other documents:

<table>
<thead>
<tr>
<th>Document No.</th>
<th>Title</th>
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<tbody>
<tr>
<td>00410B</td>
<td>Proposal Form – Part B</td>
</tr>
<tr>
<td>00470</td>
<td>Standard Pre-Bid Participation Plan Document</td>
</tr>
<tr>
<td>00471</td>
<td>Pre-Bid Good Faith Efforts Report</td>
</tr>
<tr>
<td>00472</td>
<td>Goal Deviation Request</td>
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<tr>
<td>00500</td>
<td>Form of Business</td>
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<tr>
<td>00501</td>
<td>Resolution of Contractor (if a corporation)</td>
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<tr>
<td>00570</td>
<td>Amended S/MWBE Participation Plan</td>
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<tr>
<td>00571</td>
<td>Contractor’s Good Faith Efforts Report</td>
</tr>
<tr>
<td>00572</td>
<td>Plan Deviation Request</td>
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<tr>
<td>00608</td>
<td>Contractor’s Certification Regarding Non-Segregated Facilities for Project Funded by AIP Grant</td>
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<tr>
<td>00610</td>
<td>Performance Bond</td>
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<td>00611</td>
<td>Statutory Payment Bond</td>
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<td>00612</td>
<td>One-year Maintenance Bond</td>
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<tr>
<td>00613</td>
<td>One-year Surface Correction Bond</td>
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<tr>
<td>00620</td>
<td>Affidavit of Insurance (with the Certificate of Insurance attached)</td>
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<tr>
<td>00623</td>
<td>Contractor’s Act of Assurance (SRF Form ED-103)</td>
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<tr>
<td>00624</td>
<td>Affidavit of Compliance with Affirmative Action Program</td>
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<tr>
<td>00628</td>
<td>Affidavit of Compliance with Disadvantaged Business Enterprise (DBE) Program for Project Funded By AIP Grant</td>
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<tr>
<td>00630</td>
<td>(POP-2) Certification of Compliance with Pay or Play Program</td>
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<tr>
<td>00631</td>
<td>(POP-3) City of Houston Pay or Play Program – List of Subcontractors</td>
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<tr>
<td>00800</td>
<td>Supplementary Conditions for Project CIP or AIP Funded</td>
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<tr>
<td>00801</td>
<td>Supplementary Conditions for Project AIP Funded</td>
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<tr>
<td>00802</td>
<td>SRF Supplementary Conditions</td>
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<tr>
<td>00805</td>
<td>Equal Employment Opportunity Requirements (DELETE If AIP Funded)</td>
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<tr>
<td>00806</td>
<td>EPA DBE and Wage Rate Requirements (SRF only)</td>
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<td>00807</td>
<td>Bidder/Contractor Requirements for DBE Program</td>
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<td>00808</td>
<td>Minority and Women-owned Business Enterprise (MWBE) &amp; Persons with Disabilities Business Enterprise (PDBE) Program</td>
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<td>Federal Wage Rate - Highway</td>
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<td>Federal Wage Rate - Building</td>
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<td>Federal Wage Rate - Heavy</td>
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<td>Wage Rate for Building Construction</td>
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<td>Trench Safety Geotechnical Information</td>
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<td>00840</td>
<td>Pay or Play Program</td>
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<td>00912</td>
<td>Rider</td>
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</table>

00520-4
05-05-2017
ARTICLE 8

SIGNATURES

8.1 This Agreement is executed in two original copies and is effective as of the date of countersignature by City Controller.

CONTRACTOR: «LoBid1Name» (If Joint Venture)

By: ________________________________ By: ________________________________
Name: ______________________________ Name: ______________________________
Title: ______________________________ Title: ______________________________
Date: ______________________________ Date: ______________________________
Tax Identification Number: __________ Tax Identification Number: __________

CITY OF HOUSTON, TEXAS

ATTEST/SEAL: SIGNED:

By: ________________________________ By: ________________________________
City Secretary Mayor

APPROVED: COUNTERSIGNED:

By: ________________________________ By: ________________________________
Director, «Department» City Controller

Date Countersigned: ________________________________

8.2 This Contract and Ordinance have been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. Legal Department has not reviewed the content of these documents.

______________________________ ________________________________
Legal Assistant Date

END OF DOCUMENT
List of Changes:
08-01-2003  Document assigned new CSI number and minor revisions made.
01-10-2005  Edited entire document to conform to organization and content found in the Standard Agreement.
Document 00521

ASSIGNMENT

************************************************************************************************
Edit Project information below. Remove brackets and instructions when done. Change color of remaining text to black.
************************************************************************************************

Project: DR15 SWAT 4A Northside/Northline Drainage and Paving Improvements
Project Location: North of Tidwell, East of Airline Dr., West of McGallion, and South of Little York
(Key Map No. 413X, 413Y, 453B, and 453 C)
Project No: WBS NO. M-420HUD-004A-3

THE PARTIES

The City: THE CITY OF HOUSTON, 900 Bagby Street, Houston, Texas 77002 (the “City”)
and
Contractor: _____________________________________________
(Address for Written Notice) ______________________________________

and

Developer: _____________________________________________
(Address for Written Notice) ______________________________________

Developer's Engineer is: _______________________________________
(Street Address) _____________________________________________

RECITALS

The City and Developer entered into a Developer Participation Contract, Contract No. [DPC Contract No.], under which Developer agreed to design, construct, and pay for the Project and the City agreed to reimburse Developer for a part of such payments in accordance with § 47-161, et seq. of City of Houston Code of Ordinances.

The City and Contractor entered into an agreement for construction of the Project effective on or about the date of countersignature shown below (the “Agreement”).

The City now desires to assign all of its rights, duties, and interests under the Agreement to Developer, and Developer desires to accept the assignment.
Contractor has made its own inquiry and satisfied itself as to Developer’s ability to perform the City’s duties, including the duty to pay, under the Agreement and has not relied on any representations by the City as to Developer’s ability to perform such duties.

THEREFORE, FOR THE MUTUAL PROMISES SET OUT HEREIN THE PARTIES AGREE AS FOLLOWS:

ARTICLE 1
ASSIGNMENT AND PAYMENT

1.1 Effective on the day after Countersignature thereof by the City Controller, the City hereby transfers and assigns to Developer all of its rights, title, interest, and obligations under the Agreement.

1.2 Developer accepts the assignment and assumes all rights, interests, and obligations of the City under this Agreement, including the obligation to make all payments to Contractor. Developer represents and warrants that it has sufficient funds available to make all payments to Contractor required under the Agreement.

1.3 CONTRACTOR ACCEPTS THE ASSIGNMENT OF THE AGREEMENT TO DEVELOPER AND WAIVES ANY CLAIMS IT MIGHT HAVE AGAINST THE CITY NOW OR IN THE FUTURE, INCLUDING BUT NOT LIMITED TO, ANY CLAIMS FOR PAYMENT OR SUPERVISION, OR ANY CLAIMS ARISING OUT OF THE CITY’S CHOICE OF CONTRACT AND ACTUAL ASSIGNMENT OF THIS AGREEMENT TO DEVELOPER.

1.4 DEVELOPER RELEASES THE CITY FROM AND SHALL DEFEND, INDEMNIFY, AN HOLD THE CITY HARMLESS, FOR ALL CLAIMS, CAUSES OF ACTION, LIABILITIES, FINES OR EXPENSES THAT THE CITY MAY INCUR AS A RESULT OF THE ASSIGNMENT OF THE AGREEMENT TO DEVELOPER, INCLUDING BUT NOT LIMITED TO THE LOSS OR DIMINUTION OF ANY DEFENSE THAT WOULD HAVE BEEN AVAILABLE TO THE CITY IN THE ABSENCE OF THE ASSIGNMENT OF THE AGREEMENT TO DEVELOPER.

1.5 Unless otherwise required by City Ordinance, Code, or Regulation, all references to “City Engineer” in the Agreement are replaced with Developer's Engineer, who must be an Engineer licensed in the State of Texas.

1.6 Owners and Contractors' Protective Liability Insurance required under the Agreement must be issued in the name of the Developer and the City as their interests may appear. For all other insurance policies required, the City and Developer (and their respective officers, agents, and employees), shall be
named as additional insured parties on all policies, renewals or replacements except those for Worker's Compensation and Employer's Liability.

1.7 All Change Orders in excess of 5% of the "Original Contract Price", as defined in the General Conditions, must be approved by the City's Director of Public Works and Engineering, rather than City Council; however, such approval shall never increase the City's liability to pay Developer any money in excess of the original and any supplemental appropriations approved for the Developer Participation Contract.

1.8 Contractor shall include Developer in all indemnifications set out in Article 3 of the General Conditions.

1.9 Contractor shall provide the Performance, Statutory Payment, and Maintenance Bonds required by Article 11 of the General Conditions and Surface Correction Bond, if required by the Supplementary Conditions, in the form of dual obligee bonds with both the Developer and the City as obligee.

ARTICLE 2
SIGNATURES

2.1 This Assignment is executed in two original copies and is effective as of the date of countersignature by City Controller.

CONTRACTOR:

By: ________________________________
    Name: ________________________________
    Title: ________________________________
    Date: ________________________________
    Tax Identification Number: ______________

(If Joint Venture)

By: ________________________________
    Name: ________________________________
    Title: ________________________________
    Date: ________________________________
    Tax Identification Number: ______________

DEVELOPER:

By: ________________________________
    Name: ________________________________
    Title: ________________________________
    Date: ________________________________
    Tax Identification Number: ______________
This Ordinance and/or Contract have been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

__________________________________________  __________________________________________
Legal Assistant                                  Date
List of Changes:
01-14-2005 Changed color on editable verbiage so as not to be confusing with MS Word’s “track changes” colors. Added this List of Changes page. Changed “cc” list. Bernard Porter is replaced by Joseph Kurian. Henry Gregory is replaced by David Batra. Instructions revised to fit DPC version of this document.
05-05-2005: Added Contract number to the form letter.

*******************************************************************************
[Date]

[Contractor]
ATTN: [Contractor Contact]
[Contractor’s Address]
[City, ST Zip]

RE: NOTICE TO PROCEED
[Project Name]
DPC-[NNN]
Contract No. [Contract No.]

Dear [Contractor Contact]:

You are hereby notified that the Date of Commencement of the Work is [month/day/year]. On this date you are to start performing your obligations under the Contract documents. In accordance with Article 2 of the Agreement, the Contract Time is [number of calendar days] days.

Sincerely,

[Engineer’s Name]
[Engineer’s Title]
[Engineering Firm’s Name]

[Initials]

c: John J. Sakolosky, P.E.
   Edwin W. Mergele, NCARB, CSI
Chlorination/Inspection: Shailesh Patel, 1702 Seamist, 713-863-1450
Joseph Kurian, 611 Walker St., 20th Floor, 713-837-9017
Water: Ivan Wade, 7000 Ardmore, 713-654-2225
Wastewater: David Batra, 4545 Groveway, 713-641-9134
Storm sewer: Gary Hutcherson, 5500 McCarty Road, 713-678-5809
Paving: Tracy Wingate, 5500 McCarty Road, 713-678-5811
[Engineer’s Distribution List]
INSTRUCTIONS FOR DOCUMENT 00551
NOTICE TO PROCEED

PURPOSE: The Notice to Proceed informs the Contractor that it is authorized to mobilize and begin the Work.

APPLICATION: Contractor is officially notified of the Date of Commencement of the Work.

RESPONSE: Contractor has until the Date of Commencement of the Work to make preparations for mobilization.

INSTRUCTIONS: This document is prepared by the City Project Manager and forwarded to the Contractor for his response.

Word Processor replaces italicized text and brackets with corresponding information. The following instructions correspond to bracketed-italicized fields on the form, reading from top to bottom.

1. Insert date document will be mailed.
2. Insert name of Contractor's Company performing the Work.
3. Insert name of Contractor's designated representative.
4. Insert Contractor's street address.
5. Insert Contractor's city, state, and zip code.
6. Insert Project name as stated in Contract documents.
7. Insert Project DPC number.
8. Insert Construction Contract number.
9. Insert name of Contractor's designated representative.
10. Insert the Date of Commencement of the Work.
11. Insert Contract Time (number of days).
12. Insert name of Engineer.
13. Insert title of Engineer.
15. Insert any additional distribution addees.
**CONTRACTOR’S REVISED MWSBE PARTICIPATION PLAN**

As soon as the Contractor becomes aware that the Contractor may not abide by the most current approved Plan, the Contractor shall submit this completed form with a Record of Post-Bid Good Faith Efforts (Document 00571), a Request for Plan Deviation (Document 00572), and any other document evidencing “Good Faith Efforts”, as required by the Good Faith Efforts Policy (Document 00808). The City will review this Revised Participation Plan and may approve this Revised Plan if the Contractor has made Good Faith Efforts. For more information, visit [http://www.houstontx.gov/obo](http://www.houstontx.gov/obo).

<table>
<thead>
<tr>
<th>NAICS Code (6 digit)</th>
<th>Description of Work (Plan Sheet #, Unit Price #, Scope of Work #, as applicable)</th>
<th>% of Total Bid Price (2 decimal places)</th>
<th>Cert. Type for Goal (MBE, WBE, SBE)</th>
<th>Certified Firm Name</th>
<th>Firm Address</th>
<th>Contact Name</th>
<th>Phone No. and E-Mail (if available)</th>
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Signature for Company: ____________________________ *   Date: ____________________
Print Name: ____________________________   Phone: ____________________

*I understand that supplying inaccurate information may violate Texas Penal Code Section 37.10 and lead to City sanctions.*
<table>
<thead>
<tr>
<th>NAICS Code (6 digit)</th>
<th>Plan Item Number (if applicable)/ Description of Work</th>
<th>% of Total Bid Price (2 decimal places)</th>
<th>Cert. Type for Goal (MBE, WBE, SBE)</th>
<th>Certified Firm Name</th>
<th>Firm Address</th>
<th>Contact Name</th>
<th>Phone No. and E-Mail (if available)</th>
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Signature for Company: ____________________________  *  Date: ________________
Print Name: ______________________________________  Phone: ________________

*I understand that supplying inaccurate information may violate Texas Penal Code Section 37.10 and lead to City sanctions

00570-2  
08-01-2013  
<<Contractor Name>>
A Contractor that may be unable to follow an agreed Participation Plan (Document 00470 or 00570) must submit this completed form, a Plan Deviation Request Form (Document 00572), and any other documentation of “Good Faith Efforts” (see Document 00808) that the OBO Representative may require. The Contractor shall submit one completed Document 00571 (Part A) for each Certified Firm that is no longer performing part or all of its work duties under the Approved Plan. The Contractor has the burden to demonstrate “Good Faith Efforts” to meet the MWSBE goal, which includes correctly and accurately preparing and submitting this form and other efforts described in the Good Faith Efforts Policy (Document 00808). The Office of Business Opportunity may review Participation Plan and Good Faith Efforts from time to time and may request that the Contractor submit this form and other information.

**UNLESS THE CONTRACTOR MEETS THE GOALS IN THE AGREED PARTICIPATION PLAN, FAILURE TO SUBMIT THIS FORM MAY RESULT IN A DEFAULT OF THE CONTRACT.**

### PART A (REASON FOR NON-USE OF CERTIFIED FIRM IN AGREED PLAN)

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Plan Item No.</th>
<th>MWSBE Type for Goal</th>
<th>Certified Firm Name, Address, Phone No. and E-mail</th>
<th>Plan Goal &amp; Actual Use (in % of total)</th>
<th>Method of Contact</th>
<th>Reason for Non-Use (why the Contractor was not able to use the Certified Firm in accordance with the Agreed Plan)</th>
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### PART B (REASON FOR NONUSE OF REPLACEMENT CERTIFIED FIRMS—IF APPLICABLE)

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<th>NAICS Code</th>
<th>Plan Item No.</th>
<th>MWSBE Type for Goal</th>
<th>Certified Firm Name, Phone No. and E-mail</th>
<th>Certified Firm Contact Person</th>
<th>Method of Contact</th>
<th>Prime Contact Date</th>
<th>Certified Firm Response</th>
<th>Results of Contact (why Certified Firm was unsuitable or unusable)</th>
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Authorized Signature: ___________________________  Date: ____________  Phone: ________________

Print Name: ___________________________  Email Address: ___________________________
## PART B CONTINUATION (REASON FOR NONUSE OF REPLACEMENT CERTIFIED FIRMS)

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Plan Item No.</th>
<th>MWSBE Type for Goal</th>
<th>Certified Firm Name, Phone No. and E-Mail</th>
<th>Certified Firm Contact Person</th>
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Authorized Signature: ___________________________  Date: _______________  Phone: ____________________

Print Name: ___________________________  Email Address: ___________________________
Document 00572

CONTRACTOR’S REQUEST FOR PLAN DEVIATION

Contractor Name: ____________________________________________

Project Name: ______________________________________________

<table>
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<tr>
<th>Approved Participation Plan Percentages</th>
<th>MBE %</th>
<th>WBE %</th>
<th>SBE %</th>
<th>Total %</th>
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<tr>
<th>Contractor’s Requested Participation Plan</th>
<th>MBE %</th>
<th>WBE %</th>
<th>SBE %</th>
<th>Total %</th>
</tr>
</thead>
</table>

Justification: Please provide the reason the Contractor is unable to meet the MWSBE goal in the Approved Plan.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Good Faith Efforts: Please list any efforts not listed in Contractor’s Record of Good Faith Effort (Document 00571).

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Please attach additional pages if the space for Justification or Good Faith Efforts is insufficient.

Date: ___________________________  *Contractor: ___________________________

E-mail: _________________________  *By: ________________________________

Phone Number: ___________________  Title: ____________________________

*I understand that the approval of this deviation request does not constitute a final decision by OBO that Contractor has used Good Faith Efforts in meeting the Contracting Goal.

FOR OFFICIAL USE ONLY:  Approved ☐  Not Approved ☐

OBO Representative

Date: ___________________________  Title: ___________________________

00572-1

08-01-2013
LIST OF PROPOSED SUBCONTRACTORS AND SUPPLIERS

PROJECT NAME: «LegalPrjName»  TOTAL DBE AWARD: $ ________________
ORIG. CONTRACT PRICE: $ ________________  TOTAL MWSBE AWARD: $ ________________
PROJECT NO.: WBS No. «WBSNo»  TOTAL HUB AWARD: $ ________________
DATE OF REPORT: ________________  TOTAL PDBE AWARD: $ ________________

<table>
<thead>
<tr>
<th>NAICS (6 digits)</th>
<th>SUBCONTRACTOR OR SUPPLIER (INCLUDE “MWSBE”, “PDBE”, “DBE”, OR “HUB” DESIGNATION)²</th>
<th>ADDRESS</th>
<th>SCOPE OF WORK³</th>
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NOTES:  1. RETURN FOR ALL PROJECTS AS REQUIRED IN DOCUMENT 00800 – SUPPLEMENTARY CONDITIONS. RETURN WITHIN THE SPECIFIED NUMBER OF DAYS AFTER RECEIPT OF NOTICE OF INTENT TO AWARD
2. DESIGNATE FIRMS CERTIFIED BY THE CITY OFFICE OF BUSINESS OPPORTUNITY ON THIS FORM.
3. DESCRIBE THE WORK TO BE PERFORMED, FOR WHICH THE FIRM IS CERTIFIED, SUCH AS “PAVING”, “ELECTRICAL”, ETC.
4. CONTRACTOR SHALL EXECUTE CONTRACTS WITH APPROVED SUBCONTRACTORS AND SUPPLIERS WITHIN 30 DAYS AFTER THE DATE OF THE NOTICE TO PROCEED. COPIES OF CONTRACTS WITH DESIGNNATED FIRMS MUST BE SENT TO THE OFFICE OF BUSINESS OPPORTUNITY.

SIGNATURE: ____________________________  COMPANY NAME: ____________________________
NAME: ____________________________  TITLE: ____________________________
(Type or Print)

00600-1
07-01-2013
Continuation Page

PROJECT NAME: «LegalPrjName»
DATE OF REPORT: ___________________________
PROJECT NO.: WBS No. «WBSNo»

<table>
<thead>
<tr>
<th>NAICS (6 digits)</th>
<th>SUBCONTRACTOR OR SUPPLIER (INCLUDE “MWSBE”, “PDBE”, “DBE”, OR “HUB” DESIGNATION)</th>
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SIGNATURE: ______________________________ COMPANY NAME: ___________________________

NAME: ________________________________ TITLE: ________________________________

(END or Print)

END OF DOCUMENT
Document 00601

DRUG POLICY COMPLIANCE AGREEMENT

I, ___________________________________________ ____________________________
Name Title

of ________________________________________________________________
Contractor

have authority to bind Contractor with respect to its Bid, Proposal, or performance of any and all
contracts it may enter into with the City of Houston; and that by making this Agreement, I affirm
that Contractor is aware of and by the time the Contract is awarded will be bound by and agree
to designate appropriate safety impact positions for company employee positions, and to
comply with the following requirements before the City issues a Notice to Proceed:

1. Develop and implement a written Drug Free Workplace Policy and related drug testing
   procedures for Contractor that meet the criteria and requirements established by the
   Mayor's Amended Policy on Drug Detection and Deterrence (Mayor's Drug Policy) and
   the Mayor's Drug Detection and Deterrence Procedures for Contractors (Executive
   Order No. 1-31).

2. Obtain a facility to collect urine samples consistent with Health and Human Services
   (HHS) guidelines and an HHS-certified drug-testing laboratory to perform drug tests.

3. Monitor and keep records of drug tests given and results; and upon request from the City
   of Houston, provide confirmation of such testing and results.


I affirm on behalf of Contractor that full compliance with the Mayor's Drug Policy and
Executive Order No. 1-31 is a material condition of the Contract with the City of Houston,

I further acknowledge that falsification, failure to comply with or failure to timely submit
declarations or documentation in compliance with the Mayor's Drug Policy or Executive Order
No. 1-31 will be considered a breach of the Contract with the City and may result in non-award
or termination of the Contract by the City.

_________________________________________ ________________________________
Contractor Title

_________________________________________ ________________________________
Signature Date

END OF DOCUMENT
CITY OF HOUSTON
CHECKLIST FOR
STANDARD DOCUMENT
DRUG POLICY SUBMITTAL

Document 00603

CHECKLIST FOR DRUG POLICY SUBMITTAL

TO: STEPHEN PACK
PWE/DIRECTOR’S OFFICE
SECURITY MANAGEMENT
SECTION
611 WALKER STREET
3RD FLOOR ANNEX
HOUSTON, TEXAS 77002

FROM: "MagingEngName"
MANAGING ENGINEER
ENGINEERING SECTION
ENGINEERING & CONSTRUCTION / PWE

DATE: July 31, 2018

CONTRACTOR: «LoBid1Name»
PROJECT NAME: «LegalPrjName»
PROJECT No.: WBS No. «WBSNo»
PROJECT MANAGER: «PrjMgrName» TELEPHONE: «PrjMgrTel» FAX: «PrjMgrFax»

DOCUMENTS CHECKED BELOW ARE BEING SUBMITTED: (Project Manager, check.)

DOC. 00601 - DRUG POLICY COMPLIANCE AGREEMENT (Standard Form)
DOC. 00602 - CONTRACTOR’S DRUG-FREE WORKPLACE POLICY (Contractor creates this Document)
DOC. 00605 - LIST OF SAFETY IMPACT POSITIONS (Contractor creates this List)
"OR"
DOC. 00606 - CONTRACTOR'S CERTIFICATION OF NO SAFETY IMPACT POSITIONS

CCODT REVIEW: THE FOLLOWING CHECKED ITEM(S) ARE MISSING FROM SUBMISSION/POLICY AND NEED TO BE CORRECTED PRIOR TO AWARD:

- NAME OF DRUG TESTING LAB
- REASON FOR TESTING:
  - RANDOM TESTING - 25% ANNUALLY
  - REASONABLE SUSPICION
  - POST ACCIDENT

- SAFETY IMPACT POSITIONS INCOMPLETE
- EMPLOYEE ACKNOWLEDGMENT FORM
- DRUG TESTING PROCEDURES
- CONSEQUENCE OF POSITIVE TEST: PERMANENTLY REMOVED FROM ANY CONTRACT CITY WORKSITE.
- CONSEQUENCE OF REFUSAL TO CONSENT: PERMANENTLY REMOVED FROM ANY CONTRACT CITY WORKSITE.
- OTHER: _______________________________

COMMENTS: _______________________________

DATE RECEIVED: ___________________________ RESUBMITTAL DATE: ___________________________

END OF DOCUMENT

00603-1
05-15-2017
Prior to award of the Contract, Low Bidder will be required to file the following with the City:

1. A history of all OSHA actions, advisories, etc., Contractor has received on all jobs worked in any capacity, prime or subcontractor. The history shall be for the two-year period preceding the Bid Date of the Project.

2. A list of all on-the-job injuries, accidents, and fatalities suffered by any present or former employees of Contractor during the same two-year period.

3. If less than the two-year period, give the date Contractor started doing business.

This information must be submitted to the City within the time period stated in Document 00498 - Notice of Intent to Award. An officer of the company must certify in a notarized statement that the information submitted is true and correct.

END OF DOCUMENT
Contractor is to provide a complete List of Employee Classifications that are considered in a "Safety Impact Position" and the number of employees in each of those classifications.

<table>
<thead>
<tr>
<th>Employee Classification</th>
<th>Number of Employees</th>
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END OF DOCUMENT
CONTRACTOR’S CERTIFICATION OF NO SAFETY IMPACT POSITIONS IN PERFORMANCE OF A CITY CONTRACT

BEFORE ME, the undersigned authority, on this day personally appeared ____________________________,
Affiant

who being by me duly sworn on his oath stated that he is ____________________________
Title

of ____________________________
Contractor

and that no employee safety impact positions, as defined in §5.17 of Executive Order No. 1-31, will be involved in performing ____________________________.
Project

Contractor agrees and covenants that it shall immediately notify the City of Houston Director of Personnel if any safety impact positions are established to provide services in performing this City Contract.

______________________________
Affiant’s Signature

SWORN AND SUBSCRIBED before me on this day of ____________________________, 20__.

Notary Public in and for the State of TEXAS

Print or Type Notary Public Name

My Commission Expires: ____________________________
Expiration Date

END OF DOCUMENT
Document 00607

CERTIFICATION REGARDING DEBARMENT,
SUSPENSION, AND OTHER RESPONSIBILITY MATTERS

Contractor certifies to the best of its knowledge and belief that it and its principals:

1. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal, State, or local department or agency;

2. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction: violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

3. Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph 2 of this certification; and

4. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

I understand that a false statement on this certification may be grounds for rejection of this proposal or termination of the award. In addition, under 18 USC Section 1001, a false statement may result in a fine of up to $10,000 or imprisonment for up to five years, or both.

Company:

Typed Name & Title of Authorized Representative

Signature of Authorized Representative Date

☐ I am unable to certify the above statements. My explanation is attached.

END OF DOCUMENT

00607-1
02-01-2004
Document 00610

PERFORMANCE BOND

THAT WE, ____________________________________, as Principal, (the “Contractor”), and the other subscriber hereto, ____________________________________, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston (the “City”), a municipal corporation, in the penal sum of $ _____________ for the payment of which sum, well and truly to be made to the City, its successors and assigns, Contractor and Surety do bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City for ____________________________________, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall faithfully and strictly perform the Contract in all its terms, provisions, and stipulations in accordance with its true meaning and effect, and in accordance with the Contract documents referred to therein and shall comply strictly with each and every provision of the Contract and with this Bond, then this obligation shall become null and void and shall have no further force and effect; otherwise the same is to remain in full force and effect. Should the Contractor fail to faithfully and strictly perform the Contract in all its terms, including but not limited to the indemnifications thereunder, the Surety shall be liable for all damages, losses, expenses and liabilities that the City may suffer in consequence thereof, as more fully set forth herein.

It is further understood and agreed that the Surety does hereby relieve the City or its representatives from the exercise of any diligence whatever in securing compliance on the part of the Contractor with the terms of the Contract, and the Surety agrees that it shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the Contractor in all matters pertaining to the Contract. The Surety understands and agrees that the provision in the Contract that the City will retain certain amounts due the Contractor until the expiration of 30 days from the acceptance of the Work is intended for the City's benefit, and the City will have the right to pay or withhold such retained amounts or any other amount owing under the Contract without changing or affecting the liability of the Surety hereon in any degree.
It is further expressly agreed by Surety that the City or its representatives are at liberty at any time, without notice to the Surety, to make any change in the Contract documents and in the Work to be done thereunder, as provided in the Contract, and in the terms and conditions thereof, or to make any change in, addition to, or deduction from the Work to be done thereunder; and that such changes, if made, shall not in any way vitiate the obligation in this Bond and undertaking or release the Surety therefrom.

It is further expressly agreed and understood that the Contractor and Surety will fully indemnify and save harmless the City from any liability, loss, cost, expense, or damage arising out of Contractor’s performance of the Contract.

If the City gives Surety notice of Contractor’s default, Surety shall, within 45 days, take one of the following actions:

1. Arrange for Contractor, with consent of the City, to perform and complete the Contract; or

2. Take over and assume completion of the Contract itself, through its agents or through independent contractors, and become entitled to the payment of the balance of the Contract Price.

If the Surety fails to take either of the actions set out above, it shall be deemed to have waived its right to perform and complete the Contract and receive payment of the balance of the Contract Price and the City shall be entitled to enforce any remedies available at law, including but not limited to completing the Contract itself and recovering any cost in excess of the Original Contract Price from the Surety.

This Bond and all obligations created hereunder shall be performable in Harris County, Texas. This Bond is given in compliance with the provisions of Chapter 2253, Texas Government Code, as amended, which is incorporated herein by this reference.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.
IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

By: ____________________________
   Name: _________________________
   Title: __________________________

By: ____________________________
   Name: _________________________
   Title: __________________________
   Date: __________________________

ATTEST/SURETY WITNESS:
(SEAL)

By: ____________________________
   Name: _________________________
   Title: __________________________
   Date: __________________________

By: ____________________________
   Name: _________________________
   Title: __________________________
   Attorney-in-Fact
   Date: __________________________

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

__________________________________________
Legal Assistant

__________________________________________
Date

END OF DOCUMENT
THAT WE, ____________________________, as Principal, hereinafter called Contractor and the other subscriber hereto, ____________________________, as Surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of Houston, a municipal corporation, in the sum of $ ____________ for the payment of which sum, well and truly to be made to the City of Houston, and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a contract in writing with the City of Houston for ____________________________, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein;

NOW, THEREFORE, if the said Contractor shall pay all claimants supplying labor and materials to him or a Subcontractor in the prosecution of the Work provided for in the Contract, then, this obligation shall be void; otherwise the same is to remain in full force and effect;

PROVIDED HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253, Texas Government Code, as amended, and all liabilities on this Bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.
IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)  
WITNESS: (if not a corporation)

By: ___________________________  
   Name: ________________________  
   Title: _________________________  

By: ___________________________  
   Name: ________________________  
   Title: _________________________  
   Date: _________________________

ATTEST/SURETY WITNESS:  
(SEAL)

By: ___________________________  
   Name: ________________________  
   Title: _________________________  
   Date: _________________________

By: ___________________________  
   Name: ________________________  
   Title: _________________________  

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

______________________________  
Legal Assistant

______________________________  
Date

END OF DOCUMENT
ONE-YEAR MAINTENANCE BOND

THAT WE, ____________________________________________, as Principal, hereinafter called Contractor, and the other subscriber hereto, ____________________________________, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of $ ________________, for the payment of which sum well and truly to be made to the City of Houston and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City of Houston for ____________________________________________, all of such work to be done as set out in full in said Contract documents herein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and correct work not in accordance with the Contract documents discovered within the established one-year period, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.
IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL:  (if a corporation) 
WITNESS:  (if not a corporation)  

______________________________  
Name of Contractor

By: ____________________________  
Name: ____________________________  
Title: ____________________________  
Date: ____________________________  

ATTEST/SURETY WITNESS:  
(SEAL)

______________________________  
Full Name of Surety

______________________________  
Address of Surety for Notice

______________________________  
Telephone Number of Surety

By: ____________________________  
Name: ____________________________  
Title: ____________________________  
Date: ____________________________  
Name: ____________________________  
Title: Attorney-in-Fact  
Date: ____________________________

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

______________________________  
Legal Assistant

______________________________  
Date

END OF DOCUMENT
ONE-YEAR SURFACE CORRECTION BOND

THAT WE, ____________________________________________, as Principal, hereinafter called Contractor, and the other subscriber hereto, ________________________, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of $ __________________ such sum being equal to four percent of the Original Contract Price, for the payment of which sum to be made to the City of Houston and its successors, Contractor and Surety do bind themselves, their successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has entered into a Contract in writing with the City of Houston, Texas, dated of even date herewith, for _________________________, all of such work to be done in accordance with the Contract documents therein referred to, and adopted by the City Council of the City of Houston.

NOW THEREFORE, if the Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and repair, replace, restore, and correct surface work associated with backfill operations of subsurface work not in accordance with the Contract documents discovered within one year from the date that the One-year Maintenance Bond has expired, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.
IN WITNESS THEREOF, the said Principal and Surety have signed and sealed this instrument on the respective dates written below their signatures.

ATTEST, SEAL: (if a corporation) 
WITNESS: (if not a corporation) 

By: 
Name: 
Title: 

By: 
Name: 
Title: 
Date: 

ATTEST/SURETY WITNESS: 

Full Name of Surety 

Address of Surety for Notice 

Telephone Number of Surety 

By: 
Name: 
Title: 
Date: 

By: 
Name: 
Title: Attorney-in-Fact 
Date: 

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant 
Date 

END OF DOCUMENT
AFFIDAVIT OF INSURANCE

BEFORE ME, the undersigned authority, on this day personally appeared

__________________________________________, who

being by me duly sworn on his oath stated that he is ___________________________, of

__________________________________________,

Contractor's Company Name

the Contractor named and referred to within the Contract documents; that he is fully
competent and authorized to give this affidavit and that the attached original insurance
certificate truly and accurately reflects the insurance coverage that is now available and
will be available during the term of the Contract.

__________________________________________

Affiant's Signature

SWORN AND SUBSCRIBED before me on _____________________________.

Date

__________________________

Notary Public in and for the State of TEXAS

__________________________

Print or type Notary Public name

My Commission Expires: ____________________________

Expiration Date

END OF DOCUMENT
BEFORE ME, the undersigned authority, on this day personally appeared ____________________________, who
being by me duly sworn on his oath stated that he is ____________________________,
Title
of ____________________________,
Contractor
the Contractor named and referred to within the Contract documents; that he is fully
competent and authorized to give this affidavit and that the Contract is in compliance
with the Affirmative Action Program of the City and has done all that is required by the
Contract documents, the Affirmative Action Program, and pursuant to Chapter 15, Code
of Ordinances, City of Houston, §15.16 et seq.

________________________________________
Affiant's Signature

SWORN AND SUBSCRIBED before me on this day of ____________________________, 20__.

________________________________________
Notary Public in and for the State of TEXAS

________________________________________
Print or Type Notary Public Name

My Commission Expires: _______________
Expiration

END OF DOCUMENT
In accordance with the City of Houston Pay or Play Program authorized by Ordinance 2007-534 and Executive Order 1-7, Contractor/Subcontractor agrees to abide by the terms of this Program. This certification is required of all contractors for contracts subject to the program. You must agree EITHER to PAY or to PLAY for all covered employees. The Contractor/Subcontractor may also Pay on behalf of some covered employees and Play on behalf of other covered employees.

The Contractor/Subcontractor will comply with all provisions of the Pay or Play Program and will furnish all information and reports requested to determine compliance with program requirements of the Pay or Play Program (See Executive Order 1-7 for the terms of the Pay or Play program) The criteria of the program is as follows:

The Contractor/Subcontractor agrees to “Pay” $1.00 per hour for work performed by covered employees under the contract with the City. If independent contract labor is utilized the Contractor/Subcontractor agrees to report hours worked by the independent contract laborer and pay $1.00 per hour for work performed.

Otherwise the Contractor/Subcontractor agrees to “Play” by providing health benefits to each covered employee. The health benefits must meet the following criteria:

1. The employer will contribute no less than $150 per employee per month toward the total premium cost for single coverage only; and
2. The employee contribution, if any amount, will be no greater than 50% of the total premium cost and no more than $150 per month.
3. Pursuant to E.O. 1-7 section 4.04 a contractor is deemed to have complied with respect to a covered employee who is not provided health benefits if the employee refuses the benefits and the employee’s contribution to the premium is no more than $40 per month.

Please select whether you choose to: Pay Play Both

The Contractor/Subcontractor will file compliance reports with the City, which will include activity for covered employees subject to the program, in the form and to the extent requested by the administering department. Compliance reports shall contain information including, but not limited to, documentation showing employee health coverage and employee work records.

Note: The Contractor is responsible to the City for the compliance of covered employees of covered subcontractors and only forms that are accurate and complete will be accepted.

<table>
<thead>
<tr>
<th>*Estimated Number of:</th>
<th>Prime Contractor</th>
<th>Sub-Contractor</th>
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</thead>
<tbody>
<tr>
<td>Total Employees on City Job</td>
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<tr>
<td>Covered Employees</td>
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<tr>
<td>Non-Covered Employees</td>
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<tr>
<td>Exempt Employees</td>
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</tbody>
</table>

*Required
I hereby certify that the above information is true and correct.

Contractor *(Signature)* Date

Name and Title *(Print or type)*
Document 00631  
(POP-3)  
City of Houston  
Pay or Play Program  
List of Subcontractors

<table>
<thead>
<tr>
<th>Subcontractor Name</th>
<th>Supplier Y/N?</th>
<th>Amount of Subcontract</th>
<th>Pay</th>
<th>Play</th>
<th>Both (Pay and Play)</th>
<th>N/A</th>
<th>Contact Person</th>
<th>Phone</th>
<th>Email Address</th>
<th>Mailing Address</th>
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*If the above information is found to be submitted fraudulently with the intent to bypass or deceive the purpose of the Pay or Play Program the contractor will be held liable for all compliance requirements from the inception of the contract. All subcontracts that surpass the $200,000.00 threshold will be responsible for Pay or Play compliance from the inception of the contract.

**Affidavit**

I hereby solemnly affirm, certify and confirm that the total sub-contract value stated above is the final value of the contract (*) including all material costs, fuel, payroll, taxes, fees, profit sharing, labor or any payments in relation to the contracted work and no separate payment or contract has been made for the sub-contract under contract no._____________________. The above sub-contract value includes all the costs related to work under the contract. The contractor and sub-contractor(s) agree to inform The Mayor's Office of Business Opportunity of any related cost(s) added to the contracted work and re-submit POP-3 with the current value of the sub-contract. I understand that compliance with "Pay or Play" program is mandatory and nothing has been hidden to circumvent the program requirements.

Contractor Authorized Representative & Title  
Date  
Name & Signature
CERTIFICATION BY PROPOSED MATERIAL SUPPLIERS, LESSORS, AND PROFESSIONAL SERVICE PROVIDERS REGARDING EQUAL EMPLOYMENT OPPORTUNITY

Company Name: (Supplier, Lessor, Professional Service Provider) (Amount of Contract)

Company Address: 

Company Telephone Number: Fax: 

E-mail Address: 

Web Page/URL Address: 

Company Tax Identification Number: 

Project No.: [WBS/CIP/AIP/File No.] 

Project Name: [Legal Project Name] 

In accordance with Chapter 15 of the City of Houston’s Code of Ordinances, Supplier/Lessor/Professional Service Provider represents to be an equal opportunity employer and agrees to abide by the terms of the Ordinance. This certification is required of all Suppliers/Lessors/Professional Service Providers (“Supplier”) with contracts in the amount of $50,000.00 or more.

[ ] Yes [ ] No Supplier agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age.

[ ] Yes [ ] No Supplier agrees that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

[ ] Yes [ ] No Supplier will comply with all provisions of Executive Order No. 11246 and rules, regulations and applicable orders of the Department of Labor or other Federal Agency responsible for enforcement of applicable equal opportunity and affirmative action provisions and will likewise furnish all information and reports required by the Mayor or Contract Compliance Officers for the purpose of investigation to ascertain and effect compliance with the City of Houston’s Office of Affirmative Action and Contract Compliance.

[ ] Yes [ ] No The Supplier shall file and cause their sub-tier contractors to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor or Contract Compliance Officers. Compliance reports filed at such times as directed shall contain information including, but not limited to, the practices, policies, programs, and employment policies.

I hereby certify that the above information is true and correct.

COMPANY OFFICER (Signature) DATE 

NAME AND TITLE (Print or type) 

END OF DOCUMENT
CERTIFICATION OF PAYMENT
TO SUBCONTRACTORS AND SUPPLIERS

The undersigned, ______________________, states that he is the ______________________
Affiant Title
of ________________________________ Contractor
and that he is duly authorized to execute this Certification of Payment to Subcontractors and Suppliers; that Contractor has made payments to Subcontractors and Suppliers for all labor, materials, equipment, and services furnished to date for Work on Project No. ________________ in the amounts for which Contractor has been paid; that the labor, materials, equipment, and services covered by this Certificate of Payment have been furnished in accordance with and all in compliance with the Contract Documents; that no sums have been withheld by Contractor for Subcontractors and Suppliers as a result of any allegations of deficiencies in the Work; and that such payments were made in accordance with the Contract Documents and with the laws of the State of Texas.

______________________________
Affiant's Signature

SWORN AND SUBSCRIBED before me on _________________________________.
Date

______________________________
Notary Public in and for the State of TEXAS

______________________________
Print or type name

My Commission Expires: ____________________
Expiration Date

END OF DOCUMENT
Instructions:

If Contractor withholds any amount of a payment to a Subcontractor for any reason, the Contractor shall send Payment Notifications to the Subcontractor explaining why the payment was withheld.

Contractor shall provide the City Monitoring Authority with Payment Notifications for each subcontractor from which Contractor has withheld payment. Contractor shall submit all necessary Payment Notifications (Document 00646), Payment Reporting Forms (Document 00642), and other documentation at the same time Contractor submits the Application and Certification for Payment or the Estimate for Payment.
PAYMENT NOTIFICATION – EXPLANATION OF WITHHOLDING

Legal Project Name: _____________________________________________________________

Outline Agreement No.: ______________________ WBS No.: ___________________________

Contractor’s Company Name: _____________________________________________________

Address: _____________________________________________________________________

Date: _______________________________________________________________________

SUBCONTRACTOR PAYMENT INFORMATION:

Subcontractor Name: _____________________________________________________________

Street Address: __________________________________________________________________

City, State, and Zip Code: _________________________________________________________

Business Phone Number: _________________________________________________________

Amount of Subcontractor Invoice: ________________________________________________

Amount of Payment Made: ___________________________________________________________________

Amount of Payment Withheld: _______________________________________________________

Date Payment First Withheld: __________________________________________________________________

DETAILED EXPLANATION OF WITHHOLDING: _______________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

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_______________________________________________________________________________

____________________________________  _______________________________________
(Signature of Contractor’s Representative) (Print or Type Name of Contractor’s Representative)

00646
02-01-2010
List of Changes:

02-04-2005: Added new Paragraph 3.25.1.3 concerning strict liability. Edited Paragraph 3.25.1.1 accordingly. Edited Paragraph 9.6.1.4 to remove the words “retainage of”.

08-15-2006: Revised many references to Section(s) to read Paragraph(s). Added Small Business Enterprise (SBE) requirement to Paragraphs 3.5.3, 3.5.3.1, 3.5.3.2 and 3.5.3.3.

08-17-2006: Added new Paragraphs 5.2.4, 5.2.5, 9.2.1 and 9.4.2 concerning prompt payment provisions.

10-10-2006: Added new Paragraphs 9.7.1.8, 9.7.1.9 concerning prompt payment provisions. Changed 9.8.1 to “20 days”, and added language to 9.8.2 concerning “7 calendar days” and payment disputes.

03-10-2008: Revised Table 1 after 11.2.11 (Installation Floater), and expanded Paragraph 11.5.1 on Maintenance Bonds.

09-10-2008: Revised 5.2.5[sic] on page 17 to read 5.2.4.

10-24-2008: Revised many sections to include or amend numbering.

08-01-2009: Amended 1.1.6., definition of City Engineer. Amended 2.2 to say “Duties” and added 2.2.2 stating that the contract imposes no implied duty on City. Added 3.5.4 concerning Contractor Participation in the Pay or Play Program. Added 3.28 pertaining to Contractor Debt. Amended 4.1.2 to prohibit the City Engineer from delegating signature authority under 4.4. Amended 4.1.11 stating that City owes no duty to Contractor not stated in contract. Amended 4.3.2 to delete second sentence concerning City Engineers decision as a condition precedent to litigation. Amended 4.6 to require both parties to waive claims, attorney fees, and interest. Amended 11.2.6 to require Contractor to notify the City of any Insurance Policy cancelation or modification. Amended 11.2.8 to exempt Workers’ Compensation coverage from certain documentation requirements. Amended Table 1 after 11.2.11 to specify automobile coverage requirements. Added 11.3.3 to address content requirements on Certificates of Insurance. Added 13.3.2 to extend joint and several liability to any series, affiliate, subsidiary, or successor to which Contractor assigns or transfers assets. Amended throughout to standardize references to Sections (x.x), Paragraphs (x.x.x), and Subparagraphs (x.x.x.x and below).

01-15-2010: Amended Sections 4.4 and 4.6 concerning written decisions, findings of fact, and hearings by the City engineer, precedent to litigation, and interest under Chapter 2251 of the Texas Local Government Code. Removed Section 4.5 NON-BONDING MEDIATION and renumbered and renamed Section 4.6 as 4.5 CONDITION PRECEDENT TO SUIT; WAIVER OF ATTORNEY FEES AND INTEREST.

05-01-2010: Amended Subsection 1.1.5 to change “municipal corporation” to “home rule municipality”. Amended Subsection 3.9.1.1 to reflect change from Low Sulfur Diesel Fuel (500 ppm) to Ultra Low Sulfur Fuel (15 ppm).

12-07-2010: Amended Section 14.1.1.5 to mirror change in Section 3.9.1.1; Low Sulfur Diesel Fuel was changed to Ultra Low Sulfur Fuel.

12-09-2010: Amended Section 4.5 (and Table of Contents) by adding “Interim Payment Waiver & Release” language from Document 00850. Amended Subsection 11.3 to include new insurance requirements.
12-10-2010: Inserted phrase into definition of Claim (§1.1.7) defining what a Claim can constitute.

01-14-2011: Insertion of terms “Business Enterprise” and “Business Enterprise Policy” into definition section (§1.1) and insertion of those terms in §3.5, as appropriate, and deletion of old §3.5.3.

01-18-2011: Renaming of §4.5; renumbering of Table of Contents due to introduction of “Interim Payment Waiver & Release” as a separate section (§4.6).

01-31-2011: Edit of Section 4.6, Interim Payment Waiver & Release” to reflect language suggestions of Litigation Division of Legal Dept.

02-09-2011: Edit of language in definitions of “Business Enterprise” and “Business Enterprise Policy”

10-12-2011: Amended Section 8.2, related to delays and extensions of time, to strengthen language suggested in 2011 Construction Law CLE.

10-19-2011: General reformatting of entire document for consistency; updating of header re: date; insertion of “Mayor’s Office of Business Opportunity”, as appropriate, to reflect name change

10-27-2011: Added a definition for “Mayor’s Office of Business Opportunity”; amended Section 8.2.2 to refer to Section 4.3.6.2; replaced MWBE with “Business Enterprise”, where appropriate; added “persons, or entities” to Section 5.1 to broaden applicable provisions; updated issue date to proposed Issue date of November 1, 2011.

10-31-2011: Edited definition of “Business Enterprise”

07-01-2013: Edited Section 3.5.3 to remove the binding arbitration requirement for contractor and subcontractor claims, per change in Office of Business Opportunity policy.

07-25-2013: Removed Section 4.5.1, regarding conditions precedent to suit.

11-01-2014: Changed Section 3.5.2 to reflect a move away from arbitration to mediation to resolve subcontractor disputes; removed requirement for City Engineer’s decision before a suit may be brought from Section 4.5.2; included language in Section 5.1.3 requiring submission of written contracts with Subcontractors within 30 days of Notice to Proceed issuance; changed Section 11.2 to reflect required insurance coverages updated for new fiscal year; added more explicit language regarding the City’s Additional Insured status in Section 11.2.4 (“Insured Parties”) and the City’s waiver of subrogation requirement in Section11.2.7 (“Subrogation”).

01-01-2015: Changed the Automobile Insurance requirement from $2,000,000 to $1,000,000.

07-01-2015: Changed language in Article 11 to reflect new insurance requirements.

07-10-2015: Edited Section 9 and Section 14 to make electronic submission of certified payrolls mandatory.

08-14-2015: Edited Section 11 to reflect new standard insurance language for City contracts.

07-01-2016: Edited Section 3.5.4 to bring Pay or Play provisions up to date; updated Section 11 to make current required insurance coverages for FY2017.

05-19-2017: Reinserted Section 4.5.1, regarding conditions precedent to suit, and retitled Section 4.5, “Condition Precedent to Suit; Waiver of Attorney Fees and Interest”.

GENERAL CONDITIONS

November 28, 2017 EDITION

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5. SUBCONTRACTORS AND SUPPLIERS
6. CONSTRUCTION BY THE CITY OR BY SEPARATE CONTRACTORS
7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. SAFETY PRECAUTIONS
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ARTICLE 1 - GENERAL PROVISIONS

1.1 DEFINITIONS

1.1.1 Agreement: Document signed by the Parties and binding the Parties, containing the name of Contractor, title and location of the Project, Original Contract Time, Original Contract Price, enumeration of documents included in the Contract, and other provisions.

1.1.2 Bonds: Performance Bond, Payment Bond, Maintenance Bond, and other Surety instruments executed by Surety. When in singular form, refers to individual instrument.

1.1.3 Business Enterprise: Any business entity registered in a program authorized by 49 C.F.R. § 26 (where applicable) or City Code of Ordinances, Chapter 15, Article II, relating to Equal Opportunity Employment and taking affirmative action to ensure that applicants are employed and employees are treated without regard to race, religion, color, sex, national origin, or age. The term "Business Enterprise" may include any Disadvantaged Business Enterprise ("DBE"), Minority Business Enterprise ("MBE"), Woman Business Enterprise ("WBE"), Small Business Enterprise ("SBE"), Person with Disability Enterprise ("PDBE"), and any Historically Underutilized Business ("HUB").

1.1.4 Business Enterprise Policy: Contract documents and applicable policies relating to Business Enterprises and authorized under 49 C.F.R. § 26 or City Code of Ordinances, Chapter 15, Article II.

1.1.5 Cash Allowance: An estimated sum of money to be used only for a limited class of expenditures such as utility relocation costs, fees for special licenses or permits, or other “pass-through” costs that would be the same for any contractor. Cash Allowances may not be used to purchase goods or services that are not specified in the Contract. The unspecified items must be purchased according to the terms of Article 7.

1.1.6 Change Order: Written instrument prepared by the City and signed by City Engineer and Contractor, specifying the following:

1.1.6.1 a change in the Work;
1.1.6.2 a change in Contract Price, if any; and
1.1.6.3 a change in Contract Time, if any.

The value of a Change Order is the net amount after offsetting all deductions against all additions effected by the Change Order.

1.1.7 City: The City of Houston, a home rule municipality located principally within Harris County, Texas, including its successors and its authorized representatives.

1.1.8 City Engineer: The City Engineer, or the City employee representing the City Engineer, designated in the Agreement and authorized to represent the City, or successors.

1.1.9 Claim: Written demand or written assertion by one Party seeking adjustment of the Contract, payment of money, extension of time, or other relief under the Contract and includes, but is not limited to, claims for materials, labor, equipment, delay, changes, adjustments, substitutions, fees and third party claims. The Party making the Claim has the responsibility to substantiate the Claim.

1.1.10 Conditions of the Contract: General Conditions and Supplementary Conditions.

1.1.11 Construction Manager: Person or firm under contract with the City as its authorized representative to oversee and administer construction of the Work, and who may perform the role of Project Manager and Inspector, as designated by City Engineer in writing.

1.1.12 Contract: The Agreement; documents enumerated in and incorporated into the Agreement, Modifications, and amendments.

1.1.13 Contract Price: The monetary amount stated in the Agreement adjusted by Change Order, and increases or decreases in Unit Price Quantities, if any.

1.1.14 Contract Time: The number of days stated in the Agreement to substantially complete the Work, plus days authorized by Change Order.

1.1.15 Contractor: Person or firm identified as such in the Agreement including its successors and its authorized representatives.

1.1.16 Date of Commencement of the Work: Date established in Notice to Proceed on which Contract Time will commence. This date will not be changed by failure of Contractor, or persons or entities for whom Contractor is responsible, to act.

1.1.17 Date of Substantial Completion: Date that construction, or portion thereof designated by City Engineer, is certified by City Engineer to be substantially complete.
1.1.18 **Design Consultant:** Person or firm, under contract with the City, to provide professional services during construction and its authorized representatives. If a Design Consultant is not employed for services during construction, Project Manager will perform duties of Design Consultant designated in the Contract in addition to usual duties of Project Manager.

1.1.19 **Drawings:** Graphic and pictorial portions of the Contract that define the character and scope of the Work.

1.1.20 **Extra Unit Price:** Unit Prices, which may be required for completion of the Work. These Unit Prices and Unit Price Quantities are in the Contract and are included in Original Contract Price.

1.1.21 **Furnish:** To supply, pay for, deliver to the site, and unload.

1.1.22 **General Requirements:** The sections of Division 01 Specifications that specify administrative and procedural requirements and temporary facilities required for the Work.

1.1.23 **Inspector:** City’s employee or agent authorized to assist with inspection of the Work.

1.1.24 **Install:** Unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, clean, protect, and similar operations.

1.1.25 **Legal Holiday:** Day established by the City Council as a holiday.

1.1.26 **Major Unit Price Work:** An individual Unit Price item,

- 1.1.26.1 whose value is greater than five percent of Original Contract Price,
- 1.1.26.2 whose value becomes greater than five percent of Original Contract Price as the result of an increase in quantity, or
- 1.1.26.3 whose value is $100,000, whichever is least.

1.1.27 **Mayor’s Office of Business Opportunity:** any reference to, or use of, the “Office of Affirmative Action” shall mean the Mayor’s Office of Business Opportunity, or any such future name to which it is changed.

1.1.28 **Minor Change in the Work:** A written change in the Work, ordered by City Engineer, that does not change Contract Price or Contract Time, and that is consistent with the general scope of the Contract.

1.1.29 **Modification:** Change Order, Work Change Directive, or Minor Change in the Work.

1.1.30 **Notice of Noncompliance:** A written notice by City Engineer to Contractor regarding defective or nonconforming work that does not meet the Contract requirements, and that establishes a time by which Contractor shall correct the defective or nonconforming work.

1.1.31 **Notice to Proceed:** A written notice by City Engineer to Contractor establishing Date of Commencement of the Work.

1.1.32 **Original Contract Price:** The monetary amount originally stated in the Agreement.

1.1.33 **Parties:** Contractor and the City. When in singular form, refers to Contractor or the City.

1.1.34 **Pollutant:** Any materials subject to the Texas Solid Waste Disposal Act.

1.1.35 **Pollutant Facility:** Any facility regulated by the State of Texas to protect the health and environment from contamination by Pollutants, including without limitation, landfills, oil and gas production and storage facilities, wastewater facilities, waste injection wells, and storage tanks (including drums).

1.1.36 **Product:** Materials, equipment, or systems incorporated into the Work or to be incorporated into the Work.

1.1.37 **Product Data:** Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by Contractor to illustrate a Product.

1.1.38 **Project:** Total construction, of which the Work performed under the Contract may be the whole or a part, and which may include construction by the City or by separate contractors.

1.1.39 **Project Manager:** City Engineer’s authorized representative for administration of the Work. Titles used within the City’s departments may be different than those used in this definition.

1.1.40 **Provide:** Furnish and Install, complete, ready for intended use.
1.1.41 **Samples:** Physical examples that illustrate Products, or workmanship, and establish standards by which the Work is judged.

1.1.42 **Shop Drawings:** Drawings, diagrams, schedules, and other data specially prepared for the Work by Contractor, Subcontractor or Supplier, to illustrate a portion of the Work.

1.1.43 **Specifications:** Divisions 01 through 16 of the documents that are incorporated into the Agreement, consisting of written General Requirements and requirements for Products, standards, and workmanship for the Work, and performance of related services.

1.1.44 **Stipulated Price:** Single lump sum amount stated in the Contract for completion of the Work, or for designated portion of the Work.

1.1.45 **Subcontractor:** Person or firm that has direct or indirect contract with Contractor or with another Subcontractor to perform a portion of the Work and its authorized representatives.

1.1.46 **Superintendent:** Employee of Contractor having authority and responsibility to act for and represent Contractor.

1.1.47 **Supplementary Conditions:** Part of Conditions of the Contract that amends or supplements General Conditions.

1.1.48 **Supplier:** Manufacturer, distributor, materialman, or vendor having a direct agreement with Contractor or Subcontractor for Products, or services and its authorized representatives.

1.1.49 **Surety:** Corporate entity that is bound by one or more Bonds, and is responsible for completion of the Work, including the correction period, and for payment of debts incurred in fulfilling the Contract. Surety shall include co-surety or reinsurer, as applicable.

1.1.50 **Underground Facilities:** Pipes, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments and encasements containing such facilities that exist below ground level.

1.1.51 **Unit Price:** An amount stated in the Contract for an individual, measurable item of work, which, when multiplied by actual quantity incorporated into the Work, amounts to full compensation for completion of the item, including work incidental to it.

1.1.52 **Unit Price Quantities:** Quantities indicated in the Contract that are approximations made by the City for contracting purposes.

1.1.53 **Work:** Entire construction required by the Contract, including all labor, Products, and services provided by Contractor to fulfill Contractor's obligations. The Work may constitute the whole or a portion of the Project.

1.1.54 **Work Change Directive:** A written change in the Work, ordered by City Engineer, that is within the general scope of the Contract and consisting of additions, deletions, or other revisions. A Work Change Directive will state proposed basis for adjustment, if any, in Contract Price or Contract Time, or both.

1.2 **EXECUTION, CORRELATION, AND INTENT**

1.2.1 Execution of the Contract by Contractor is conclusive that Contractor has visited the Work site, become familiar with local conditions under which the Work will be performed, and fully informed itself as to conditions and matters which can affect the Work or costs. Contractor further agrees that it has carefully correlated personal observations with requirements of the Contract.

1.2.2 The Contract and Modifications have been read and carefully considered by Contractor, who understands and agrees to their sufficiency for the Work. The Contract may not be more strongly construed against the City than against Contractor and Surety.

1.2.3 Contractor shall include all items necessary for proper execution and completion of the Work.

1.2.4 Reference to standard specifications, manuals, or codes of a technical society, organization, or association, or to laws or regulations of a governmental authority, whether specific or implied, mean the latest edition in effect as of date of receipt of bids, except as may be otherwise specifically stated in the Contract.

1.2.5 No provision of any referenced standard, specification, or manual changes the duties and responsibilities of the City, City Engineer, Contractor, or Design Consultant from those set forth in the Contract. Nor do these provisions assign to Design Consultant any duty or authority to supervise or direct performance of the Work or any duty or
authority to undertake any actions contrary to provisions of the Contract.

1.2.6 Organization of Specifications into divisions, sections, and articles and arrangement of Drawings does not control Contractor in dividing the Work among Subcontractors or in establishing the extent of work to be performed by any trade.

1.2.7 Unless otherwise defined in the Contract, words which have well-known construction industry technical meanings are used in the Contract in accordance with these recognized meanings.

1.3 OWNERSHIP AND USE OF DOCUMENTS

1.3.1 Drawings, Specifications, and other documents prepared by the City or by Design Consultant are instruments of service through which the Work to be executed by Contractor is described. Contractor may retain one Contract record set.

1.3.2 Neither Contractor, Subcontractor, nor Supplier will own or claim a copyright to documents contained in the Contract or any part of the Contract.

1.3.3 Documents contained in the Contract, prepared by the City or by Design Consultant, and copies furnished to Contractor, are for use solely with respect to the Work. They may not be used by Contractor, Subcontractor or Supplier on other projects or for additions to the Work, outside the scope of the Work, without the specific written consent of City Engineer, and Design Consultant, when applicable.

1.3.4 Contractor, Subcontractors, and Suppliers are granted a limited license to use and reproduce applicable portions of the Contract appropriate to and for use in execution of their work under the Contract.

1.4 INTERPRETATION

1.4.1 Specifications are written in an imperative streamlined form and are directed to Contractor, unless noted otherwise. When written in this form, words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.4.2 In the interest of brevity, the Contract frequently omits modifying words such as "all" and "any" and articles such as "the" and "an", but an absent modifier or article is not intended to affect interpretation of a statement.

ARTICLE 2 - THE CITY

2.1 LIMITATIONS OF THE CITY’S OFFICERS AND EMPLOYEES

2.1.1 No officer or employee of the City may authorize Contractor to perform an act or work contrary to the Contract, except as otherwise provided in the Contract.

2.2 DUTIES OF THE CITY

2.2.1 If a building permit is required, the City will process an application for, and Contractor shall purchase the building permit before Date of Commencement of the Work.

2.2.2 The City will make available to Contractor a reproducible set of Drawings. Additional copies will be furnished, on Contractor's request, at the cost of reproduction.

2.2.3 When necessary for performance of the Work, the City will provide surveys describing physical characteristics, legal limitations, legal description of site, and horizontal and vertical control adequate to lay out the Work.

2.2.4 Information or services that the City is required to provide under the Contract will be provided by the City with reasonable promptness to avoid delay in orderly progress of the Work.

2.2.5 The Contract imposes no implied duty on the City. The City does not warrant any plans or specifications associated with the Contract.

2.2.6 Except as expressly stated in this Article, the City owes no duty to the Contractor or any subcontractor.

2.3 AVAILABILITY OF LAND AND USE OF SITE

2.3.1 The City will furnish, as indicated in the Contract, rights-of-way, land on which the Work is to be performed, and other land designated in the Contract for use by Contractor unless otherwise provided in the Contract.

2.3.2 Contractor shall confine operations at site to those areas permitted by law, ordinances, permits, and the Contract, and may not unreasonably encumber site with materials or equipment.
2.3.3 In addition to land provided by the City under Section 2.3, Contractor shall provide all land and access to land that may be required for use by Contractor for temporary construction facilities or for storage of materials and equipment, and shall indemnify the City during its use of the land as stated in Section 3.25.

2.4 THE CITY'S RIGHT TO STOP THE WORK

2.4.1 If Contractor fails to carry out the Work in accordance with the Contract, or fails to correct work which is not in accordance with requirements of the Contract as required in Sections 12.1 and 12.2, the City may, by Notice of Noncompliance, order Contractor to stop the Work or any portion of the Work until the cause for the order has been eliminated. However, the right of the City to stop the Work will not give rise to a Claim for delay or to a duty on the part of the City to exercise this right for the benefit of Contractor or any other person or entity, except to the extent required by Section 6.2. If Contractor corrects the defective or nonconforming work within the time established in Notice of Noncompliance, City Engineer will give written notice to Contractor to resume performance of the Work.

2.5 THE CITY'S RIGHT TO CARRY OUT WORK

2.5.1 If Contractor fails to carry out work in accordance with the Contract, and fails within the period established in a Notice of Noncompliance to correct the nonconforming work, the City may, after expiration of the required period, correct the deficiencies without prejudice to other remedies the City may have, including rights of the City under Section 14.1.

2.5.1.1 When the City corrects deficiencies, City Engineer will issue an appropriate Change Order and deduct from payments then or thereafter due Contractor the cost of correcting the deficiencies, including compensation for Design Consultant's and Construction Manager's additional services and expenses made necessary by such default, neglect, or failure. This action by the City and amounts charged to Contractor are both subject to prior approval of City Engineer. If payments, then or thereafter due Contractor, are not sufficient to cover these amounts, Contractor shall pay the difference to the City.

2.5.2 Notwithstanding the City's right to carry out work, maintenance and protection of the Work remains Contractor's responsibility, as provided in the Contract.

ARTICLE 3 - CONTRACTOR

3.1 RESPONSIBILITIES

3.1.1 Contractor shall maintain office with agent in the greater City of Houston area during the Contractor's performance under the Contract. Contractor shall file its street address with City Engineer.

3.1.2 Contractor and Contractor's employees shall not give or lend money or anything of value to an officer or employee of the City. Should this Paragraph 3.1.2 be violated, City Engineer may terminate the Contract under Section 14.1.

3.2 REVIEW OF CONTRACT AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 Contractor shall carefully study and compare documents contained in the Contract with each other and with information furnished by the City pursuant to Section 2.2 and shall immediately report, in writing, any errors, inconsistencies, or omissions to City Engineer. If work is affected, Contractor shall obtain a written interpretation or clarification from City Engineer before proceeding with the affected work. However, Contractor will not be liable to the City for failure to report an error, inconsistency, or omission in the Contract unless Contractor had actual knowledge or should have had knowledge of the error, inconsistency, or omission.

3.2.2 Contractor shall take field measurements and verify field conditions, and shall carefully compare the conditions and other information known to Contractor with the Contract, before commencing activities. Contractor shall immediately report, in writing, to City Engineer for interpretation or clarification of discrepancies, inconsistencies, or omissions discovered during this process.

3.2.3 Contractor shall make a reasonable attempt to understand the Contract before requesting interpretation from City Engineer.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 Contractor shall supervise, direct, and inspect the Work competently and efficiently, devoting the attention and applying the skills and
expertise as necessary to perform the Work in accordance with the Contract. Contractor is solely responsible and has control over construction means, methods, techniques, sequences, and procedures of construction; for safety precautions and programs in connection with the Work; and for coordinating all work under the Contract.

3.3.2 Regardless of observations or inspections by the City or City’s consultants, Contractor shall perform and complete the Work in accordance with the Contract and submittals approved pursuant to Section 3.18. The City is not liable or responsible to Contractor or Surety for work performed by Contractor that is not in accordance with the Contract regardless of whether discovered during construction or after acceptance of the Work.

3.4 SUPERINTENDENT

3.4.1 Contractor shall employ a competent Superintendent and necessary assistants who shall be present at the site during performance of the Work. Communications given to Superintendent are binding on the Contractor.

3.4.2 Contractor shall notify City Engineer in writing of its intent to replace the Superintendent. Contractor may not replace the Superintendent if City Engineer makes a reasonable objection in writing.

3.5 LABOR

3.5.1 Contractor shall provide competent, qualified personnel to survey and lay out the Work and perform construction as required by the Contract. The City may, by written notice, require Contractor to remove from the Work any employee of Contractor or Subcontractors to whom City Engineer makes a reasonable objection.

3.5.2 Contractor shall comply with the applicable Business Enterprise Policy set out in this Agreement and in the Supplementary Conditions, as set out in Chapter 15, Article V of the City of Houston Code of Ordinances.

3.5.3 When Original Contract Price is greater than $1,000,000, Contractor shall make Good Faith Efforts to award subcontracts or supply agreements in at least the percentages set out in the Supplementary Conditions for Business Enterprise Policy. Contractor acknowledges that it has reviewed the requirements for Good Faith Efforts on file with the City’s Office of Business Opportunity and shall comply with them.

3.5.3.1 Contractor shall require written subcontracts with Business Enterprises and shall submit all disputes with Business Enterprises to voluntary mediation. Business Enterprise subcontracts complying with City Code of Ordinances Chapter 15, Article II must contain the terms set out in Subparagraph 3.5.3.2. If Contractor is an individual person, as distinguished from a corporation, partnership, or other legal entity, and the amount of the subcontract is $50,000 or less, the subcontract must also be signed by the attorneys of the respective parties.

3.5.3.2 Contractor shall ensure that subcontracts with Business Enterprise firms are clearly labeled "THIS CONTRACT MAY BE SUBJECT TO MEDIATION ACCORDING TO THE TEXAS ALTERNATIVE DISPUTE RESOLUTION ACT" and contain the following terms:

3.5.3.2.1 (Business Enterprise) may not delegate or subcontract more than 50 percent of work under this subcontract to any other subcontractor without the express written consent of the City’s OBO Director (the “Director”).

3.5.3.2.2 (Business Enterprise) shall permit representatives of the City of Houston, at all reasonable times, to perform (1) audits of the books and records of the Subcontractors and Suppliers, and (2) inspections of all places where work is to be undertaken in connection with this subcontract. (Business Enterprise) shall keep the books and records available for this purpose for at least four years after the end of its performance under this subcontract. Nothing in this provision shall affect the time for bringing a cause of action nor the applicable statute of limitations.

3.5.3.2.3 Within five business days of execution of this subcontract, Contractor and (Business Enterprise) shall designate in writing to the Director an agent for receiving any notice required or permitted to be given pursuant to Chapter 15 of the Houston City Code of Ordinances, along with the street and mailing address and phone number of the agent.

3.5.4 The requirements and terms of the City of Houston Pay or Play Program, as set out in Executive Order 1-7, as revised from time to time, are incorporated into the Contract for all purposes. Contractor has reviewed Executive Order 1-7 and shall comply with its terms and conditions. IF
CONTRACTOR DOES NOT PAY IN ACCORDANCE WITH THE PAY OR PLAY PROGRAM WITHIN 30 DAYS OF THE DATE CITY ENGINEER SENDS CONTRACTOR WRITTEN NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS UP TO THE AMOUNT OWED FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS CONTRACT, AND CONTRACTOR WAIVES ANY RECOURSE.

3.6 PREVAILING WAGE RATES

3.6.1 Contractor shall comply with governing statutes providing for labor classification of wage scales for each craft or type of laborer, worker, or mechanic.

3.6.2 Prevailing wage rates applicable to the Work may be one or a combination of the following wage rates identified in Division 00:

3.6.2.1 Federal Wage Rate General Decisions
   3.6.2.1.1 Highway Rates
   3.6.2.1.2 Building Rates
   3.6.2.1.3 Heavy Construction Rates
   3.6.2.1.4 Residential Rates

3.6.2.2 City Prevailing Wage Rates
   3.6.2.2.1 Building Construction Rates
   3.6.2.2.2 Engineering Construction Rates
   3.6.2.2.3 Asbestos Worker Rates

3.6.3 Each week Contractor shall submit to the City’s Mayor’s Office of Business Opportunity certified copies of payrolls showing classifications and wages paid by Contractor, Subcontractors, and Suppliers for each employee under the Contract, for any day included in the Contract.

3.7 LABOR CONDITIONS

3.7.1 In the event of labor disputes affecting Contractor or Contractor’s employees, Contractor shall utilize all possible means to resolve disputes in order that the Work not be delayed to any extent. These means will include seeking injunctive relief and filing unfair labor practice charges, and any other action available to Contractor.

3.7.2 When Contractor has knowledge that any actual or potential labor dispute is delaying or is threatening to delay timely performance of the Work, Contractor shall immediately notify City Engineer in writing. No Claims will be accepted by City Engineer for costs incurred as a result of jurisdictional or labor disputes.

3.8 DRUG DETECTION AND DETERRENCE

3.8.1 It is the policy of the City to achieve a drug-free work force and to provide a workplace that is free from the use of illegal drugs and alcohol. It is also the policy of the City that manufacture, distribution, dispensation, possession, sale, or use of illegal drugs or alcohol by contractors while on the City’s premises is prohibited. By executing the Contract, Contractor represents and certifies that it meets and will comply with all requirements and procedures set forth in the Mayor’s Policy on Drug Detection and Deterrence, City Council Motion No. 92-1971 (“Mayor’s Policy”) and the Mayor’s Drug Detection and Deterrence Procedures for Contractors, Executive Order No. 1-31, (Revised) (“Executive Order”). Mayor’s Policy is on file in the office of the City Secretary. Copies of Executive Order may be obtained at the location specified in the Advertisement for Bids.

3.8.1.1 The Executive Order applies to the City’s contracts for labor or services except the following:
   3.8.1.1.1 contracts authorized by Emergency Purchase Orders,
   3.8.1.1.2 contracts in which imposition of requirements of the Executive Order would exclude all potential bidders or proposers, or would eliminate meaningful competition for the Contract,
   3.8.1.1.3 contracts with companies that have fewer than 15 employees during any 20-week period during a calendar year and no safety impact positions,
   3.8.1.1.4 contracts with non-profit organizations providing services at no cost or reduced cost to the public, and
   3.8.1.1.5 contracts with federal, state, or local governmental entities.

3.8.1.2 Prior to execution of the Contract, Contractor shall have filed with the City:
   3.8.1.2.1 a Drug Policy Compliance Agreement form (Attachment “A” to the Executive Order), and
   3.8.1.2.2 a copy of Contractor’s drug free workplace policy, and
   3.8.1.2.3 a written designation of all safety impact positions, if applicable, or a Contractor’s Certification of a No Safety Impact Positions form (Attachment “C” to the Executive Order).
3.8.1.3 Every six months during performance of the Contract and upon completion of the Contract, Contractor shall file a Drug Policy Compliance Declaration form (Attachment "B" to the Executive Order). The Contractor shall submit the Drug Policy Compliance Declaration within 30 days of expiration of each six-month period of performance and within 30 days of completion of the Contract. The first six-month period shall begin on Date of Commencement of the Work.

3.8.1.4 Contractor shall have a continuing obligation to file updated designation of safety impact positions when additional safety impact positions are added to Contractor's employee workforce during performance of the Work.

3.8.1.5 Contractor shall require its Subcontractors and Suppliers to comply with the Mayor's Policy and Executive Order. Contractor is responsible for securing and maintaining required documents from Subcontractors and Suppliers for the City inspection throughout the term of the Contract.

3.8.1.6 Failure of Contractor to comply with requirements will be a material breach of the Contract entitling the City to terminate in accordance with Section 14.1.

3.9 MATERIALS & EQUIPMENT

3.9.1 Unless otherwise provided in the Contract, Contractor shall provide and assume full responsibility for Products, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, transportation, temporary facilities, supplies, and other facilities and incidentals necessary for Furnishing, performing, testing, starting-up, and completing the Work.

3.9.1.1 Contractor, Subcontractors, and Suppliers shall use Ultra Low Sulfur Diesel Fuel in all diesel operating vehicles and motorized equipment utilized in performing the Work. Ultra Low Sulfur Diesel Fuel is defined as diesel fuel having 15 ppm or the applicable standard set by state or federal law or rules and regulations of the Texas Commission on Environmental Quality, or the Environmental Protection Agency, whichever is less in sulfur content. Off-road Ultra Low Sulfur Diesel Fuel may be used in lieu of on-road Ultra Low Sulfur Diesel Fuel. Contractor shall provide, upon request by City Engineer, proof that Contractor, Subcontractors, and Suppliers are using Ultra Low Sulfur Diesel Fuel.

3.9.2 Contractor shall provide Products that are:

3.9.2.1 new, unless otherwise required or permitted by the Contract, and

3.9.2.2 of specified quality.

If required by City Engineer, Contractor shall furnish satisfactory evidence, including reports of required tests, as to kind and quality of Products.

3.9.3 Contractor shall store Products in a safe, neat, compact, and protected manner. Contractor shall also store Products delivered during the work, along the right-of-way:

3.9.3.1 so as to cause the least inconvenience to property owners, tenants, and general public; and

3.9.3.2 so as not to block access to, or be closer than, three feet to any fire hydrant.

Contractor shall protect trees, lawns, walks, drives, streets, and other improvements that are to remain, from damage. If private or public property is damaged by Contractor, Contractor shall, at its sole expense, restore the damaged property to at least its original condition.

3.9.3.1 Contractor shall obtain City Engineer's approval for storage areas used for Products for which payment has been requested under Paragraph 9.6.1. Contractor shall provide the City access to the storage areas for inspection purposes. Products, once paid for by the City, become the property of the City and may not be removed from place of storage, without City Engineer's written permission except for a movement to the site. Contractor's Installation Floater, required under Section 11.2, shall cover all perils, including loss or damage to Products during storage, loading, unloading, and transit to the site.

3.10 PRODUCT OPTIONS AND SUBSTITUTIONS

3.10.1 For Products specified by reference standards or by description only, Contractor may provide any Product meeting those standards or description.

3.10.2 For Products specified by naming one or more manufacturers with provision for substitutions or equal, Contractor may submit a request for substitution for any manufacturer not named.

3.10.3 City Engineer will consider requests for substitutions only within the first 15 percent of
Contract Time, or first 90 days after date of Notice to Proceed, whichever is less.

3.10.4 Contractor shall document each request for substitution with complete data substantiating compliance of proposed substitution with the Contract.

3.10.5 A request for substitution constitutes a representation that Contractor:
   3.10.5.1 has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified Product;
   3.10.5.2 shall provide the same warranty for the substitution as for the specified Product;
   3.10.5.3 shall coordinate installation of the proposed substitution and make changes to other work which may be required for the Work to be completed, with no additional cost or increase in time to the City;
   3.10.5.4 confirms that cost data is complete and includes all related costs under the Contract;
   3.10.5.5 waives Claim for additional costs or time extensions that may subsequently become apparent; and
   3.10.5.6 shall provide review or redesign services by a design consultant with appropriate professional license and shall obtain re-approval and permits from authorities.

3.10.6 City Engineer will not consider and will not approve substitutions when:
   3.10.6.1 they are indicated or implied on Shop Drawing or Product Data submittals without separate written request; or
   3.10.6.2 acceptance will require revision to the Contract.

3.10.7 City Engineer may reject requests for substitution, and his decision will be final and binding on the Parties.

3.11 CASH ALLOWANCES

3.11.1 Contract Price includes Cash Allowances as identified in the Contract.

3.11.2 The City will pay the actual costs of Cash Allowance item exclusive of profit, overhead or administrative costs. If actual costs exceed the Cash Allowance, City Engineer must approve a Change Order for the additional costs.

3.12 WARRANTY

3.12.1 Contractor warrants to the City that Products furnished under the Contract are:
   3.12.1.1 free of defects in title;
   3.12.1.2 of good quality; and
   3.12.1.3 new, unless otherwise required or permitted by the Contract.

If required by the City Engineer, Contractor shall furnish satisfactory evidence as to kind, quality and title of Products, and that Products conform to requirements of the Contract.

3.12.2 In the event of a defect in a Product, either during construction or warranty period, Contractor shall take appropriate action with manufacturer of Product to assure correction or replacement of defective Product with minimum delay.

3.12.3 Contractor warrants that the Work is free of defects not inherent in the quality required or permitted, and that the Work does conform with the requirements of the Contract. Contractor further warrants that the Work has been performed in a thorough and workmanlike manner.

3.12.4 Contractor warrants that the Work is free of concentrations on polychlorinated biphenyl (PCB) and other substances defined as hazardous by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) or any other applicable law or regulation.

3.12.5 Work not conforming to requirements of Section 3.12, including substitutions not properly approved and authorized, may be considered nonconforming work.

3.12.6 Contractor's warranty excludes remedy for damage or defect caused by:
   3.12.6.1 improper or insufficient maintenance by the City;
   3.12.6.2 normal wear and tear under normal usage; or
   3.12.6.3 claim that hazardous material was incorporated into the Work, if that material was specified in the Contract.

3.12.7 Contractor warrants that title to all work covered by Contractor's request for payment passes to the City upon incorporation into the Work or upon Contractor's receipt of payment, whichever occurs first. The Contractor further warrants that the title is free of all liens, claims, security interests or other interests ("Encumbrances"). If not, upon written demand from City Engineer, Contractor shall
immediately take legal action necessary to remove Encumbrances.

3.13 TAXES

3.13.1 Contractor shall pay all sales, consumer, use, and similar taxes, which are in effect or scheduled to go into effect on or before bids are received, related to work provided by Contractor.

3.13.2 Contractor shall obtain, and require Subcontractors and Suppliers to obtain, necessary permits from the state and local taxing authorities to perform contractual obligations under the Contract, including sales tax permits.

3.13.3 The City is exempt from the Federal Transportation and Excise Tax. Contractor shall comply with federal regulations governing the exemptions.

3.13.4 Products incorporated into the Work are exempt from state sales tax according to provisions of the TEX. TAX CODE ANN. CH. 151, Subsection H.

3.14 PERMITS, FEES, AND NOTICES

3.14.1 Unless otherwise provided in the Contract, Contractor shall secure and pay for all construction permits, licenses, and inspections:

- necessary for proper execution and completion of the Work; and
- legally required at time bids are received.

3.15 CONSTRUCTION SCHEDULES

3.15.1 On receipt of Notice to Proceed, Contractor shall promptly prepare and submit construction schedule for the Work for City Engineer’s review. The schedule must reflect the minimum time required to complete the Work not to exceed Contract Time.

3.15.2 Contractor shall give 24-hour written notice to City Engineer before commencing work or resuming work where work has been stopped. Contractor shall also give the same notice to inspectors.

3.15.3 Contractor shall incorporate milestones specified in Summary of Work Specification into the construction schedule. Contractor’s failure to meet a milestone, as determined by City Engineer, may be considered a material breach of the Contract.

3.15.4 Each month, Contractor shall submit to City Engineer a copy of an updated construction schedule indicating actual progress, incorporating applicable changes, and indicating courses of action required to assure completion of the Work within Contract Time.

3.15.5 Contractor shall keep a current schedule of submittals that coordinates with the construction schedule, and shall submit the initial schedule of submittals to City Engineer for approval.

3.16 DOCUMENTS AND SAMPLES AT THE SITE

3.16.1 Contractor shall maintain at the site, and make available to City Engineer, one record copy of Drawings, Specifications, and Modifications. Contractor shall maintain the documents in good order and marked currently to record changes and selections made during construction. In addition, Contractor shall maintain at the site, approved Shop Drawings, Product Data, Samples, and similar submittals, which will be delivered to City Engineer prior to final inspection as required in Paragraph 9.11.4.

3.16.2 Contractor shall maintain all books, documents, papers, accounting records, and other relevant documentation pursuant to the Work and shall make the books, documents, papers, and accounting records available to representatives of the City for review and audits during the Contract term and for the greater of three years following Date of Substantial Completion or until all litigation or audits are fully resolved.

3.16.3 Contractor shall provide to City Attorney all documents and records that City Attorney deems necessary to assist in determining Contractor’s compliance with the Contract, with the exception of those documents made confidential by federal or state law or regulation.

3.17 MANUFACTURER’S SPECIFICATIONS

3.17.1 Contractor shall handle, store, and Install Products and perform all work in the manner required by Product manufacturer. Should the Contract and manufacturer’s instructions conflict, Contractor shall report conflict to City Engineer for resolution prior to proceeding with the affected work.

3.17.2 References in the Contract to the manufacturer’s specifications, directions, or recommendations, mean manufacturer’s current
published documents in effect as of date of receipt of bids, or in the case of a Modification, as of date of Modification.

3.18 **SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES**

3.18.1 Shop Drawings, Product Data, and Samples are not part of the Contract. The purpose of Contractor submittals is to demonstrate, for those portions of the Work for which submittals are required, the way Contractor proposes to conform to information given and design concept expressed in the Contract.

3.18.2 Contractor shall submit to Project Manager for review the Shop Drawings, Product Data, and Samples, which are required by the Contract. Review by Project Manager is subject to limitations of Paragraph 4.1.4. Contractor shall transmit the submittals to the Project Manager with reasonable promptness and in a sequence, so as to cause no delay in the Work or in activities of the City or of separate contractors. Contractor shall transmit submittals in time to allow a minimum of 30 days for Project Manager's review prior to date Contractor needs reviewed submittals returned. This time may be shortened for a particular job requirement if approved by Project Manager in advance of submittal.

3.18.3 Contractor shall certify that the content of submittals conforms to the Contract without exception by affixing Contractor's approval stamp and signature. By certifying and submitting Shop Drawings, Product Data, and Samples, Contractor represents, and Contractor's stamp of approval shall state, that Contractor has determined and verified materials, quantities, field measurements, and field construction criteria related to the submittal, and has checked and coordinated information contained within the submittals with requirements of the Contract.

3.18.4 Contractor may not perform any work requiring submittal and review of Shop Drawings, Product Data, or Samples until the submittal has been returned with appropriate review decision by the Project Manager. Contractor shall perform work in accordance with the review.

3.18.5 If Contractor performs any work requiring submittals prior to review and acceptance of the submittals by Project Manager, such work is at Contractor's risk and the City is not obligated to accept work if the submittals are later found to be unacceptable.

3.18.6 If, in the opinion of Project Manager, the submittals are incomplete, or demonstrate an inadequate understanding of the Work or lack of review by the Contractor, then submittals may be returned to the Contractor for correction and resubmittal.

3.18.7 Contractor shall direct specific attention in writing and on the resubmitted Shop Drawings, Product Data, or Samples to any additional proposed revisions, other than those revisions requested by Project Manager on previous submittals.

3.18.8 Contractor is not relieved of responsibility for deviations from requirements of the Contract by Project Manager's review of Shop Drawings, Product Data, or Samples unless Contractor has specifically informed Project Manager in writing of the deviation at the time of the submittal, and Project Manager has given written approval of the deviation.

3.18.9 When professional certification of performance criteria of Products is required by the Contract, the City may rely upon accuracy and completeness of the calculations and certifications.

3.18.10 For Product colors or textures to be selected by the City, Contractor shall submit all samples together to allow preparation of a complete selection schedule.

3.18.11 Contractor shall submit informational submittals, on which Project Manager is not expected to take responsive action, as required by the Contract.

3.18.12 Submittals made by Contractor which are not required by the Contract may be returned to Contractor without action.

3.19 **CULTURAL RESOURCES AND ENDANGERED SPECIES**

3.19.1 Contractor may not remove or disturb, or cause to be removed or disturbed, any historical, archaeological, architectural, or other cultural artifacts, relics, vestiges, remains, or objects of antiquity. If Contractor discovers one of these items, Contractor shall immediately notify City Engineer and further comply with the requirements of 13 Tex. Admin. Code Chs. 25 and 26 (2002), or successor regulation. Contractor shall protect site and cultural resources from further disturbance until professional examination can be made or until clearance to proceed is authorized in writing by City Engineer.
3.19.2 Should either threatened or endangered plant or animal species be encountered, Contractor shall cease work immediately in the area of encounter and notify City Engineer.

3.20 **CUTTING AND PATCHING**

3.20.1 Contractor is responsible for necessary cutting, fitting, and patching to accomplish the Work and shall suitably support, anchor, attach, match, and trim or seal materials to work of other contractors. Contractor shall coordinate the Work with work of other contractors to minimize conflicts, as provided in Article 6.

3.20.2 Contractor may not endanger work by cutting, digging, or other action, and may not cut or alter work of other contractors except by written consent of City Engineer and affected contractor.

3.21 **CLEANING**

3.21.1 Contractor shall perform daily cleanup of all dirt, debris, scrap materials and other disposable items resulting from Contractor's operations, whether on-site or off-site. Unless otherwise authorized in writing by City Engineer, Contractor shall keep all streets, access streets, driveways, areas of public access, walkways, and other designated areas clean and open at all times.

3.21.2 Failure of Contractor to maintain a clean site, including access streets, is the basis for City Engineer to issue a Notice of Noncompliance. Should compliance not be attained within the time period in the Notice of Noncompliance, City Engineer may authorize necessary cleanup to be performed by others and the cost of the cleanup will be deducted from monies due Contractor.

Contractor shall legally dispose off-site, all waste materials and other excess materials resulting from Contractor's operations.

3.22 **SANITATION**

3.22.1 Contractor shall provide and maintain sanitary facilities at site for use of all construction forces under the Contract. Newly-constructed or existing sanitary facilities may not be used by Contractor.

3.23 **ACCESS TO WORK AND TO INFORMATION**

3.23.1 Contractor shall provide the City, Design Consultant, testing laboratories, and governmental agencies which have jurisdictional interests, access to the Work in preparation and in progress wherever located. Contractor shall provide proper and safe conditions for the access.

3.23.2 If required by City Engineer, Contractor shall furnish information concerning character of Products and progress and manner of the Work, including information necessary to determine cost of the Work, such as number of employees, pay of employees, and time employees worked on various classes of the Work.

3.24 **TRADE SECRETS**

3.24.1 Contractor will not make any claim of ownership of trade secrets as to products used in the Work, or preparation of any mixture for the Work. City Engineer will at all times have the right to demand and Contractor shall furnish information concerning materials or samples of ingredients of any materials used, or proposed to be used, in preparation of concrete placed or other work to be done. Mixtures, once agreed on, shall not be changed in any manner without knowledge and consent of City Engineer. The City will make its best efforts to protect confidentiality of proprietary information.

3.25 **INDEMNIFICATION**

3.25.1 CONTRACTOR AGREES TO AND SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY, ITS AGENTS, EMPLOYEES, OFFICERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY THE "CITY") HARMLESS FOR ALL CLAIMS, CAUSES OF ACTION, LIABILITIES, FINES, AND EXPENSES (INCLUDING, WITHOUT LIMITATION, ATTORNEYS' FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS AND INTEREST) FOR INJURY, DEATH, DAMAGE, OR LOSS TO PERSONS OR PROPERTY SUSTAINED IN CONNECTION WITH OR INCIDENTAL TO PERFORMANCE UNDER THE CONTRACT INCLUDING, WITHOUT LIMITATION, THOSE CAUSED BY:

3.25.1.1 CONTRACTOR'S AND/OR ITS AGENTS', EMPLOYEES', OFFICERS', DIRECTORS', CONTRACTORS', OR SUBCONTRACTORS' (COLLECTIVELY IN NUMBERED SUB Paragraphs .1 through .3, "CONTRACTOR") ACTUAL OR ALLEGED NEGLIGENCE OR INTENTIONAL ACTS OR OMISSIONS;
3.25.1.2 THE CITY’S AND CONTRACTOR’S ACTUAL OR ALLEGED CONCURRENT NEGLIGENCE, WHETHER CONTRACTOR IS IMMUNE FROM LIABILITY OR NOT;

3.25.1.3 THE CITY’S AND CONTRACTOR’S ACTUAL OR ALLEGED STRICT PRODUCTS LIABILITY OR STRICT STATUTORY LIABILITY, WHETHER CONTRACTOR IS IMMUNE FROM LIABILITY OR NOT.

CONTRACTOR SHALL DEFEND, INDEMNIFY, AND HOLD THE CITY HARMLESS DURING THE TERM OF THE CONTRACT AND FOR FOUR YEARS AFTER THE CONTRACT TERMINATES.

CONTRACTOR SHALL NOT INDEMNIFY THE CITY FOR THE CITY'S SOLE NEGLIGENCE.

3.25.2 NOTWITHSTANDING ANYTHING TO THE CONTRARY, THE LIABILITY OF CONTRACTOR FOR THE CITY’S CONCURRENT NEGLIGENCE SHALL NOT EXCEED $1,000,000.

3.26 RELEASE AND INDEMNIFICATION – PATENT, COPYRIGHT, TRADEMARK, AND TRADE SECRET INFRINGEMENT

3.26.1 UNLESS OTHERWISE SPECIFICALLY REQUIRED BY THE CONTRACT, CONTRACTOR AGREES TO AND SHALL RELEASE AND DEFEND, INDEMNIFY, AND HOLD HARMLESS THE CITY, ITS AGENTS, EMPLOYEES, OFFICERS, AND LEGAL REPRESENTATIVES (COLLECTIVELY THE “CITY”) FROM ALL CLAIMS OR CAUSES OF ACTION BROUGHT AGAINST THE CITY BY ANY PARTY, INCLUDING CONTRACTOR, ALLEGING THAT THE CITY’S USE OF ANY EQUIPMENT, SOFTWARE, PROCESS, OR DOCUMENTS CONTRACTOR FURNISHES DURING THE TERM OF THE CONTRACT INFRINGES ON A PATENT, COPYRIGHT, OR TRADEMARK, OR MISAPPROPRIATES A TRADE SECRET. CONTRACTOR SHALL PAY ALL COSTS (INCLUDING, WITHOUT LIMITATION, ATTORNEYS' FEES, COURT COSTS, AND ALL OTHER DEFENSE COSTS, AND INTEREST) AND DAMAGES AWARDED.

3.26.2 CONTRACTOR SHALL NOT SETTLE ANY CLAIM ON TERMS WHICH PREVENT THE CITY FROM USING THE EQUIPMENT, SOFTWARE, PROCESS, OR PRODUCT WITHOUT THE CITY ENGINEER’S PRIOR WRITTEN CONSENT.

3.26.3 UNLESS OTHERWISE SPECIFICALLY REQUIRED BY THE CONTRACT, WITHIN 60 DAYS AFTER BEING NOTIFIED OF THE CLAIM, CONTRACTOR SHALL, AT ITS OWN EXPENSE, EITHER:

3.26.3.1 OBTAIN FOR THE CITY THE RIGHT TO CONTINUE USING THE EQUIPMENT, SOFTWARE, PROCESS, OR PRODUCT, OR

3.26.3.2 IF BOTH PARTIES AGREE, REPLACE OR MODIFY THEM WITH COMPATIBLE AND FUNCTIONALLY EQUIVALENT PRODUCTS.

IF NONE OF THESE ALTERNATIVES IS REASONABLY AVAILABLE, THE CITY MAY RETURN THE EQUIPMENT, SOFTWARE, OR PRODUCT, OR DISCONTINUE THE PROCESS, AND CONTRACTOR SHALL REFUND THE PURCHASE PRICE.

3.27 INDEMNIFICATION PROCEDURES

3.27.1 Notice of Indemnification Claims: If the City or Contractor receives notice of any claim or circumstances which could give rise to an indemnified loss, the receiving party shall give written notice to the other Party within 10 days. The notice must include the following:

3.27.1.1 a description of the indemnification event in reasonable detail,

3.27.1.2 the basis on which indemnification may be due, and

3.27.1.3 the anticipated amount of the indemnified loss.

This notice does not estop or prevent the City from later asserting a different basis for indemnification or a different amount of indemnified loss than that indicated in the initial notice. If the City does not provide this notice within the 10-day period, it does not waive any right to indemnification except to the extent that Contractor is prejudiced, suffers loss, or incurs expense because of the delay.

3.27.2 Defense of Indemnification Claims: 3.27.2.1 Assumption of Defense: Contractor may assume the defense of the claim at its own expense with counsel chosen by it that is reasonably satisfactory to the City. Contractor shall then control the defense and any negotiations to settle the claim. Within 10 days after receiving written notice of the indemnification request, Contractor must advise the City as to whether or not it will defend the claim. If Contractor does not assume the defense, the City shall assume and
control the defense, and all defense expenses constitute an indemnified loss.

3.27.2.2 Continued Participation: If Contractor elects to defend the claim, the City may retain separate counsel to participate in, but not control, the defense and to participate in, but not control, any settlement negotiations. Contractor may settle the claim without the consent or agreement of the City, unless it:

3.27.2.2.1 would result in injunctive relief or other equitable remedies or otherwise require the City to comply with restrictions or limitations that adversely affect the City;

3.27.2.2.2 would require the City to pay amounts that Contractor does not fund in full; or

3.27.2.2.3 would not result in the City's full and complete release from all liability to the plaintiffs or claimants who are parties to or otherwise bound by the settlement.

3.28 CONTRACTOR DEBT

IF CONTRACTOR, AT ANY TIME DURING THE TERM OF THIS AGREEMENT, INCURS A DEBT, AS THE WORD IS DEFINED IN SECTION 15-122 OF THE HOUSTON CITY CODE OF ORDINANCES, IT SHALL IMMEDIATELY NOTIFY CITY CONTROLLER IN WRITING. IF CITY CONTROLLER BECOMES AWARE THAT CONTRACTOR HAS INCURRED A DEBT, IT SHALL IMMEDIATELY NOTIFY CONTRACTOR IN WRITING. IF CONTRACTOR DOES NOT PAY THE DEBT WITHIN 30 DAYS OF EITHER SUCH NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS IN AN AMOUNT EQUAL TO THE DEBT FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOUSE THEREFOR. CONTRACTOR SHALL FILE A NEW AFFIDAVIT OF OWNERSHIP, USING THE FORM DESIGNATED BY CITY, BETWEEN FEBRUARY 1 AND MARCH 1 OF EVERY YEAR DURING THE TERM OF THE CONTRACT.

ARTICLE 4 - ADMINISTRATION OF THE CONTRACT

4.1 CONTRACT ADMINISTRATION

4.1.1 City Engineer will provide administration of the Contract and City Engineer is authorized to issue Change Orders, Work Change Directives, and Minor Changes in the Work.

4.1.2 City Engineer may act through Project Manager, Design Consultant, or Inspector. When the term “City Engineer” is used in the Contract, action by City Engineer is required unless City Engineer delegates his authority in writing. The City Engineer may not delegate authority to render decisions under Section 4.4.

4.1.3 The City and Design Consultant may attend project meetings and visit the site to observe progress and quality of the Work. The City and Design Consultant are not required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work.

4.1.4 Project Manager will review and approve or take other appropriate action on Contractor's submittals, but only for limited purpose of checking for conformance with information given and design concept expressed in the Contract.

4.1.5 Project Manager's review of the submittals is not conducted for purpose of determining accuracy and completeness of other details, such as dimensions and quantities, or for substantiating instructions for installation or performance of Products, all of which remain the responsibility of Contractor.

4.1.6 Project Manager's review of submittals does not relieve Contractor of its obligations under Sections 3.3, 3.12, and 3.18. Review does not constitute approval of safety precautions or, unless otherwise specifically stated by Project Manager in writing, of construction means, methods, techniques, sequences, or procedures. Project Manager's review of a specific item does not indicate approval of an assembly of which the item is a component.

4.1.7 Based on field observations and evaluations, Project Manager will process Contractor's progress payments, certify amounts due
Contractor, and issue Certificates for Payment in the amount certified.

4.1.8 Project Manager will receive and forward to City Engineer for his review and records, written warranties and related documents required by the Contract and assembled by Contractor.

4.1.9 Upon written request by Contractor or Project Manager, City Engineer will resolve matters of interpretation of or performance of the Contract, which are not Claims. City Engineer’s decisions are final and binding on the Parties.

4.1.10 City Engineer may reject work which does not conform to the Contract.

4.1.11 When City Engineer considers it necessary to implement the intent of the Contract, City Engineer may require additional inspection or testing of work in accordance with Paragraphs 13.6.3 and 13.6.4, whether such work is fabricated, Installed, or completed.

4.2 COMMUNICATIONS IN ADMINISTRATION OF THE CONTRACT

4.2.1 Except as otherwise provided in the Contract or when authorized by City Engineer in writing, Contractor shall communicate with Project Manager. Contractor shall communicate with Design Consultant, Design Consultant’s subconsultants, and separate contractors through Project Manager. The City will communicate with Subcontractors and Suppliers through Contractor.

4.3 CLAIMS AND DISPUTES

4.3.1 Documentation by Project Manager: Contractor shall submit Claims, including those alleging an error or omission by Project Manager or Design Consultant, to Project Manager for documentation and recommendation to City Engineer.

4.3.2 Decision of City Engineer: Upon submission of Claim by Project Manager or Contractor, City Engineer will resolve Claims in accordance with Section 4.4.

4.3.3 Time Limits on Claims: Claims by Contractor must be made within 90 days after occurrence of event giving rise to the Claim.

4.3.4 Continuing the Contract Performance: Pending final resolution of a Claim including referral to non-binding mediation, unless otherwise agreed in writing, Contractor shall proceed diligently with the performance of the Contract and the City will continue to make payments in accordance with the Contract.

4.3.4.1 Pending final resolution of a Claim including referral to non-binding mediation, Contractor is responsible for safety and protection of physical properties and conditions at site.

4.3.5 Claims for Concealed or Unknown Conditions: Concealed or unknown physical conditions include utility lines, other man-made structures, storage facilities, Pollutants and Pollutant Facilities, and the like, but do not include conditions arising from Contractor operations, or failure of Contractor to properly protect and safeguard subsurface facilities. Concealed conditions also include naturally-occurring soil conditions outside the range of soil conditions identified through geotechnical investigations, but do not include conditions arising from groundwater, rain, or flood.

4.3.5.1 If conditions are encountered at the site which are Underground Facilities or otherwise concealed or unknown conditions which differ materially from:

4.3.5.1.1 those indicated by the Contract; or
4.3.5.1.2 conditions which Contractor could have discovered through site inspection, geotechnical testing, or otherwise;
then Contractor will give written notice to City Engineer no later than five days after Contractor's first observation of the condition and before condition is disturbed. Contractor's failure to provide notice constitutes a waiver of a Claim.

4.3.5.2 City Engineer will promptly investigate concealed or unknown conditions. If City Engineer determines that conditions at the site are not materially different and that no change in Contract Price or Contract Time is justified, City Engineer will notify Contractor in writing, stating reasons. If City Engineer determines the conditions differ materially and cause increase or decrease in Contractor's cost or time required for performance of part of the Work, City Engineer will recommend an adjustment in Contract Price or Contract Time, or both, as provided in Article 7. Opposition by a Party to the City Engineer’s determination must be made within 21 days after City Engineer has given notice of the decision. If the Parties cannot agree on adjustment to Contract Price or Contract Time, adjustment is
subject to further proceedings pursuant to Section 4.4.

4.3.6 Claims for Additional Cost: If Contractor wishes to make a Claim for increase in Contract Price, Contractor shall give written notice before proceeding with work for which Contractor intends to submit a Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

4.3.6.1 Contractor may file a Claim in accordance with Section 4.4 if Contractor believes it has incurred additional costs, for the following reasons:

- written interpretation of City Engineer;
- order by City Engineer to stop the Work when Contractor is not at fault;
- suspension of the Work by City Engineer;
- termination of the Contract by City Engineer; or
- The City's non-compliance with another provision of the Contract.

4.3.6.2 No increase in Contract Price is allowed for delays or hindrances to the Work, except for direct and unavoidable extra costs to Contractor caused by failure of the City to provide information and services, or to make land and materials available, when required of the City under the Contract. Any increase claimed is subject to the provisions of Section 4.4 and Article 7.

4.3.6.3 The City is not liable for Claims for delay when Date of Substantial Completion occurs prior to expiration of Contract Time.

4.3.7 Claims for Additional Time: If Contractor wishes to make a Claim for an increase in Contract Time, Contractor shall give written notice as provided in Section 8.2. In case of continuing delay, only one Claim is necessary.

4.4 RESOLUTION OF CLAIMS AND DISPUTES

4.4.1 City Engineer will review Claims and take one or more of the following preliminary actions within 30 days of receipt of Claim:

- submit a suggested time to meet and discuss the Claim with City Engineer;
- reject Claim, in whole or in part, stating reasons for rejection;
- recommend approval of the Claim by the other Party;
- suggest a compromise; or
- take other actions as City Engineer deems appropriate to resolve the Claim.

4.4.2 City Engineer may request additional supporting data from claimant. Party making Claim shall, within 10 days after receipt of City Engineer's request, submit additional supporting data requested by City Engineer.

4.4.3 At any time prior to rendering a written decision regarding a Claim, City Engineer may refer Claim to non-binding mediation. If Claim is resolved, City Engineer will prepare and obtain all appropriate documentation. If Claim is not resolved, City Engineer will take receipt of Claim and begin a new review under Section 4.4.

4.4.4 If Claim is not referred to or settled in non-binding mediation, City Engineer may conduct a hearing and will render a written decision, including findings of fact, within 75 days of receipt of Claim, or a time mutually agreed upon by the Parties in writing. City Engineer may notify Surety and request Surety's assistance in resolving Claim. City Engineer's decision is final and binding on the Parties.

4.5 CONDITION PRECEDENT TO SUIT; WAIVER OF ATTORNEY FEES AND INTEREST

4.5.1 A final decision by the City Engineer is a condition precedent to file suit in any jurisdiction for a claim made in connection with this Contract.

4.5.2 Neither the City nor Contractor may recover attorney fees for any claim brought in connection with this Contract.

4.5.3 Neither the City nor the Contractor may recover interest for any damages claim brought in connection with this Contract except as allowed by TEXAS LOCAL GOVERNMENT CODE Chapter 2251.

4.6 INTERIM PAYMENT WAIVER & RELEASE

4.6.1 In accordance with section 4.3, the Contractor shall use due diligence in the discovery and submission of any Claim against the City related to the Contractor's work.

4.6.2 The Contractor shall submit any Claim to the City not later than the 90th day after the occurrence of the event giving rise to the Claim.
4.6.3 Any failure to timely comply with the requirements of section 4.6.2 waives and releases any Claim when the Contractor submits an application for payment after the 90th day.

4.6.4 This waiver does not cover any retainage. In case of any conflict of law, this language shall be revised to the minimum extent necessary to avoid legal conflict. This waiver is made specifically for the benefit of the City.

ARTICLE 5 - SUBCONTRACTORS AND SUPPLIERS

5.1 AWARD OF SUBCONTRACTS
OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.1.1 Contractor may not contract with a Subcontractor, Supplier, person, or entity that City Engineer has made a reasonable and timely objection to.

5.1.2 If City Engineer has a reasonable objection to person or entity proposed by Contractor, Contractor shall propose another with whom City Engineer has no reasonable objection.

5.1.3 Contractor shall execute contracts with approved Subcontractors, Suppliers, persons, or entities before the Subcontractors or Suppliers begin work under the Contract. All such contracts must be executed and sent to the OBO Director and Contracting Department within 30 days after the date of the Notice to Proceed and must include provisions set forth in Articles 3 and 5 of this Document.

5.1.4 Contractor shall notify City Engineer in writing of any proposed change of Subcontractor, Supplier, person, or entity previously accepted by the City.

5.1.5 Contractor shall make timely payments to Subcontractors and Suppliers for performance of the Contract. Contractor shall protect, defend, and indemnify the City from any claim or liability arising out of Contractor's failure to make the payments. Disputes relating to payment of Business Enterprise Subcontractors or Suppliers will be submitted to arbitration in same manner as other disputes under Business Enterprise subcontracts. Failure of Contractor to comply with decisions of arbitrator may be determined by City Engineer a material breach leading to termination of the Contract.

5.2 CONTRACTOR RESPONSIBILITY FOR SUBCONTRACTORS

5.2.1 Contractor is responsible to the City, as may be required by laws and regulations, for all acts and omissions of Subcontractors, Suppliers, and other persons and organizations performing or furnishing any of the Work under direct or indirect contract with Contractor.

5.2.2 Contractor shall make available to each proposed Subcontractor, prior to execution of subcontract, copies of the Contract to which Subcontractor is bound by this Section 5.2. Contractor shall notify Subcontractor of any terms of proposed subcontract which may be at variance with the Contract.

5.2.3 The City's approval of Subcontractor or Suppliers does not relieve Contractor of its obligation to perform, or to have performed to the full satisfaction of the City, the Work required by the Contract.

5.2.4 Unless there is a contractual relationship between Contractor and a Subcontractor or Supplier to the contrary, Contractor shall withhold no more retainage from Subcontractors or Suppliers than City withholds from Contractor under this Agreement. However, once a Subcontractor or Supplier completes performance, Contractor shall release all retainage to that Subcontractor or Supplier regardless if City continues to retain under this Agreement.

5.2.5 Prior to a Subcontractor or Supplier commencing performance for Contractor, Contractor shall meet with that Subcontractor or Supplier to provide instructions on invoicing procedures, dispute resolution procedures, and statutory rights, such as claim filing procedures under the McGregor Act. Subcontractors and Suppliers must certify to the City Engineer that Contractor has fulfilled the requirements of this Section.

ARTICLE 6 - CONSTRUCTION BY THE CITY OR BY SEPARATE CONTRACTORS

6.1 THE CITY'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 The City may perform on-site construction operations related to the Work and as part of the Project with the City's workforce or with separate contractors.
6.2  COORDINATION

6.2.1 The City will coordinate activities of the City's workforce and of each separate contractor with work of Contractor, and Contractor shall cooperate with the City and separate contractors.

6.2.1.1 Contractor shall participate with other separate contractors and the City in reviewing their construction schedules when directed to do so by the Project Manager. Contractor shall make revisions to construction schedule and Contract Price deemed necessary after joint review and mutual agreement. Construction schedules shall then constitute schedules to be used by Contractor, separate contractors, and the City, until subsequently revised.

6.2.2 Contractor shall afford to the City and to separate contractors reasonable opportunity for introduction and storage of their materials and equipment, and for performance of their activities.

6.2.3 If part of Contractor's work depends on proper execution of construction or operations by the City or a separate contractor, Contractor shall, prior to proceeding with that portion of the Work, inspect the other work and promptly report to City Engineer apparent discrepancies or defects in the other construction that would render it unsuitable for the proper execution of the Work. Failure of Contractor to report apparent discrepancies or defects in the other construction shall constitute acknowledgment that the City's or separate contractor's completed or partially completed construction is fit and proper to receive Contractor's work, except as to discrepancies or defects not then reasonably discoverable.

6.3  MUTUAL RESPONSIBILITY

6.3.1 The responsible party bears the costs caused by delays, by improperly timed activities, or by nonconforming construction.

6.3.2 Contractor shall promptly remedy damage caused by Contractor to completed or partially completed construction or to property of the City or separate contractor.

6.3.3 Claims or disputes between Contractor and other City contractors, or subcontractors of other City contractors, working on the Project must be submitted to binding arbitration in accordance with Construction Industry Arbitration Rules of the American Arbitration Association upon demand by any party to the dispute or by the City.

6.4  THE CITY'S RIGHT TO CLEAN UP

6.4.1 If dispute arises among Contractor, separate contractors, and the City as to responsibility under their respective contracts for maintaining premises and surrounding area free from waste materials and rubbish as described in Section 3.21, the City may clean up and allocate cost among those responsible, as determined by City Engineer.

ARTICLE 7 - CHANGES IN THE WORK

7.1  CHANGES

7.1.1 Changes in scope of the Work, subject to limitations in Article 7 and elsewhere in the Contract, may be accomplished without invalidating the Contract, or without notifying Surety by:

7.1.1.1 Change Order;  
7.1.1.2 Work Change Directive; or  
7.1.1.3 Minor Change in the Work.

7.1.2 The following types of Change Orders require City Council approval:

7.1.2.1 a single Change Order that exceeds five percent of Original Contract Price,  
7.1.2.2 a Change Order which, when added to previous Change Orders, exceeds five percent of Original Contract Price,  
7.1.2.3 a Change Order, in which the total value of increases outside of the general scope of work approved by City Council, when added to increases outside the general scope of work approved by City Council in previous Change Orders, exceeds 40 percent of the Original Contract Price, even if the net increase to the Original Contract Price is five percent or less.

In this context, “increase” means an increase in quantity resulting from the addition of locations not within the scope of work approved by City Council, or the addition of types of goods or services not bid as unit price items.

Nothing in this Section is intended to permit an increase of the Contract Price in excess of the limit set out in TEX. LOC. GOV’T CODE ANN. §252.048 or its successor statute.

7.1.3 Contractor shall proceed promptly to execute changes in the Work provided in Modifications, unless otherwise stated in the Modification.
7.2 WORK CHANGE DIRECTIVES

7.2.1 A Work Change Directive cannot change Contract Price or Contract Time, but is evidence that the Parties agree that a change, ordered by directive, will be incorporated in a subsequently issued Change Order as to its effect, if any, on Contract Price or Contract Time.

7.2.2 Failure by Contractor to commence work identified in a Work Change Directive within the time specified by City Engineer, or to complete the work in a reasonable period of time, may be determined by City Engineer to be a material breach of Contract.

7.2.3 A Work Change Directive is used in the absence of total agreement of the terms of a Change Order. Interim payments are made in accordance with Paragraph 9.6.1.

7.2.4 If Contractor signs a Work Change Directive, then Contractor agrees to its terms including adjustment in Contract Price and Contract Time or method for determining them. Agreement by the Parties to adjustments in Contract Price and Contract Time are immediately recorded as a Change Order.

7.2.5 City Engineer, by Work Change Directive, may direct Contractor to take measures as necessary to expedite construction to achieve Date of Substantial Completion on or before expiration of Contract Time. When the Work is expedited solely for convenience of the City and not due to Contractor’s failure to prosecute timely completion of the Work, then Contractor is entitled to an adjustment in Contract Price equal to actual costs determined in accordance with Article 7.

7.3 ADJUSTMENTS IN CONTRACT PRICE

7.3.1 Adjustments in Contract Price are accomplished by Change Order and are based on one of the following methods:

- 7.3.1.1 mutual acceptance of fixed price, properly itemized and supported by sufficient data to permit evaluation;
- 7.3.1.2 unit prices stated in the Contract or subsequently agreed upon;
- 7.3.1.3 cost to be determined in a manner agreed upon by the Parties and mutually acceptable fixed or percentage fee; or
- 7.3.1.4 as provided in Paragraph 7.3.2.

7.3.2 If Contractor does not agree with a change in Contract Price or Contract Time or the method for adjusting them specified in the Work Change Directive within 21 days from date of the Work Change Directive’s issuance, method and adjustment are determined by City Engineer. If Project Manager or Contractor disagree with City Engineer’s determination they then may file a Claim in accordance with Section 4.4.

7.3.2.1 If City Engineer determines a method and adjustment in Contract Price under Paragraph 7.3.2, Contractor shall provide, in a form as City Engineer may prescribe, appropriate supporting data for items submitted under Paragraph 7.3.2. Failure to submit the data within 21 days of request for the data by City Engineer shall constitute waiver of a Claim.

7.3.2.2 Unless otherwise provided in the Contract, costs for the purposes of this Paragraph 7.3.2 are limited to the following:

- 7.3.2.2.1 costs of labor, including labor burden as stated below for social security, unemployment insurance, customary and usual fringe benefits required by agreement or custom, and Workers’ Compensation insurance;
- 7.3.2.2.2.1.1 the maximum labor burden applied to costs of labor for changes in the Work is 55 percent;
- 7.3.2.2.2 costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- 7.3.2.2.3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from Contractor or others, with prior approval of City Engineer;
- 7.3.2.2.4 costs of premiums for Bonds and insurance and permit fees related to the change in the Work;
- 7.3.2.2.5 additional costs of direct supervision of work and field office personnel directly attributable to the change; and
- 7.3.2.2.6 allowances for overhead and profit as stated below.
- 7.3.2.2.6.1 the maximum allowances for overhead and profit on increases due to Change Orders:
- 7.3.2.2.6.2 for changes in the Work performed by Contractor and Subcontractors, allowance for overhead and profit are
applied to an amount equal to cost of all additions less cost of all deletions to the Work. Allowance for overhead to Contractor and first tier Subcontractors on changes performed by Subcontractors are applied to an amount equal to the sum of all increases to the Work by

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<td>to Contractor for change in the Work performed by Subcontractors:</td>
<td>10 percent</td>
<td>0 percent</td>
</tr>
<tr>
<td>to first tier Subcontractors for change in the Work performed by its Subcontractors:</td>
<td>10 percent</td>
<td>0 percent</td>
</tr>
<tr>
<td>to Contractor and Subcontractor for change in the Work performed by their respective firms:</td>
<td>10 percent</td>
<td>5 percent</td>
</tr>
</tbody>
</table>

7.3.3 If the City deletes or makes a change, which results in a net decrease in Contract Price, the City is entitled to a credit calculated in accordance with Paragraphs 7.3.1 and 7.3.2 and Subparagraphs 7.3.2.1, and 7.3.2.2.1 through 7.3.2.2.5. When both additions and credits covering related work or substitutions are involved in a change, allowance for overhead and profit is figured on the basis of a net increase, if any, with respect to that change in accordance with Subparagraph 7.3.2.2.6.

7.3.4 When Contractor agrees with the determination made by City Engineer concerning adjustments in Contract Price and Contract Time, or the Parties otherwise reach agreement upon the adjustments, the agreement will be immediately recorded by Change Order.

7.4 **MINOR CHANGES IN THE WORK**

7.4.1 A Minor Change in Work is binding on the Parties. Contractor shall acknowledge, in a written form acceptable to City Engineer, that there is no change in Contract Time or Contract Price and shall carry out the written orders promptly.

### ARTICLE 8 - TIME

8.1 **PROGRESS AND COMPLETION**

8.1.1 Time is of the essence in the Contract. By executing the Contract, Contractor agrees that Contract Time is a reasonable period for performing the Work.

8.1.2 **Computation of Time:** In computing any period of time prescribed or allowed by the General Conditions, the day of the act, event, or default after which designated period of time begins to run is not to be included. Last day of the period so computed is to be included, unless it is a Sunday or Legal Holiday, in which event the period runs until end of next day which is not a Sunday or Legal Holiday. Sundays and Legal Holidays are considered to be days and are to be included in all other time computations relative to Contract Time.

8.1.3 Contractor may not commence the Work prior to the effective date of insurance and Bonds required by Article 11.

8.1.4 Contractor shall proceed expeditiously and without interruption, with adequate forces, and shall achieve Date of Substantial Completion within Contract Time.

8.1.5 Should progress of the Work fall behind construction schedule, except for reasons stated in Paragraph 8.2.1, Contractor shall promptly submit at the request of Project Manager, updated construction schedule to City Engineer for approval. Contractor's failure to submit updated schedule may, at City Engineer's discretion, constitute a material breach of the Contract. Contractor shall take action necessary to restore progress by working the hours, including night shifts and lawful overtime operations as necessary, to achieve Date of Substantial Completion within Contract Time.

8.1.6 Except in connection with safety or protection of persons or the Work or property at the site or adjacent to the site, and except as otherwise indicated in the Contract, all the Work at the site will be performed Monday through Saturday between the hours of 7:00 a.m. and 7:00 p.m. Contractor may not perform work between 7:00 p.m. and 7:00 a.m., on a Sunday, or on a Legal Holiday, without giving City Engineer 24-hour prior written notice and receiving written consent of City Engineer.

8.2 **DELAYS AND EXTENSIONS OF TIME**
8.2.1 Contractor may request extension of Contract Time for a delay in performance of work that arises from causes beyond control and without fault or negligence of Contractor. Examples of these causes are:

8.2.1.1 acts of God or of the public enemy;
8.2.1.2 acts of government in its sovereign capacity;
8.2.1.3 fires;
8.2.1.4 floods;
8.2.1.5 epidemics;
8.2.1.6 quarantine restrictions;
8.2.1.7 strikes;
8.2.1.8 freight embargoes;
8.2.1.9 unusually severe weather; and
8.2.1.10 discovery of Pollutants or Pollutant Facilities at the site.

8.2.2 For any reason other than those listed in Section 4.3.6.2, if the Contractor’s work is delayed in any manner or respect, the Contractor shall have no claim for damages and shall have no right of additional compensation from the City by reason of any delay or increased expense to the Contractor’s work, except for an extension of time as provided in this provision.

8.2.3 Contractor may request an extension of Contract Time for delay only if:

8.2.3.1 delay is caused by failure of Subcontractor or Supplier to perform or make progress; and
8.2.3.2 cause of failure is beyond control of both Contractor and Subcontractor or Supplier.

8.2.4 Claims relating to Contract Time must be made in accordance with Paragraph 4.3.7.

8.2.5 Claims for extending or shortening Contract Time are based on written notice promptly delivered by the Party making Claim to other Party. Claim must accurately describe occurrence generating Claim, and a statement of probable effect on progress of the Work.

8.2.6 Claims for extension of Contract Time are considered only when a Claim is filed within the time limits stated in Paragraph 4.3.3.

8.2.6.1 Notwithstanding paragraph 4.3.3, an extension of time for delays under this paragraph may be granted only upon written application by the Contractor within 48 hours from the claimed delay.

8.2.7 Written notice of Claim must be accompanied by claimant’s written statement that adjustment claimed is entire adjustment to which claimant is entitled as a result of the occurrence of the event. When the Parties cannot agree, Claims for adjustment in Contract Time are determined by City Engineer in accordance with Section 4.4.

8.2.8 Adjustments to Contract Time are accomplished by Change Order.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.1 UNIT PRICE WORK

9.1.1 Where the Contract provides that all or part of the Work is based on Unit Prices, the Original Contract Price includes, for all Unit Price work, an amount equal to the sum of Unit Prices times Unit Price Quantities for each separately identified item of Unit Price work.

9.1.2 Each Unit Price includes an amount to cover Contractor's overhead and profit for each separately identified item.

9.1.3 The Contractor may not make a Claim against the City for excess or deficiency in Unit Price Quantities provided in the Contract, except as provided in Subparagraph 9.1.4. Payment at the prices stated in the Contract is in full for the completed work. Contractor is not entitled to additional payment for materials, supplies, labor, tools, machinery and all other expenditures incidental to satisfactory completion of the Work.

9.1.4 City Engineer may increase or decrease quantities of the Work within limitations stated in Paragraph 7.1.2. Contractor is entitled to payment for actual quantities of items provided at Unit Prices set forth in the Contract.

9.1.5 Where the final quantity of work performed by Contractor on Major Unit Price Work item differs by more than 25 percent from quantity of the item stated in the Contract, a Party may request an adjustment in Unit Price, for the portion that differs by more than 25 percent, by a Change Order under Section 7.3.

9.2 ESTIMATES FOR PAYMENT, UNIT PRICE WORK

9.2.1 Following the day of each month indicated in the Contract, Project Manager will prepare a Certificate for Payment for the preceding monthly period based on estimated units of work completed. Prior to preparing Certificate of Payment, Contractor
shall have submitted to City Engineer, on a form approved by the Director of the Office of Business Opportunity, evidence satisfactory to the City Engineer of payments made to Subcontractors and Suppliers for the month preceding the month for which the Certificate for Payment is prepared, including evidence of electronic submission of certified payrolls.

9.2.2 Before final completion, City Engineer will review and confirm with Contractor the actual final installed Unit Price quantities. City Engineer’s determination of actual final installed Unit Price quantities will be included in the final Certificate for Payment and any previous underpayments and overpayments will be reconciled with the actual final Unit Price quantities. Contractor shall file written notice of intent to appeal, if any, City Engineer’s determination within 10 days of receipt of final Certificate for Payment. Upon expiration of the 10-day period, City Engineer’s decision is final and binding on the Parties. If Contractor submits notice within the 10-day period, Contractor shall submit a Claim in accordance with Section 4.4.

9.3 STIPULATED PRICE WORK

9.3.1 For work contracted on a Stipulated Price basis, 10 days before submittal of first Application for Payment, Contractor shall submit to City Engineer a Schedule of Values allocated to various portions of the Work, prepared in the form and supported by the data as City Engineer may require to substantiate its accuracy. This schedule, as approved by City Engineer, is used as a basis for approval of Contractor’s Applications for Payment.

9.4 APPLICATIONS FOR PAYMENT, STIPULATED PRICE WORK

9.4.1 For work contracted on a Stipulated Price basis, Contractor shall submit Applications for Payment to City Engineer each month on a form acceptable to City Engineer in accordance with Schedule of Values. Application must indicate percentages of completion of each portion of the Work listed in Schedule of Values as of the end of the period covered by the Application for Payment.

9.4.2 Applications for Payment must be supported by substantiating data as City Engineer may require and must reflect retainages as provided below. Evidence satisfactory to the City Engineer of payments made to Subcontractors and Suppliers for the month preceding the month for which the Application for Payment is submitted must accompany each Application for Payment on a form approved by the Director of the Office of Business Opportunity. Evidence of electronic submission of certified payrolls must be included. Application must be sworn and notarized.

9.5 CERTIFICATES FOR PAYMENT

9.5.1 City Engineer will, within 10 days after the date specified in the Contract for Unit Price work, or upon receipt of Contractor’s Application for Payment for Stipulated Price work, issue a Certificate for Payment for work based on amount which City Engineer determines is properly due, with copy to Contractor.

9.5.2 Unless otherwise provided in the Contract, payment for completed work and for properly stored Products is conditioned upon compliance with procedures satisfactory to City Engineer to protect the City's interests. Procedures will include applicable insurance, storage, and transportation to site for materials and equipment stored off-site. Contractor is responsible for maintaining materials and equipment until Date of Substantial Completion.

9.5.3 Contractor shall document its use of Ultra Low Sulfur Diesel Fuel by providing invoices and receipts evidencing Contractor’s use.

9.6 COMPUTATIONS OF CERTIFICATES FOR PAYMENT

9.6.1 Subject to the provisions of the Contract, the amount of each Certificate for Payment is calculated as follows:

9.6.1.1 that portion of Contract Price allocated to completed work as determined by:

9.6.1.1.1 multiplying the percentage of completion of each portion of the Work listed in the Schedule of Values by the value of that portion of the Work, or

9.6.1.1.2 multiplying Unit Price quantities Installed times the Unit Prices listed in the Contract;

9.6.1.2 plus progress payments for completed work that has been properly authorized by Modifications;

9.6.1.3 less retainage of five percent;

9.6.1.4 plus actual costs, properly substantiated by certified copies of invoices and freight bills, of non-perishable materials and equipment delivered and properly stored, if
approved in advance by Project Manager, less 15 percent;

9.6.1.5 less any previous payments by the City.

9.7 DECISIONS TO WITHHOLD CERTIFICATION

9.7.1 City Engineer may decline to certify payment and may withhold payment in whole or in part to the extent reasonably necessary to protect the City if, in City Engineer's opinion, there is reason to believe that:

9.7.1.1 nonconforming work has not been remedied;
9.7.1.2 the Work cannot be completed for unpaid balance of Contract Price;
9.7.1.3 there is damage to the City or another contractor;
9.7.1.4 the Work will not be completed within Contract Time and that unpaid balance will not be adequate to cover actual and liquidated damages;
9.7.1.5 probable evidence that third party claims will be filed in court, in arbitration, or otherwise;
9.7.1.6 Contractor has failed to make payments to Subcontractors or Suppliers for labor, material, or equipment; or
9.7.1.7 Contractor has persistently failed to carry out work in accordance with the Contract.
9.7.1.8 Contractor has not paid Subcontractors or Suppliers because of a payment dispute; or
9.7.1.9 Contractor has failed to provide satisfactory evidence described in Paragraphs 9.2.1, 9.4.2, and 9.8.2.

9.7.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

9.7.3 City Engineer may decline to certify payment and may withhold request for payment in whole or in part upon failure of Contractor to submit initial construction schedule or monthly schedule updates, as required in Paragraphs 3.15.1 and 3.15.3.

9.8 PROGRESS PAYMENTS

9.8.1 The City will make payment, in an amount certified by City Engineer, within 20 days after City Engineer has issued a Certificate for Payment.

9.8.2 The City has no obligation to pay or to facilitate the payment to a Subcontractor or Supplier, except as may otherwise be required by law. Contractor shall comply with the prompt payment requirements of Chapter 2251 of the Government Code. State law requires payment of Subcontractors and Suppliers by Contractor within 7 calendar days of Contractor’s receipt of payment from the City, unless there is a payment dispute between Contractor and a Subcontractor or Supplier evidenced on a form approved by the Director of Mayor’s Office of Business Opportunity and submitted to the City Engineer each month with Application for Payment or Estimate for Payment.

9.8.2.1 The City may, upon request and at the discretion of City Engineer, furnish to Subcontractor information regarding percentages of completion or the amounts applied for by Contractor, and action taken thereon by the City because of work done by the Subcontractor.

9.8.2.2 Contractor shall prepare and submit to City Engineer a Certification of Payment to Subcontractors and Suppliers form to be attached to each monthly Estimate for Payment or Application for Payment.

9.8.3 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Work by the City, does not constitute acceptance of work which is not in accordance with the Contract.

9.9 DATE OF SUBSTANTIAL COMPLETION

9.9.1 When Contractor considers the Work, or a portion thereof designated by City Engineer, to be substantially complete, Contractor shall prepare and submit to Project Manager a comprehensive punch list of items to be completed or corrected. Failure to include an item on the punch list does not alter the responsibility of Contractor to comply with the Contract.

9.9.1.1 By submitting the punch list to Project Manager, Contractor represents that work on the punch list will be completed within the time provided for in Subparagraph 9.9.4.3.

9.9.2 Upon receipt of Contractor's punch list, Project Manager will inspect the Work, or designated portion thereof, to verify that the punch list contains
all items needing completion or correction. If Project Manager’s inspection discloses items not on Contractor’s punch list, the items must be added to the punch list of items to be completed or corrected. If Project Manager’s inspection reveals that Contractor is not yet substantially complete, Contractor shall complete or correct the deficiencies and request another inspection by Project Manager. The City may recover the costs of re-inspection from Contractor.

9.9.3 Prior to City Engineer’s issuing a Certificate of Substantial Completion, Contractor shall also provide:

9.9.3.1 Certificate of Occupancy for new construction, or Certificate of Compliance for remodeled work, as applicable, and

9.9.3.2 compliance with Texas Accessibility Standards through state inspection of the Work, if required. If Contractor calls for inspection in a timely manner and the inspection is delayed through no fault of Contractor, and City Engineer so confirms, City Engineer may, upon request by Contractor, add the inspection to the punch list in Paragraph 9.9.2 and issue a Certificate of Substantial Completion.

9.9.4 When the Work, or designated portion thereof, is determined by City Engineer to be sufficiently complete in accordance with the Contract so the City can occupy or utilize the Work, or designated portion thereof, for the purpose for which it is intended, City Engineer will prepare a Certificate of Substantial Completion that incorporates the punch list in Paragraph 9.9.2 and establishes:

9.9.4.1 Date of Substantial Completion;

9.9.4.2 responsibilities of the Parties for security, maintenance, heating, ventilating and air conditioning, utilities, damage to the Work, and insurance; and

9.9.4.3 fixed time within which Contractor shall complete all items on punch list of items to be corrected accompanying the certificate.

9.9.5 Warranties required by the Contract shall commence on the Date of Substantial Completion unless otherwise provided by City Engineer in Certificate of Substantial Completion. Warranties may not commence on items not substantially completed.

9.9.6 After Date of Substantial Completion and upon application by Contractor and approval by City Engineer, the City may make payment, reflecting adjustment in retainage, if any, as follows:

9.9.6.1 with the consent of Surety, the City may increase payment to Contractor to 96 percent of Contract Price, less value of items to be completed and accrued liquidated damages.

9.9.7 Contractor shall complete or correct the items in Paragraph 9.9.2 within the time period set out in the Certificate of Substantial Completion. If Contractor fails to do so, the City may issue a Notice of Noncompliance and proceed according to Section 2.5.

9.10 PARTIAL OCCUPANCY OR USE

9.10.1 The City may occupy or use any completed or partially completed portion of the Work at any stage, provided the occupancy or use is consented to by Contractor and Contractor’s insurer and authorized by public authorities having jurisdiction over the Work. Consent of Contractor to partial occupancy or use may not be unreasonably withheld.

9.10.2 Immediately prior to the partial occupancy or use, Project Manager and Contractor shall jointly inspect the area to be occupied or portion of the Work to be used to determine and record condition of the Work.

9.10.3 Partial occupancy or use of a portion of the Work does not constitute acceptance of work not in compliance with requirements of the Contract.

9.11 FINAL COMPLETION AND FINAL PAYMENT

9.11.1 Contractor shall review the Contract and inspect the Work prior to Contractor notification to City Engineer that the Work is complete and ready for final inspection. Contractor shall submit affidavit that the Work has been inspected and that the Work is complete in accordance with requirements of the Contract.

9.11.2 Project Manager will make final inspection within 15 days after receipt of Contractor’s written notice that the Work is ready for final inspection and acceptance. If Project Manager finds the Work has been completed in accordance with the Contract, Contractor shall submit items set out in Paragraph 9.11.4 and, for stipulated price contracts, a final Application for Payment. City Engineer will,
within 10 days, issue Certificate of Final Completion stating that to the best of City Engineer’s knowledge, information, and belief, the Work has been completed in accordance with the Contract, and will recommend acceptance of the Work by City Council.

9.11.3 Should work be found not in compliance with requirements of the Contract, City Engineer will notify Contractor in writing of items of noncompliance. Upon inspection and acceptance of the corrections by Project Manager, compliance with all procedures of Paragraph 9.11.2, and Contractor’s submission of the items set out in Paragraph 9.11.4, the City Engineer will issue Certificate of Final Completion to Contractor as provided in Paragraph 9.11.2.

9.11.4 Contractor shall submit the following items to City Engineer before City Engineer will issue a Certificate of Final Completion:
   9.11.4.1 affidavit that payrolls, invoices for materials and equipment, and other indebtedness of Contractor connected with the Work, less amounts withheld by the City, have been paid or otherwise satisfied. If required by City Engineer, Contractor shall submit further proof including waiver or release of lien or claims from laborers or Suppliers of Products;
   9.11.4.2 certificate evidencing that insurance required by the Contract to remain in force after final payment is currently in effect, will not be canceled or materially changed until at least 30 days written notice has been given to the City;
   9.11.4.3 written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover correction and warranty period required by the Contract;
   9.11.4.4 consent of Surety to final payment; and
   9.11.4.5 copies of record documents, maintenance manuals, tests, inspections, and approvals.

Upon City Engineer’s issuance of a Certificate of Final Completion, Contractor may request increase in payment to 99 percent of Contract Price, less accrued liquidated damages.

9.11.5 If Contractor fails to submit required items in Paragraph 9.11.4 within 10 days of Project Manager's inspection of the Work under Paragraph 9.11.2 or Paragraph 9.11.3, City Engineer may, but is not obligated to:
   9.11.5.1 deduct liquidated damages accrued from monies held;
   9.11.5.2 proceed to City Council for acceptance of the Work, minus some or all of the items Contractor fails to submit under Paragraph 9.11.4; and,
   9.11.5.3 upon acceptance by City Council of the portion of the Work completed, make final payment as set out in Paragraph 9.11.8.

9.11.6 If final completion is materially delayed through no fault of Contractor, or by issuance of Change Orders affecting date of final completion, and City Engineer so confirms, the City may, upon application by Contractor and certification by City Engineer, and without terminating the Contract, make payment of balance due for that portion of the Work fully completed and accepted.

9.11.7 If remaining balance due for work not corrected is less than retainage stipulated in the Contract, Contractor shall submit to City Engineer written consent of Surety to payment of balance due for that portion of the Work fully completed and accepted, prior to certification of the payment. The payment is made under terms governing final payment, except that it does not constitute waiver of Claims.

9.11.8 The City will make final payment to Contractor within 30 days after acceptance of the Work by City Council, subject to limitations, if any, as stated in the Contract.

9.11.9 Acceptance of final payment by Contractor shall constitute a waiver of all Claims, whether known or unknown, by Contractor, except those previously made in writing and identified by Contractor as unsettled at the time of final payment.

9.12 LIQUIDATED DAMAGES

9.12.1 Contractor, Surety, and the City agree that failure to complete the Work within Contract Time will cause damages to the City and that actual damages from harm are difficult to estimate accurately. Therefore, Contractor, Surety, and the City agree that Contractor and Surety are liable for and shall pay to the City the amount stipulated in Supplementary Conditions as liquidated damages, and that the amount of damages fixed therein is a reasonable forecast of just compensation for harm to the City resulting from Contractor's failure to complete the Work within Contract Time. The amount stipulated will be paid for each day of delay beyond Contract Time until Date of Substantial Completion.
9.12.2 Contractor shall pay the City an amount equal to $1,200.00 per diesel operating vehicle or piece of motorized equipment per incident of high sulfur diesel fuel usage.

ARTICLE 10 - SAFETY PRECAUTIONS

10.1 SAFETY PROGRAMS

10.1.1 Contractor is responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with performance of the Contract. Contractor shall submit a safety program to City Engineer prior to mobilizing for the Work, and is solely responsible for safety, efficiency, and adequacy of ways, means, and methods, and for damage which might result from failure or improper construction, maintenance, or operation performed by Contractor.

10.2 POLLUTANTS AND POLLUTANT FACILITIES

10.2.1 If Contractor encounters material on-site which it reasonably believes to be a Pollutant or facilities which it reasonably believes to be a Pollutant Facility, Contractor shall immediately stop work in affected area and immediately notify City Engineer, confirming the notice thereafter in writing.

10.2.2 If City Engineer determines that the material is a Pollutant or a facility is a Pollutant Facility, work in affected area may not be resumed except by Modification, and only if the work would not violate applicable laws or regulations.

10.2.3 If City Engineer determines that the material is not a Pollutant or a facility is not a Pollutant Facility, work in affected area will be resumed upon issuance of a Modification.

10.3.1.1 employees performing work on-site, and other persons who may be affected thereby;

10.3.1.2 work, including Products to be incorporated into the Work, whether in proper storage, under control of Contractor or Subcontractor; and

10.3.1.3 other property at or adjacent to the site, such as trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal or replacement in course of construction.

10.2.4 Contractor is not required to perform, unless authorized by Change Order, work relating to Pollutants or Pollutant Facilities except for that work relating to Pollutants or Pollutant Facilities specified in the Contract.

10.3 SAFETY OF THE ENVIRONMENT, PERSONS, AND PROPERTY

10.3.1 Contractor shall take reasonable precautions for safety and shall provide reasonable protection to prevent damage, injury, or loss from all causes, to:

10.3.2 Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons, property, or environment.

10.3.2.1 Contractor shall comply with requirements of Underground Facility Damage Prevention and Safety Act TEX. UTIL. CODE ANN. Ch. 251 (Vernon Supp. 2002).

10.3.2.2 Contractor shall comply with all safety rules and regulations of the Federal Occupational Health and Safety Act of 1970 and subsequent amendments (OSHA).

10.3.3 Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection of persons and property, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying owners and users of adjacent sites and utilities.

10.3.4 Contractor shall designate responsible member of Contractor's organization at site whose duty is prevention of accidents. This person will be Contractor's Superintendent unless otherwise designated by Contractor in writing to City Engineer.

10.3.5 Contractor shall prevent windblown dust and may not burn or bury trash debris or waste products on-site. Contractor shall prevent environmental pollution, including but not limited to particulates, gases and noise, as a result of the Work.

10.3.6 When use or storage of hazardous materials or equipment, or unusual methods are necessary for execution of the Work, Contractor shall exercise utmost care and carry on the activities under supervision of properly qualified personnel.
10.3.7 Contractor shall promptly remedy damage and loss to property referred to in Subparagraphs 10.3.1.2 and 10.3.1.3, caused in whole or in part by Contractor, or Subcontractors, which is not covered by insurance required by the Contract. Contractor is not required to remedy damage or loss attributable to the City, Design Consultant, or other contractors.

10.4 EMERGENCIES

10.4.1 In emergencies affecting safety of persons or property, Contractor shall act at Contractor's discretion to prevent imminent damage, injury, or loss. Additional compensation or extension of time claimed by Contractor because of emergencies are determined as provided in Article 7.

ARTICLE 11 - INSURANCE AND BONDS

11.1 GENERAL INSURANCE REQUIREMENTS

11.1.1 With no intent to limit Contractor's liability under indemnification provisions set forth in Paragraphs 3.25 and 3.26, Contractor shall provide and maintain in full force and effect during term of the Contract and all extensions and amendments thereto, at least the following insurance and available limits of liability.

11.1.2 If any of the following insurance is written as "claims made" coverage and the City is required to be carried as additional insured, then Contractor's insurance shall include a two-year extended discovery period after last date that Contractor provides any work under the Contract.

11.1.3 Aggregate amounts of coverage, for purposes of the Contract, are agreed to be amounts of coverage available during fixed 12-month policy period.

11.2 INSURANCE TO BE PROVIDED BY CONTRACTOR

11.2.1 Risks and Limits of Liability: Contractor shall maintain the insurance coverages in the listed amounts, as set out in Table 1.

11.2.2 If Limit of Liability for Excess Coverage is $2,000,000 or more, Limit of Liability for Employer's Liability may be reduced to $500,000.

11.2.3 Insurance Coverage: At all times during the term of this Contract and any extensions or renewals, Contractor shall provide and maintain insurance coverage that meets the Contract requirements. Prior to beginning performance under the Contract, at any time upon the Director's request, or each time coverage is renewed or updated, Contractor shall furnish to the Director current certificates of insurance, endorsements, all policies, or other policy documents evidencing adequate coverage, as necessary. Contractor shall be responsible for and pay (a) all premiums and (b) any claims or losses to the extent of any deductible amounts. Contractor waives any claim it may have for premiums or deductibles against the City, its officers, agents, or employees. Contractor shall also require all subcontractors or consultants whose subcontracts exceed $100,000 to provide proof of insurance coverage meeting all requirements stated above except amount. The amount must be commensurate with the amount of the subcontract, but no less than $500,000 per claim.

11.2.4 Form of insurance: The form of the insurance shall be approved by the Director and the City Attorney; such approval (or lack thereof) shall never (a) excuse non-compliance with the terms of this Section, or (b) waive or estop the City from asserting its rights to terminate this Contract. The policy issuer shall (1) have a Certificate of Authority to transact insurance business in Texas, or (2) be an eligible non-admitted insurer in the State of Texas and have a Best's rating of at least B+, and a Best's Financial Size Category of Class VI or better, according to the most current Best's Key Rating Guide. Each insurer is subject to approval by City Engineer in City Engineer's sole discretion as to conformance with these requirements.

11.2.5 Required Coverage: The City shall be an Additional Insured under this Contract, and all policies except Professional Liability and Worker's Compensation must name the City as an Additional Insured. Contractor waives any claim or right of subrogation to recover against the City, its officers, agents, or employees, and each of Contractor's insurance policies except professional liability must contain coverage waiving such claim. Each policy, except Workers' Compensation and Professional Liability, must also contain an endorsement that the policy is primary to any other insurance available to the Additional Insured with respect to claims arising under this Contract. If professional liability coverage is written on a "claims made" basis, Contractor shall also provide proof of renewal each year for two years after substantial completion of the Project, or in the alternative: evidence of extended reporting period.
coverage for a period of two years after substantial completion, or a project liability policy for the Project covered by this Contract with a duration of two years after substantial completion.

11.2.6  **Deductibles:** Contractor assumes and bears any claims or losses to extent of deductible amounts and waives any claim it may ever have for same against the City, its officers, agents, or employees.

11.2.7  **Notice:** CONTRACTOR SHALL GIVE 30 DAYS’ ADVANCE WRITTEN NOTICE TO THE DIRECTOR IF ANY OF ITS INSURANCE POLICIES ARE CANCELED OR NON-RENEWED. Within the 30-day period, Contractor shall provide other suitable policies in order to maintain the required coverage. If Contractor does not comply with this requirement, the Director, at his or her sole discretion, may immediately suspend Contractor from any further performance under this Agreement and begin procedures to terminate for default.

11.2.8  **Subrogation:** Contractor waives any claim or right of subrogation to recover against the City, its officers, agents, or employees. Each policy, except professional liability, must contain an endorsement waiving such claim.

11.2.9  **Endorsement of Primary Insurance:** Each policy, except Workers’ Compensation policies, must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising hereunder.

11.2.10  **Liability for Premium:** Contractor is solely responsible for payment of all insurance premium requirements hereunder and the City is not obligated to pay any premiums.

11.2.11  **Additional Requirements for Workers’ Compensation Insurance Coverage:** Contractor shall, in addition to meeting the obligations set forth in Table 1, maintain throughout the term of the Contract Workers’ Compensation coverage as required by statute, and Contractor shall specifically comply with requirements set forth in Paragraph 11.2.10. The definitions set out below shall apply only for purposes of this Paragraph 11.2.10.

11.2.12  **Definitions:**

11.2.12.1  **Certificate of Coverage:** A copy of certificate of insurance, or coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory Workers’ Compensation insurance coverage for Contractor’s, Subcontractor’s, or Supplier’s employees providing services for the duration of the Contract.

11.2.12.2  **Duration of the Work:** Includes the time from Date of Commencement of the Work until Contractor’s work under the Contract has been completed and accepted by City Council.

11.2.12.3  **Persons providing services for the Work** (Subcontractor in Texas Labor Code § 406.096): includes all persons or entities performing all or part of services Contractor has undertaken to perform on the Work, regardless of whether that person contracted directly with Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of the entity, or employees of entity which furnishes persons to provide services on the Work. Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to the Work. Services do not include activities unrelated to the Work, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

11.2.13  Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of coverage agreements, which meets the statutory requirements of TEX. LAB. CODE ANN., Section 401.011(44) for employees of Contractor providing services on the Work, for duration of the Work.

11.2.14  Contractor shall provide a Certificate of Coverage to the City prior to being awarded the Contract.

11.2.15  If coverage period shown on Contractor’s original Certificate of Coverage ends during duration of the Work, Contractor shall file new Certificate of Coverage with the City showing that coverage has been extended.
11.2.16 Contractor shall obtain from each person providing services on the Work, and provide to City Engineer:

11.2.16.1 Certificate of Coverage, prior to that person beginning work on the Work, so the City will have on file Certificates of Coverage showing coverage for all persons providing services on the Work; and

11.2.16.2 no later than seven days after receipt by Contractor, new Certificate of Coverage showing extension of coverage, if coverage period shown on current Certificate of Coverage ends during the duration of the Work.

11.2.17 Contractor shall retain all required Certificates of Coverage for the duration of the Work and for one year thereafter.

11.2.18 Contractor shall notify City Engineer in writing by certified mail or personal delivery, within 10 days after Contractor knew or should have known, of any change that materially affects provision of coverage of any person providing services on the Work.

11.2.19 Contractor shall post on-site a notice, in text, form and manner prescribed by Texas Workers' Compensation Commission, informing all persons providing services on the Work that they are required to be covered, and stating how person may verify coverage and report lack of coverage.

11.2.20 Contractor shall contractually require each person with whom it contracts to provide services on the Work to:

11.2.20.1 provide coverage, based on proper reporting of classification codes, payroll amounts and filing of any coverage agreements, which meets statutory requirements of Tex. Lab. Code Ann., Section 401.011(44) for all its employees providing services on the Work, for the duration of the Work;

11.2.20.2 provide to Contractor, prior to that person's beginning work on the Work, a Certificate of Coverage showing that coverage is being provided for all employees of the person providing services on the Work, for the duration of the Work;

11.2.20.3 provide 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 Work;

11.2.20.4 obtain from each other person with whom it contracts, and provide to Contractor: (1) Certificate of Coverage, prior to other person's beginning work on the Work; and (2) new Certificate of Coverage showing extension of coverage, prior to end of coverage period, if coverage period shown on the current Certificate of Coverage ends during duration of the Work.

11.2.20.5 retain all required Certificates of Coverage on file for the duration of the Work and for one year thereafter;

11.2.20.6 notify City Engineer in writing by certified mail or personal delivery within 10 days after person knew, or should have known, of change that materially affects provision of coverage of any person providing services on the Work; and

11.2.20.7 contractually require each person with whom it contracts to perform as required by Paragraphs 11.2.10.1 through 11.2.10.7, with Certificates of Coverage to be provided to person for whom they are providing services.

11.2.21 By signing the Contract or providing or causing to be provided a Certificate of Coverage, Contractor is representing to the City that all employees of Contractor who will provide services on the Work will be covered by Workers' Compensation coverage for the duration of the Work, that coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with appropriate insurance carrier. Contractor is not allowed to self-insure Workers' Compensation. Contractor may be subject to administrative penalties, criminal penalties, civil penalties, or other civil actions for providing false or misleading information.

11.2.22 Contractor's failure to comply with Paragraph 11.2.10 is a breach of the Contract by Contractor, which entitles the City to declare the Contract void if Contractor does not remedy breach within 10 days after receipt of notice of breach from City Engineer.
11.2.23 Subcontractor Insurance Requirements: Contractor shall require Subcontractors and Suppliers to obtain Commercial General Liability, Workers’ Compensation, Employer’s Liability and Automobile Liability coverage that meets all the requirements of Paragraph 11.2. The amount must be commensurate with the amount of the subcontract, but not less than $500,000 per occurrence. Contractor shall require all Subcontractors with whom it contracts directly, whose subcontracts exceed $100,000, to provide proof of Commercial General Liability and Automobile Liability insurance coverage meeting the above requirements. Contractor shall comply with all requirements set out under Paragraph 11.2.10 as to Workers’ Compensation Insurance for all Subcontractors and Suppliers.

### TABLE 1

<table>
<thead>
<tr>
<th>REQUIRED COVERAGE</th>
<th>(Coverage)</th>
<th>(Limit of Liability)</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 Workers’ Compensation</td>
<td></td>
<td>Statutory Limits for Workers’ Compensation</td>
</tr>
<tr>
<td>.2 Employer’s Liability</td>
<td></td>
<td>Bodily Injury by Accident $500,000 (each accident)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bodily Injury by Disease $500,000 (policy limit)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bodily Injury by Disease $500,000 (each employee)</td>
</tr>
<tr>
<td>.3 Commercial General Liability: Including Contractor’s Protective, Broad Form Property Damage, Contractual Liability, Explosion, Underground and Collapse, Bodily Injury, Personal Injury, Products, and Completed Operations (for a period of one year following completion of the Work).</td>
<td></td>
<td>Combined single limit of $1,000,000 (each occurrence), subject to general aggregate of $1,000,000;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Products and Completed Operations $2,000,000 aggregate.</td>
</tr>
<tr>
<td>.4 Owner’s and Contractor’s Protective Liability</td>
<td></td>
<td>$1,000,000 combined single limit each Occurrence/aggregate</td>
</tr>
<tr>
<td>.5 Installation Floater (Unless alternative coverage approved by City Attorney)</td>
<td></td>
<td>Value of stored material or equipment, listed on Certificates of Payments, but not yet incorporated into the Work</td>
</tr>
<tr>
<td>.6 Automobile Liability Insurance: (For automobiles furnished by Contractor in course of his performance under the Contract, including Owned, Non-owned, and Hired Auto coverage)</td>
<td></td>
<td>$1,000,000 combined single limit each occurrence for (1) Any Auto or (2) All Owned, Hired, and Non-Owned Autos</td>
</tr>
<tr>
<td>.7 Excess Coverage</td>
<td></td>
<td>$1,000,000 each occurrence/combined aggregate in excess of limits specified for Employer’s Liability, Commercial General Liability, and Automobile Liability</td>
</tr>
</tbody>
</table>

Aggregate Limits are per 12-month policy period unless otherwise indicated.

11.3 PROOF OF INSURANCE

11.3.1 Prior to commencing services and at time during the term of the Contract, Contractor shall furnish City Engineer with Certificates of Insurance, along with Affidavit from Contractor confirming that Certificate accurately reflects insurance coverage that is available during term of the Contract. If requested in writing by City Engineer, Contractor shall furnish City Engineer with certified copies of Contractor’s actual insurance policies. Failure of Contractor to provide certified copies, as requested, may be deemed, at City Engineer’s or City Attorney’s discretion, a material breach of the Contract.

11.3.2 Notwithstanding the proof of insurance requirements, Contractor shall continuously maintain in effect required insurance coverage set forth in Paragraph 11.2. Failure of Contractor to comply with
this requirement does constitute a material breach by Contractor allowing the City, at its option, to immediately suspend or terminate work, or exercise any other remedy allowed under the Contract. Contractor agrees that the City has not waived or is not estopped to assert a material breach of the Contract because of any acts or omissions by the City regarding its review or non-review of insurance documents provided by Contractor, its agents, employees, or assigns.

11.3.3 Contractor shall provide updated certificates of insurance to the Director upon request. The Contractor shall be responsible for delivering a current certificate of insurance in the proper form to the Director as long as Contractor is required to furnish insurance coverage under Paragraph 11.2.

11.3.4 Every certificate of insurance Contractor delivers in connection with this Contract shall

11.3.4.1 be less than 12 months old;
11.3.4.2 include all pertinent identification information for the Insurer, including the company name and address, policy number, NAIC number or AMB number, and authorized signature;
11.3.4.3 include in the Certificate Holder Box the Project name and reference numbers, contractor’s email address, and indicates the name and address of the Project Manager;
11.3.4.4 include the Contractor’s email address in the Certificate Holder Box;
11.3.4.5 include the Project reference numbers on the City address so the Project reference number is visible in the envelope window; and
11.3.4.6 be appropriately marked to accurately identify all coverages and limits of the policy, effective and expiration dates, and waivers of subrogation in favor of the City for Commercial General Liability, Automobile Liability, and Worker’s Compensation/Employers’ Liability.

11.4 PERFORMANCE AND PAYMENT BONDS

11.4.1 For Contracts over the value of $25,000, Contractor shall provide Bonds on the City’s standard forms covering faithful performance of the Contract and payment of obligations arising thereunder as required in the Contract pursuant to Chapter 2253 of the Government Code. The Bonds must be for 100 percent of Original Contract Price and in accordance with conditions stated on standard City Performance and Payment Bond and Statutory Payment Bond forms. Bonds may be obtained from Contractor's usual source and cost for the Bonds are included in Contract Price.

11.5 MAINTENANCE BONDS

11.5.1 One-year Maintenance Bond: Contractor shall provide Bond on standard City One-year Maintenance Bond form, providing for Contractor's correction, replacement, or restoration of any portion of the Work which is found to be not in compliance with requirements of the Contract during one-year correction period required in Paragraph 12.2. The Maintenance Bond must be for 100 percent of the Original Contract Price.

11.6 SURETY

11.6.1 A Bond that is given or tendered to the City pursuant to the Contract must be executed by a surety company that is authorized and admitted to write surety Bonds in the State of Texas.

11.6.2 If a Bond is given or tendered to the City pursuant to the Contract in an amount greater than 10 percent of Surety's capital and surplus, Surety shall provide certification that Surety has reinsured that portion of the risk that exceeds 10 percent of Surety’s capital and surplus. The reinsurance must be with one or more reinsurers who are duly authorized, accredited, or trusted to do business in the State of Texas. The amount reinsured by reinsurer may not exceed 10 percent of reinsurer's capital and surplus. The amount of allowed capital and surplus must be based on information received from State Board of Insurance.

11.6.3 If the amount of a Bond is greater than $100,000, Surety shall:

11.6.3.1 also hold certificate of authority from the United States Secretary of Treasury to qualify as surety on obligations permitted or required under federal law; or,
11.6.3.2 Surety may obtain reinsurance for any liability in excess of $100,000 from reinsurer that is authorized and admitted as a reinsurer in the State of Texas and is the holder of a certificate of authority from the United States Secretary of the Treasury to qualify as surety or reinsurer on obligations permitted or required under federal law.
11.6.4 Determination of whether Surety on the Bond or the reinsurer holds a certificate of authority from the United States Secretary of the Treasury is based on information published in Federal Register covering the date on which Bond was executed.

11.6.5 Each Bond given or tendered to the City pursuant to the Contract must be on City forms with no changes made by Contractor or Surety, and must be dated, executed, and accompanied by power of attorney stating that the attorney in fact executing such the bond has requisite authority to execute such Bond. The Bonds must be dated and must be no more than 30 days old.

11.6.6 Surety shall designate in its Bond, power of attorney, or written notice to the City, an agent resident in Harris County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of the suretyship.

11.6.7 Contractor shall furnish information to a payment bond beneficiary as required by TEX. GOV’T CODE ANN. CH. 2253.

11.7 DELIVERY OF BONDS

11.7.1 Contractor shall deliver required Bonds to the City within time limits stated in Notice of Intent to Award and prior to Date of Commencement of the Work.

ARTICLE 12 - UNCOVERING AND CORRECTION OF THE WORK

12.1 UNCOVERING OF THE WORK

12.1.1 If a portion of the Work has been covered which City Engineer has not specifically requested to observe prior to its being covered, City Engineer may request to see such work and it must be uncovered by Contractor. If such work is in accordance with the Contract, the costs of uncovering and covering such work are charged to the City by Change Order. If such work is not in accordance with the Contract, Contractor shall pay for uncovering and shall correct the nonconforming Work promptly after receipt of Notice of Noncompliance to do so.

12.2 CORRECTION OF THE WORK

12.2.1 Contractor shall promptly correct or remove work rejected by City Engineer or work failing to conform to requirements of the Contract, whether observed before or after Date of Substantial Completion and whether fabricated, Installed, or completed.

12.2.2 Contractor bears costs of correcting the rejected or nonconforming work including additional testing and inspections, and compensation for Design Consultant’s services and expenses made necessary thereby.

12.2.3 If within one year after Date of Substantial Completion, or after date for commencement of warranties established under Paragraph 9.9.5 or by other applicable special warranty required by the Contract, whichever is later in time, any of the Work is found not to be in accordance with the requirements of the Contract, Contractor shall correct such work promptly after receipt of Notice of Noncompliance to do so.

12.2.4 One-year correction period for portions of the Work completed after Date of Substantial Completion will begin on the date of acceptance of that portion of the Work. This obligation under this Paragraph survives acceptance of the Work under the Contract and termination of the Contract.

12.2.5 The one-year correction period does not establish a duration for the Contractor’s general warranty under Paragraph 3.12. The City retains the right to recover damages from the Contractor as long as may be permitted by the applicable statute of limitations.

12.2.6 If Contractor does not proceed with correction of the nonconforming work within time fixed by Notice of Noncompliance, the City may correct nonconforming work or remove nonconforming work and store salvageable Products at Contractor’s expense. Contractor shall pay the costs of correction of nonconforming work and removal and storage of salvageable Products to the City. If Contractor does not pay costs of the correction or removal and storage within 10 days after written notice, the City may sell the Products at auction or at private sale. The City will account for proceeds thereof after deducting costs and damages that would have been borne by Contractor, including compensation for services of Design Consultant and necessary expenses. If the proceeds of sale do not cover costs which Contractor should have borne, Contractor shall pay the value of the deficiency to the City.

12.2.7 Contractor bears cost of correcting work originally installed by Contractor, the City, or by separate contractors and damaged by Contractor’s correction or removal of Contractor’s work.
12.3 **ACCEPTANCE OF NONCONFORMING WORK**

12.3.1 If City Engineer prefers to accept work which is not in accordance with requirements of the Contract, City Engineer may do so only by issuance of Change Order, instead of requiring its removal and correction. City Engineer will determine Contract Price reduction. The reduction will become effective even if final payment has been made.

**ARTICLE 13 - MISCELLANEOUS PROVISIONS**

13.1 **GOVERNING LAWS**

13.1.1 The Contract is subject to the laws of the State of Texas, the City Charter and Ordinances, the laws of the federal government of the United States, and all rules and regulations of any regulatory body or officer having jurisdiction.

13.1.2 Venue for any litigation relating to the Contract is Harris County, Texas.

13.2 **SUCCESSORS**

13.2.1 The Contract binds and benefits the Parties and their legal successors and permitted assigns; however, this Paragraph 13.2.1 does not alter the restrictions on assignment and disposal of assets set out in Paragraph 13.3.1. The Contract does not create any personal liability on the part of any officer or agent of the City.

13.3 **BUSINESS STRUCTURE AND ASSIGNMENTS**

13.3.1 Contractor may not assign the Contract at law or otherwise, or dispose of all or substantially all of its assets without City Engineer's prior written consent. Nothing in this Section, however, prevents the assignment of accounts receivable or the creation of a security interest as described in §9.406 of the Texas Business & Commerce Code. In the case of such an assignment, Contractor shall immediately furnish the City with proof of the assignment and the name, telephone number, and address of the assignee and a clear identification of the fees to be paid to the assignee.

13.3.2 Any series, as defined by the TEX. ORG. CODE ANN., affiliate, subsidiary, or successor to which Contractor assigns or transfers assets shall join in privity and be jointly and severally liable under this Contract.

13.4 **WRITTEN NOTICE**

13.4.1 All notices required or permitted by the Contract must be in writing and must be effected by hand delivery; registered or certified mail, return receipt requested; or facsimile with confirmation copy mailed to receiving Party. Notice is sufficient if made or addressed with proper postage to the address stated in the Agreement for each Party ("Notice Address") or faxed to the facsimile number stated in the Agreement for each Party. The notice is deemed delivered on the earlier of:

- 13.4.1.1 the date the Notice is actually received;
- 13.4.1.2 the third day following deposit in a United States Postal Service post office or receptacle; or
- 13.4.1.3 the date the facsimile is sent unless the facsimile is sent after 5:00 p.m. local time of the recipient and then it is deemed received on the following day.

Any Party may change its Notice Address or facsimile number at any time by giving written notice of the change to the other Party in the manner provided for in this Paragraph at least 15 days prior to the date the change is affected.

13.5 **RIGHTS AND REMEDIES**

13.5.1 Duties and obligations imposed by the Contract and rights and remedies available thereunder are in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

13.5.2 No act or failure to act by the City or Contractor is a waiver of rights or duties afforded them under the Contract, nor is the act or failure to act constitute approval of or acquiescence in a breach of the Contract. No waiver, approval or acquiescence is binding unless in writing and, in the case of the City, signed by City Engineer.

13.6 **TESTS AND INSPECTIONS**

13.6.1 Contractor shall give City Engineer, Construction Manager, and Design Consultant timely notice of the time and place where tests and inspections are to be made. Contractor shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.6.2 The City will employ and pay for services of an independent testing laboratory to perform inspections or acceptance tests required by the Contract except:

- 13.6.2.1 inspections or tests covered by Paragraph 13.6.3;
13.6.2.2 those otherwise specifically provided in the Contract; or
13.6.2.3 costs incurred in connection with tests or inspections conducted pursuant to Paragraph 12.2.2.

13.6.3 Contractor is responsible for and shall pay all costs in connection with inspection or testing required in connection with City Engineer’s acceptance of a Product to be incorporated into the Work, or of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation into the Work.

13.6.4 Neither observations by the City, Construction Manager, or Design Consultant, nor inspections, tests, or approvals by others, relieves Contractor from Contractor's obligations to perform the Work in accordance with the Contract.

13.7 INTEREST

13.7.1 No interest will accrue on late payments by the City except as provided under Chapter 2251 of the Government Code.

13.8 PARTIES IN INTEREST

13.8.1 The Contract does not bestow any rights upon any third party, but binds and benefits the Parties only.

13.9 ENTIRE CONTRACT

13.9.1 The Contract merges the prior negotiations and understandings of the Parties and embodies the entire agreement of the Parties. No other agreements, assurances, conditions, covenants, express or implied, or other terms of any kind, exist between the Parties regarding the Contract.

13.10 WRITTEN AMENDMENT

13.10.1 Changes to the Contract that cannot be effected by Modifications, must be made by written amendment, which will not be effective until approved by City Council.

13.11 COMPLIANCE WITH LAWS

13.11.1 Contractor shall comply with the Americans with Disabilities Act of 1990 as amended (ADA) and Texas Architectural Barriers Act and all regulations relating to either statute.

13.11.2 Contractor shall comply with all applicable federal, state, and city laws, rules and regulations.

13.12 SEVERABILITY

13.12.1 If any part of the Contract is for any reason found to be unenforceable, all other parts remain enforceable to the extent permitted by law.

13.13 ANTI-BOYCOTT OF ISRAEL

13.13.1 Contractor certifies that Contractor is not currently engaged in, and agrees for the duration of this Agreement not to engage in, the boycott of Israel as defined by Section 808.001 of the Texas Government Code.

13.14 ZERO TOLERANCE POLICY FOR HUMAN TRAFFICKING & RELATED ACTIVITIES

13.14.1 The requirements and terms of the City of Houston’s Zero Tolerance Policy for Human Trafficking and Related Activities, as set forth in Executive Order 1-56, as revised from time to time, are incorporated into this Agreement for all purposes. Contractor has reviewed Executive Order 1-56, as revised, and shall comply with its terms and conditions as they are set out at the time of this Agreement’s effective date. Contractor shall notify the City’s Chief Procurement Officer, City Attorney, and the Director of any information regarding possible violation by the Contractor or its subcontractors providing services or goods under this Agreement.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CITY FOR CAUSE

14.1.1 Each of the following acts or omissions of Contractor or occurrences shall constitute an "Event of Default" under the Contract:

14.1.1.1 Contractor refuses or fails to supply enough properly skilled workers or proper Products;

14.1.1.2 Contractor disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;

14.1.1.3 Contractor is guilty of material breach of any duty or obligation of Contractor under the Contract, including, but not
14.1.1.4 Contractor has had any other contract with the City terminated for cause at any time subsequent to the effective date of the Contract as set out in the Agreement; or

14.1.1.5 Contractor fails to utilize Ultra Low Sulfur Diesel Fuel, as required in Paragraph 3.9.1.1.

14.1.2 If an Event of Default occurs, City Engineer may, at his option and without prejudice to any other rights or remedies which the City may have, deliver a written notice to Contractor and Surety describing the Event of Default and giving the Contractor 10 days to cure the Event of Default. If after the cure period, Contractor has failed or refused to cure the Event of Default, then City Engineer may deliver a second written notice to Contractor giving notice of the termination of the Contract or of the termination of Contractor's performance under the Contract ("Notice of Termination"). If City Engineer issues a Notice of Termination, then City Engineer may, subject to any prior rights of Surety and any other rights of the City under the Contract or at law:

14.1.2.1 request that Surety complete the Work; or
14.1.2.2 take possession of the site and all materials, equipment, tools, and construction equipment and machinery on the site owned by Contractor; and
14.1.2.3 finish the Work by whatever reasonable method City Engineer may deem expedient.

14.1.3 After Contractor's receipt of a Notice of Termination, and except as otherwise directed in writing by City Engineer, Contractor shall:

14.1.3.1 stop the Work on the date and to the extent specified in the Notice of Termination;
14.1.3.2 place no further orders or subcontracts for Products or services;
14.1.3.3 terminate all orders and subcontracts to the extent that they relate to performance of work terminated;
14.1.3.4 assign to the City, in the manner, at the times, and to the extent directed by City Engineer, all rights, title, and interest of Contractor, under the terminated supply orders and subcontracts with approval of City Engineer;
14.1.3.5 supply orders and subcontracts with approval of City Engineer;
take action as may be necessary, or as City Engineer may direct, for protection and preservation of property related to the Work that is in possession of Contractor, and in which the City has or may acquire an interest; and
secure the Work in a safe state before leaving the site, providing any necessary safety measures, shoring, or other devices.

14.1.4 If the City terminates the Contract or terminates Contractor's performance under the Contract for any one or more of the reasons stated in Paragraph 14.1.1, Contractor may not receive any further payment until the Work is complete, subject to Paragraph 14.1.5.

14.1.5 If the unpaid balance of Contract Price exceeds the costs of finishing the Work, including liquidated damages and other amounts due under the Contract, the balance will be paid to Contractor. If the costs of finishing the Work exceed the unpaid balance, Contractor shall, within 10 days of receipt of written notice setting out the amount of the excess costs, pay the difference to the City. The amount to be paid to Contractor or the City will be certified by City Engineer in writing, and this obligation for payment shall survive termination of the Contract or termination of Contractor's performance under the Contract. Termination of the Contractor for cause shall not relieve the Surety from its obligation to complete the project.

14.2 TERMINATION BY THE CITY FOR CONVENIENCE

14.2.1 City Engineer may, without cause and without prejudice to other rights or remedies of the City, give Contractor and Surety a Notice of Termination with a seven days written notice.

14.2.2 After receipt of the Notice of Termination, and except as otherwise approved by City Engineer, Contractor shall conform to requirements of Paragraph 14.1.3.

14.2.3 After receipt of the Notice of Termination, Contractor shall submit to the City its termination Claim, in forms required by City Engineer. The Claim will be submitted to the City promptly, but no later than six months from the effective date of termination, unless one or more extensions are granted by City Engineer in writing. If Contractor fails to submit its termination Claim within the time allowed, in accordance with Paragraph 14.2.4, City
Engineer will determine, on the basis of available information, the amount, if any, due to Contractor because of termination, and City Engineer's determination is final and binding on the Parties. The City will then pay to Contractor the amount so determined.

14.2.4 City Engineer will determine, on the basis of information available to City Engineer, the amount due, if any, to Contractor for the termination as follows:

14.2.4.1 Contract Price for all work performed in accordance with the Contract up to the date of termination determined in the manner prescribed for monthly payments in Article 9, except no retainage is withheld by the City either for payment determined by percentage of completion or for materials and equipment delivered to the site, in storage or in transit.

14.2.4.2 Reasonable termination expenses, including costs for settling and paying Subcontractor and Supplier claims arising out of termination of the Work, reasonable cost of preservation and protection of the City's property after termination, if required, and the cost of Claim preparation. Termination expenses do not include field or central office overhead, salaries of employees of Contractor, or litigation costs, including attorneys' fees.

No amount is allowed for anticipated profit or central office overhead on uncompleted work, or any cost or lost profit for other business of Contractor alleged to be damaged by the termination.

14.2.5 Contractor shall promptly remove from the site any construction equipment, tools, and temporary facilities, except the temporary facilities which City Engineer may wish to purchase and retain.

14.2.6 Contractor shall cooperate with City Engineer during the transition period.

14.2.7 The City will take possession of the Work and materials delivered to the site, in storage, or in transit, as of date or dates specified in the Notice of Termination, and is responsible for maintenance, utilities, security, and insurance, as stated in Notice of Termination.

14.3.1 City Engineer may, without cause, after giving Contractor and Surety 24-hour prior written notice, order Contractor to suspend, delay, or interrupt the Work in whole or in part for a period of time as City Engineer may determine.

14.3.2 An adjustment will be made in Contract Time equivalent to the time of suspension.

14.3.3 Adjustment will be made to Contract Price for increases in the cost of performance of the Work, including profit on increased cost of performance caused by suspension, delay, or interruption of the Work in accordance with Paragraph 7.3. No adjustment will be made to the extent that:

14.3.3.1 performance was, or would have been, suspended, delayed, or interrupted by another cause for which Contractor is responsible; or

14.3.3.2 adjustment is made or denied under another provision of the Contract.

14.4 TERMINATION BY CONTRACTOR

14.4.1 Contractor may terminate the Contract if the Work is stopped for a period of 30 days through no act or fault of Contractor, directly related to one of these events:

14.4.1.1 issuance of an order of a court or other public authority having jurisdiction;

14.4.1.2 act of government, such as a declaration of national emergency which makes material unavailable; or

14.4.1.3 if repeated suspensions, delays, or interruptions by the City as described in Paragraph 14.3 constitute, in the aggregate, more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less;

No termination will be effective for the above reasons if Contractor delivers written notice to City Engineer describing the reason for termination, giving the proposed termination date, and granting the City a reasonable opportunity to respond and cure any City default before termination is effective.

14.4.2 If the Contract is terminated pursuant to this Paragraph 14.4, Contractor shall comply with the requirements of Paragraphs 14.2.2 through 14.2.7.

[END OF DOCUMENT]
SUPPLEMENTARY CONDITIONS

The following Paragraphs amend and supplement the July 1, 2016 edition of the General Conditions. Unaltered portions of General Conditions remain in effect.

MANDATORY

Use Paragraph 1.1.9.1 to name a firm which is under contract to the City to manage the Contract. Do not use this Paragraph to name in-house project managers or consultants who provide personnel to supplement City staff.

ARTICLE 1 - GENERAL PROVISIONS:

1.1 DEFINITIONS: Insert the following Paragraphs 1.1.9.1, 1.1.23, and 1.1.25 reorder the remaining definitions accordingly. Please insert the amended definition of “Specifications”.

1.1.9.1 The firm of has been employed by the City as Construction Manager for the Work.

1.1.23 Good Faith Efforts. Steps taken to achieve an MBE, WBE, SBE, or PDBE goal or other requirements which, by their scope, intensity, and usefulness, demonstrate the bidder’s responsiveness to fulfill the business opportunity objective, as well as the Contractor’s responsibility to put forth measures to meet or exceed the MBE, WBE, SBE, or PDBE goal (Contract Goal). These steps apply from before a contract’s award, through its duration, and after its conclusion, in the event the Contractor has been unsuccessful in meeting the Contract Goal. These efforts are required whether a Goal Oriented Contract or a Regulated Contract, as defined in the Office of Business Opportunity’s Policy & Procedures Manual, available at http://www.houstontx.gov/obo.

1.1.25 Incidental Work. Work described as incidental shall be work defined in Document 01110 - Summary of Work, that do not have a direct pay item listed in the Document 00410B - Bid Form Part B, or less than 1% of the Contract Price and not
1.1.45 Specifications. Divisions 01 through 16 of the documents that are incorporated into the Agreement, consisting of written General Requirements and requirements for Products, standards, and workmanship for the Work, and performance of related services. All specifications are amended to include, under the Measurement and Payment Section, the following sentence: “Work described as Incidental Work shall not be paid as a separate unit price item.”

ARTICLE 3 - THE CONTRACTOR

3.5 LABOR: Insert the following Paragraphs, 3.5.3.1.1, 3.5.3.1.2, and 3.5.3.1.3.

3.5.3.1.1 If the Original Contract Price is greater than One Million Dollars, Contractor shall make Good Faith Efforts to comply with the City ordinances regarding Minority Business Enterprises (MBE), Women Business Enterprises (WBE), Persons with Disabilities Business Enterprises (PDBE) and Small Business Enterprise (SBE) participation goals which are as follows:

3.5.3.1.1.1 the MBE goal is ____ percent,
3.5.3.1.1.2 the WBE goal is ____ percent, and
3.5.3.1.1.3 the PDBE goal is ____ percent.
3.5.3.1.1.4 The bidder may substitute SBE participation of no more than four percent of the MBE goal, the WBE goal, or portions of the MBE Goal and WBE Goal.

3.5.3.1.1.5 The bidder may not use Native-American-owned firms that are certified as MBEs to meet MBE contract goals. Native-Americans firms can only be used as SBEs in fulfillment of the above stated goals.

3.5.3.1.1.6 The bidder may not use MWSBE Suppliers to account for more than 50% of the MWSBE participation plan.

3.5.3.1.2 The MBE, WBE, PDBE, and SBE goals are specific to this Agreement. The Contractor shall make reasonable efforts to achieve these goals.

3.5.3.1.3 Failure by Contractor to comply with the goals for MBE, WBE, SBE, or PDBE is a material breach of the Agreement, which may result in termination of the Agreement, or such other remedy permitted as the City deems appropriate.

************************************************************************************

OPTIONAL

For SRF projects, insert Paragraph 3.5.3.1.1 below in lieu of the paragraph above.

************************************************************************************

3.5.3.1.1 The Contractor shall make Good Faith Efforts as described in Document 00806 regarding Environmental Protection Agency Disadvantaged Business Enterprises participation goals, which are as follows:

1. the MBE goal is 12.94 percent, and

2. the WBE goal is 8.72 percent

ARTICLE 8 - TIME

************************************************************************************

OPTIONAL

Include the following Paragraph under 8.1 on Utility Maintenance projects only.

************************************************************************************

8.1 PROGRESS AND COMPLETION: Delete Paragraph 8.1.6 in its entirety and replace it with the following Paragraph 8.1.6.

Contractor may perform Work at the site 24 hours per day, seven days per week. Contractor shall give 24-hour prior written notice and receive confirmation of
notice from Project Manager prior to performing work between 7:00 p.m. and 7:00 a.m., on a Sunday, or on a Legal Holiday. Contractor shall comply with City Code of Ordinances, Chapter 30 relating to Noise and Sound Level Regulation.

********************************************
MANDATORY
Include the following Paragraph under 8.1 on all projects:
********************************************

8.1 PROGRESS AND COMPLETION: Add the following Paragraph 8.1.6.1.

8.1.6.1 Contractor shall credit the City by Change Order for inspection services for overtime work or work performed on Sundays or Legal Holidays. The amount Contractor credits the City will be [$50.00 per hour] [actual costs] per inspector for inspection services.

ARTICLE 9 - PAYMENTS AND COMPLETION

********************************************
OPTIONAL

Use Section 9.1 for Stipulated Price (Lump Sum) Contracts with individual Specification sections containing references to unit prices.
********************************************

9.1 UNIT PRICE WORK: Delete Section 9.1 in its entirety and insert the following Section 9.1.

9.1 References to Unit Prices in individual Specification sections are not applicable to the Contract. Include payment for portions of the Work required by these sections in the Stipulated Price for the Contract.

********************************************
MANDATORY

Using table below as a guideline, insert amount of calculated daily cost to City, to be used for liquidated damages, in Paragraph 9.12.1.1. Include calculations in Project files. Department will consider guidelines based on the Project and its Scope.

<table>
<thead>
<tr>
<th>Est. Amount of Construction Cost</th>
<th>Liquidated Damages per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project less than $2.5 M</td>
<td>$800</td>
</tr>
<tr>
<td>Project $2.5 M to $7.5 M</td>
<td>$1200</td>
</tr>
<tr>
<td>Non-facility Projects Greater than $7.5 M</td>
<td>$1500</td>
</tr>
<tr>
<td>Facility Projects greater than $7.5 M</td>
<td>$2000</td>
</tr>
</tbody>
</table>

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OPTIONAL

Use Section 9.4.3 for Early Payment Discount language when the contractor has agreed to the discount. Delete the Section 9.4.3 when the contractor has NOT agreed to the discount.

9.4 APPLICATIONS FOR PAYMENT, STIPULATED PRICE WORK:
Insert the following Paragraph 9.4.3.

9.4.3 The City of Houston’s standard payment term is to pay 30 days after receipt of invoice or receipt of goods or services, whichever is later, according to the requirements of the Texas Prompt Payment Act (Texas Government Code, Chapter 2251). However, the City will pay in less than 30 days in return for an early payment discount from vendor as follows:
   9.4.3.1 Payment Time - 10 Days: 2% Discount
   9.4.3.2 Payment Time - 20 Days: 1% Discount
If the City fails to make a payment according to the early payment schedule above, but does make the payment within the time specified by the Prompt Payment Act, the City shall not receive the discount, but shall pay no other penalty. When the payment date falls on a Saturday, Sunday, or official holiday when City offices are closed and City business is not expected to be conducted, payment may be made on the following business day.

9.12 LIQUIDATED DAMAGES: Insert the following Paragraph 9.12.1.1.

9.12.1.1 The amount of liquidated damages payable by Contractor or Surety for each and every day of delay beyond Contract Time, are «LiquidatedDamages» per day.

OPTIONAL

Include the following Paragraph 9.12.1.2 ONLY if the project is an Utility Maintenance Branch Wastewater Collection System Rehabilitation project.

9.12.1.2 The amount of liquidated damages provided in General Conditions Paragraph 9.12.1 payable by Contractor or Surety for each and every day of delay beyond the time stipulated in Summary of Work Paragraph 1.08.B are as follows:

   9.12.1.2.1 Repair Items: If Contractor does not complete replacement, improvement and/or new installations on
existing service lines and any associated work of all work orders within twelve (12) days from the date the work orders were issued, the City of Houston may, at its discretion, collect $400.00 (four hundred dollars) in liquidated damages per day for each repair not completed within twelve (12) days.

9.12.1.2.2 **Restoration Items**: If Contractor does not complete the repairing, resurfacing and/or sodding of concrete, asphalt and/or lawn areas and any associated work disturbed by construction within six (6) days after the repair items are completed, the City of Houston may, at its discretion, collect $400.00 (four hundred dollars) in liquidated damages per day for each restoration not completed within six (6) days.

9.13 **CONTRACTOR BONUS:**

******************************************************************************

**OPTIONAL**
Include bonus for early completion for construction contracts involving street reconstruction with an estimated Contract Price in excess of three million dollars or Contract Time over 120 days. This applies to storm drainage, water and wastewater projects that involve significant street reconstruction. Department will consider guidelines based on the Project and its Scope. General Guideline:

<table>
<thead>
<tr>
<th>Estimate of $3 - $6 million</th>
<th>$1,000/day (max. 30 - 60 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimate of $6 - $10 million</td>
<td>$1,500/day (max. 30 - 90 days)</td>
</tr>
<tr>
<td>Estimate over $10 million</td>
<td>$2,000/day (max. 60 - 90 days)</td>
</tr>
</tbody>
</table>

The maximum allowable bonus will not exceed 3% of the estimated Original Contract Price on a thoroughfare or 1.5% on local streets without authorization.

******************************************************************************

9.13.1 **BONUS FOR EARLY COMPLETION**

9.13.1.1 The City will pay Contractor a bonus of [bonus dollars] per day for each day earlier than [Contract Time stated in the Agreement] days, after Date of Commencement of the Work, that Contractor achieves substantial completion, for a maximum of [maximum days allowed] days.

ARTICLE 11 - INSURANCE AND BONDS
OPTIONAL

Use Paragraph 11.2.1.2 if any of the following additional insurance is required by the nature of the contract. DO NOT require any additional insurance that is unnecessary; notify the Legal Department when requiring any additional insurance. When inserting additional insurance requirements into Table 2, number them consecutively, starting with .1 as follows:

Example:

<table>
<thead>
<tr>
<th>Table 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 Property and Casualty Coverage</td>
</tr>
<tr>
<td>.2 Contractor’s Pollution Liability Coverage</td>
</tr>
<tr>
<td>.3 Etc.</td>
</tr>
</tbody>
</table>

11.2 INSURANCE TO BE PROVIDED BY CONTRACTOR: Insert the following Paragraph 11.2.1.2., and Table 2, “Additional Required Coverage”.

11.2.1.2 Contractor shall purchase for the duration of the Contract the insurance set out in Table 2 in addition to the minimum insurance coverage set out in section 11.2.1.

TABLE 2
ADDITIONAL REQUIRED COVERAGE
DEFENSE COSTS EXCLUDED FROM FACE AMOUNT OF POLICY.

OPTIONAL

Use Builder’s Risk insurance only for projects that include lift stations, plant or facility work. Include Building Wage rates in the project manual and have Assistant Director initial the following block to signify approval {_______}.

(Coverage) (Limit of Liability)____

Property and Casualty Coverage:
"All Causes of Loss" Builder’s Risk Form for directing physical change to building or plant construction on the Work site and/or all land improvements including all work. (Including but not limited to earthquake, flood, boiler, and machinery including testing, damage to existing or adjoining property, time element

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coverage, collapse, soft costs (management, architecture, financial costs, pre-opening costs, etc.), transit coverage, off-site storage).

*********************************************************************************

**OPTIONAL**

*Use Flood Hazard Insurance only for projects that include structures. Do not include Flood Insurance for line projects, projects outside of the 100-year floodplain, or projects with structures less than $10,000 in value. Have Assistant Director initial the following block to signify approval {_______}.*

*********************************************************************************

Flood Hazard Insurance: Contractor shall apply for flood insurance on all insurable structures built under the Contract. A copy of the completed application must be provided to City Engineer before commencing construction of the Work. Contractor shall obtain flood hazard insurance as soon as possible and submit a copy of the policy to City Engineer.

*********************************************************************************

**OPTIONAL**

*Use for projects which contain construction requirements for Petroleum or (asbestos contamination) remediation or handling. Have Assistant Director initial the following block to signify approval {_______}.*

*********************************************************************************

**Contractor’s Pollution Liability:** $1,000,000 each occurrence

Including pollution coverage for Contractual Liability, Clean-up costs, Abatement, Transport, and Non-owned disposal sites. Including Bodily Injury Liability, Property Damage Liability, and environmental damage arising from pollution conditions caused in performance of operations. Including Asbestos and Lead if part of operations.

(MCS - 90 endorsement to Auto Policy $1,000,000 and removal of Pollution Exclusion)

*********************************************************************************

**OPTIONAL**

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11.5 MAINTENANCE BONDS: Insert the following Paragraph 11.5.2.

11.5.2 One-year Surface Correction Bond: Contractor shall provide, on the City standard form, an additional One-Year Bond in an amount equal to four percent of the Original Contract Price or cost of repair. Bond shall provide for Contractor's correction, replacement, or restoration of backfill or subsurface and surface work not in accordance with the Contract, within one year from the date the One-Year Maintenance Bond has expired.

END OF DOCUMENT
EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS
(City of Houston Information Requirements for the Successful Bidder on All Construction Contracts)

DOCUMENTS THAT MUST BE SIGNED AND RETURNED TO THE CITY OF HOUSTON PRIOR TO FINAL EXECUTION OF CONTRACT

Certification by Bidder Regarding Equal Employment Opportunity ..............EEO-3

Total Work Force Composition of the Company...........................................EEO-6

or in lieu thereof, a copy of the latest Equal Employment Opportunity Commission's EEO-1 form (This information is required only if the Contractor has a work force of 50 or more people and the Contract is $50,000 or more.)

Company's Equal Employment Opportunity Compliance Program .............EEO-7

INFORMATION THAT MUST BE SUPPLIED DURING THE COURSE OF THE WORK

Certification By Proposed Subcontractor Regarding Equal Employment Opportunity ..........................................................EEO-26

Subcontractor's Equal Employment Opportunity Compliance Program .......................................................................... EEO-29


PLEASE COMPLETE PAGES EEO-3 THROUGH EEO-7 AND MAIL TO:

City of Houston
Office of Business Opportunity
Contract Compliance Section
611 Walker, 7th Floor
Houston, Texas 77002
Attention: Director

The remainder of the reports can be mailed at the appropriate time.
EQUAL EMPLOYMENT OPPORTUNITY PROGRAM REQUIREMENTS

The following are Equal Employment Opportunity requirements to be met and documents to be submitted to:
Office of Business Opportunity
Contract Compliance Section
611 Walker, 7th Floor
Houston, Texas 77002

Under the conditions and terms of all City construction contract, the prime contractor is responsible for all Equal Employment Opportunity compliance, including subcontractor compliance.

EQUAL EMPLOYMENT OPPORTUNITY FORMS (EEO Forms)

These forms are submitted by the prime contractors at the beginning of the Project and as requested:
- EEO Forms 3, 6, and 7 by prime contractors.

These forms are submitted by all subcontractors before they begin work on the project.
- EEO Forms 26 - 29 by subcontractors.

This form is submitted by all suppliers, lessors, or professional services providers before they begin work on the project:
- EEO Form 30

POSTING

The following poster should be clearly displayed on each job site, or in case of annual service agreements, in the Contractor's office:

Equal Employment Opportunity is the Law Poster

JOB SITE VISITS

Site visits will be made by a Contract Compliance Officer who will make their presence known to the Project Manager, Supervisor, or Foreman, and will conduct interviews with employees on site.

PAYMENT AND EVALUATION

Upon completion of the Project, as part of the contract-awarding department's total clearance process, the Office of Business Opportunity’s Contract Compliance Section must certify to the department that all EEO compliance requirements have been met.
CERTIFICATION BY BIDDER REGARDING
EQUAL EMPLOYMENT OPPORTUNITY

GENERAL

In accordance with Executive Order 11246 (30 F.R. 12319-25), the implementing rules and regulations thereof, and orders of the Secretary of Labor, a certification regarding Equal Opportunity is required of bidders or prospective contractors and their proposed subcontractors prior to the award of contracts or subcontracts.

CERTIFICATION OF BIDDER

Bidder's Name: __________________________________________

Address: ________________________________________________

Telephone Number: ____________________ Fax: ____________________

Name of the company's EEO Officer: __________________________

E-mail Address: __________________________________________

Web Page/URL Address: __________________________________

IRS Employer Identification Number: _________________________

Work to be performed: ____________________________________

Project No: ____________________________________________

1. Participation in a previous contract or subcontract.

   a. Bidder has participated in a previous contract or subcontract subject to the Equal Opportunity Clause.    YES    NO

   b. Compliance reports were required to be filed in connection with such contract or subcontract.    YES    NO

   c. Bidder has filed all compliance reports required by Executive Orders 10925, 11114, 11246, or by regulations of the Equal Employment Opportunity Commission issued pursuant to Title VII of the Civil Rights Act of 1964.    YES    NO

   d. If answer of Item c. is "No", please explain in detail on reverse side of this certification.
2. Dollar amount of bid: $

3. Anticipated performance period in days:

4. Expected total number of employees to perform the proposed construction:

5. Nonsegregated facilities.
   a. Notice to prospective federally-assisted construction contractors
      (1) A Certification of Nonsegregated Facilities, as required by the May 9, 1967, Order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to the recipient prior to the award of a federally-assisted construction contract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause.

      (2) Contractors receiving federally-assisted construction contract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide the forwarding of the following notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity Clause.

The federally-assisted construction Contractor certifies that he/she does not maintain or provide any segregated facilities at any of his/her establishments, and does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor certifies further that he/she will not maintain or provide segregated facilities at any of his/her establishments, and will not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin because of habit, local custom, or otherwise. The federally-assisted construction Contractor agrees that (except where he/she has obtained identical certifications from proposed Subcontractors for specific time periods) he/she will obtain identical certifications in duplicate from proposed Subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he/she will retain the duplicate of such certifications in his/her files. The Subcontractor will include the original in his/her bid package.
6. Race or ethnic group designation of bidder. Enter race or ethnic group in appropriate box:

☐ White  ☐ Black  ☐ Hispanic
☐ Pacific Islander, Asian  ☐ American Indian, Aleut.

7. Gender of Owner  ☐ Male  ☐ Female

REMARKS: ________________________________________________________________

Certification - The information above is true and complete to the best of my knowledge and belief.

__________________________________________  ____________________________
Company Officer (Please Type)  

__________________________________________  ____________________________
Signature  Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.
### CITY OF HOUSTON

Company Wide EEO Report

1. Check One
   - __Prime
   - __Subcontractor

2. Name and Address

3. FEED No.

4. County

5. TX CSJ DOT Project No. (if Applicable)

6. Contractor’s Beginning Work Date on Project

7. City Of Houston Contract No.

8. This Report is based on Pay Period ending MM/DD/YYYY

9. TEXAS CONSTRUCTION EMPLOYMENT

#### TABLE A

<table>
<thead>
<tr>
<th>JOB CATEGORIES</th>
<th>TOTAL EMPLOYEES</th>
<th>TOTAL MINORITIES</th>
<th>WHITE (Not of Hispanic Origin)</th>
<th>BLACK (Not of Hispanic Origin)</th>
<th>HISPANIC</th>
<th>AMERICAN INDIAN or ALASKAN NATIVE</th>
<th>ASIAN</th>
<th>NATIVE HAWAIIAN or OTHER PACIFIC ISLANDER</th>
<th>TWO OR MORE RACIAL GROUPS</th>
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<tbody>
<tr>
<td>OfficIals (Managers)</td>
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<td>0</td>
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<td><strong>TOTALS</strong></td>
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</tbody>
</table>

#### TABLE B

<table>
<thead>
<tr>
<th>On-The-Job Trainees (OJT)</th>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
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<td>0</td>
</tr>
</tbody>
</table>

**OJT TOTALS**

<table>
<thead>
<tr>
<th>M</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

10. If any employees reported in Table A are apprentices, name of the program, job category, count, race & sex.

11. Summarize all hires for the entire active month by job category, race, sex (Use additional sheet if needed).

12. Preparer

13. Reviewer
The Company's Office of Business Opportunity Program shall consist of documented good faith efforts to comply with the goals, timetables, and objectives set forth in the following Affirmative Action steps:

A. City of Houston's Specific Equal Employment Opportunity Policy and Clause as contained in City Council Ordinance No. 78-1538, passed August 9, 1978.


Project: ____________________________________________________________

Company Officer (Please Type)

_____________________________________________________________ Date

Signature

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.
1. GENERAL
   a. Equal employment opportunity requirements not to discriminate and to take affirmative action to assure equal employment opportunity are required by Executive Order 11246, as amended. The requirements set forth in these Special Provisions shall constitute the specific affirmative action requirements for Project activities under this Contract and shall supplement the notice of requirement for affirmative action to ensure equal employment opportunity and standard federal equal employment opportunity construction contract specifications.
   b. The Contractor shall work with the City and the Federal Government in carrying out equal employment opportunity obligations and in their review of his/her activities under the Contract.
   c. The prime Contractor and all Subcontractors holding subcontracts of $10,000 or more shall comply with the following minimum specific requirement activities of equal employment opportunity. The Contractor shall include these requirements in every subcontract of $10,000 or more with such modification of language as is necessary to make them binding on the Subcontractor.

2. EQUAL EMPLOYMENT OPPORTUNITY POLICY

   The Contractor shall accept as his/her operating policy the following statement which is designed to further the provision of equal employment opportunity to all persons without regard to their race, age, color, religion, sex, or national origin, and to promote the full realization of equal employment opportunity through a positive continuing program:

   It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, color, sex, or national origin. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

3. EQUAL EMPLOYMENT OPPORTUNITY OFFICER

   The Contractor shall designate and make known to the City contracting officers an equal employment opportunity officer (hereinafter referred to as the EEO Officer) who must be capable of effectively administering and promoting an active Contractor program of equal employment opportunity and who must be assigned adequate authority and responsibilities to do so.

4. DISSEMINATION OF POLICY
a. All members of the Contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement the Contractor's equal employment opportunity policy and contractual responsibilities to provide equal employment opportunity in each grade and classification of employment. To ensure that the above agreement will be met, the following actions shall be taken as a minimum:

(1) Periodic meetings of supervisory and personnel office employees shall be conducted before the start of work and then not less often than once every six months, at which time the Contractor's equal employment opportunity policy and its implementation will be reviewed and explained. The meetings shall be conducted by the EEO Officer or other knowledgeable company official.

(2) All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, or other knowledgeable company official, covering all major aspects of the Contractor's equal employment opportunity obligations, within 30 days following their reporting for duty with the Contractor.

(3) The EEO Officer or appropriate company official shall instruct all employees engaged in the direct recruitment of employees for the Project relative to the methods followed by the Contractor in locating and hiring minorities and females.

b. In order to make the Contractor's equal employment opportunity policy known to all employees, prospective employees, and potential sources of employees, i.e., schools, employment agencies, labor unions (where appropriate), college placement officers, etc., the Contractor shall take the following actions:

(1) Notices and posters setting forth the Contractor's equal employment opportunity policy shall be placed in areas readily accessible to employees, applicants for employment, and potential employees.

(2) The Contractor's equal employment opportunity policy and the procedures to implement such policy shall be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.

5. RECRUITMENT

a. When advertising for employees, the Contractor shall include in all advertisements for employees the notation "An Equal Opportunity Employer". All such advertisements will be published in newspapers, or other publications, having a large circulation among minority groups in the area from which the Project work force would normally be derived.
b. The Contractor shall, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee-referral sources likely to yield qualified minority-group applicants, including, but not limited to, State employment agencies, schools, colleges, minority-group organizations, and female recruitment agencies. To meet this requirement, the Contractor shall, through his/her EEO Officer, identify sources of potential minority and female employees, and establish with such identified sources procedures whereby such group applicants may be referred to the Contractor for employment consideration.

In the event the Contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, he/she is expected to observe the provisions of that agreement to the extent that the system permits the Contractor's compliance with equal employment opportunity Contract provisions. (The U. S. Department of Labor has held that where implementation of such agreements has the effect of discriminating against minorities or women, or obligates the Contractor to do the same, such implementation violates Executive Order 11246 as amended).

c. The Contractor shall encourage his/her present employees to refer female or minority-group applicants for employment by posting appropriate notices or bulletins in areas accessible to all such employees. In addition, information and procedures with regard to referring such applicants will be discussed with employees.

6. PERSONNEL ACTIONS

a. Wage, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff and termination, shall be taken without regard to race, color, religion, sex, national origin, or age. The following procedures shall be followed:

(1) The Contractor shall conduct periodic inspections of Project sites to ensure that working conditions and employee facilities do not indicate discriminatory treatment of Project-site personnel.

(2) The Contractor shall periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.

(3) The Contractor shall periodically review selected personnel actions in depth to determine whether there is evidence of discrimination.

Where evidence is found, the Contractor shall promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.
(4) The Contractor shall promptly investigate all complaints of alleged discrimination made in connection with his/her obligations under this Contract, shall attempt to resolve such complaints, and shall take appropriate corrective action. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the Contractor shall inform every complainant of all avenues of appeal.

7. TRAINING AND PROMOTION

a. The Contractor shall assist in locating, qualifying, and increasing the skills of minority-group and women employees and applicants for employment.

b. Consistent with the Contractor's work force requirements and as permissible under Federal and State regulations, the Contractor shall make full use of training programs, i.e., apprenticeship and on-the-job training programs, for the geographical area of Contract performance.

c. The Contractor shall advise employees and applicants for employment of available training programs and entrance requirements for each.

d. The Contractor shall periodically review the training and promotion potential of minority-group and women employees and shall encourage eligible employees to apply for such training and promotion.

8. UNIONS

If the Contractor relies in whole or in part upon unions as a source of employees, he/she shall use his/her best efforts to obtain the cooperation of such unions to increase minority groups and women within the unions, and to effect referrals by such unions of minority and female employees. Actions by the Contractor, either directly or through a contractor's association acting as his/her agent, will include the procedures set forth below:

a. The Contractor shall use best efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minority-group members and women for membership in the unions and increasing the skills of minority-group employees and women so that they may qualify for higher-paying employment.

b. The Contractor shall use best efforts to incorporate an equal employment opportunity clause into all union agreements to the end that such unions will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, or age.

c. The Contractor is to obtain information as to the referral practices and policies of the labor union, except that to the extent such information is within the exclusive possession of the labor union, and such labor union refuses to furnish such information to the Contractor, the Contractor shall
so certify to the City and shall set forth what efforts have been made to obtain such information.

d. In the event the union is unable to provide the Contractor with a reasonable flow of minority and women referrals within the time limit set forth in the collective bargaining agreement, the Contractor shall, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, age, sex, or national origin, making full efforts to obtain qualified and/or qualifiable minority group persons and women. (The U. S. Department of Labor has held that it shall be no excuse that the union with which the Contractor has a collective bargaining agreement providing for exclusive referral failed to refer minority employees.) In the event the union referral practice prevents the Contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such Contractor shall immediately notify the City.

9. SUBCONTRACTING

a. The Contractor shall use his/her best efforts to solicit bids from and to utilize minority-group and female subcontractors or subcontractors with meaningful minority-group and/or female representation among their employees.

b. The Contractor shall use his/her best efforts to assure Subcontractors' compliance with their equal employment opportunity obligations.

10. RECORDS AND REPORTS

a. The Contractor shall keep such records as are necessary to determine compliance with the Contractor's equal employment opportunity obligations. The records kept by the Contractor will be designed to indicate:

(1) The number of minority and non-minority group members and women employed in each work classification on the Project.

(2) The progress and efforts being made in cooperation with unions to increase employment opportunities for minorities and women (applicable only to contractors who rely in whole or in part on unions as a source of their work force).

(3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minority and female employees.

(4) The progress and efforts being made in securing the services of female and minority subcontractors.

b. All records, including payrolls, must be retained for a period of three years following completion of the Contract work and shall be available at
reasonable times and places for inspection by authorized representatives of the City and/or the appropriate federal agency.
Pursuant to City Council Ordinance No. 78-1538, passed August 9, 1978, all contracts entered into by the City of Houston involving the expenditure of $10,000 or more, shall incorporate the following Equal Employment Opportunity Clause:

1. The Contractor, Subcontractor, vendor, Supplier, or lessee shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age. The Contractor, Subcontractor, vendor, Supplier, or lessee shall take affirmative action to ensure that applicants are employed and that employees are treated during employment without regard to their race, religion, color, sex, national origin, or age. Such action will include, but not be limited to, the following: employment; upgrading; demotion or transfer; recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor, Subcontractor, vendor, Supplier, or lessee agrees to post in conspicuous places available to employees, and applicants for employment, notices to be provided by the City setting forth the provisions of this Equal Employment Opportunity Clause.

2. The Contractor, Subcontractor, vendor, Supplier, or lessee states that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

3. The Contractor, Subcontractor, vendor, Supplier, or lessee shall send to each labor union or representatives of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer advising the said labor union or workers’ representative of the Contractor’s and Subcontractor’s commitments under Section 202 of Executive Order No. 11246, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

4. The Contractor, Subcontractor, vendor, Supplier, or lessee will comply with all provisions of Executive Order No. 11246 and the rules, regulations, and relevant orders of the Secretary of Labor or other Federal Agency responsible for enforcement of the equal opportunity and affirmative action provisions applicable, and shall likewise furnish all information and reports required by the Mayor and/or Contractor Compliance Officers for purposes of investigation to ascertain and effect compliance with this program.

5. The Contractor, Subcontractor, vendor, Supplier, or lessee shall furnish all information and reports required by Executive Order No. 11246, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant
thereto, and shall permit access to all books, records, and accounts by the appropriate City and Federal officials for purposes of investigation to ascertain compliance with such rules, regulations, and orders. Compliance reports filed at such times as directed shall contain information as to the employment practice policies, program, and workforce statistics of the Contractor, Subcontractor, vendor, Supplier, or lessee.

6. In the event of a Contractor's, Subcontractor's, vendor's, Supplier's, or lessee's non-compliance with the non-discrimination clause of this Contract or with any of such rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part, and the Contractor, Subcontractor, vendor, Supplier, or lessee may be declared ineligible for further City contracts in accordance with procedures provided in Executive Order No. 11246, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as may otherwise be provided by law.

7. The Contractor shall include the provisions of paragraphs 1 through 8 of this Equal Employment Opportunity Clause in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965 so that such provisions will be binding upon each Subcontractor or vendor. The Contractor shall take such action with respect to any subcontractor or purchase order as the contracting agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event the Contractor becomes involved in, or is threatened with litigation with a Subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

8. The Contractor shall file and shall cause each of his Subcontractors, if any, to file compliance reports with the City in the form and to the extent as may be prescribed by the Office of Business Opportunity. Compliance reports filed at such times as directed shall contain information as to the practices, policies, programs, employment policies, and employment statistics of the Contractor and each Subcontractor.
NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION
TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY
(EXECUTIVE ORDER 11246)

1. The Offeror's or Bidder's attention is called to the "Equal Opportunity Clause" and the "Standard Federal Equal Employment Opportunity Construction Contract Specifications" set forth herein.

2. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate work force in each trade on all construction work in the covered area, are as follows:

<table>
<thead>
<tr>
<th>Timetables</th>
<th>Goals for Minority Participation for Each Trade</th>
<th>Goals for Female Participation for Each Trade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>26.2% - 27.3%</td>
<td>6.9%</td>
</tr>
</tbody>
</table>

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or Federally-assisted) performed in the covered area.

The Contractor's compliance with the Executive Order and the regulations in 41 CFR Part 60-4 shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in 41 CFR 60-4.3(a), and its efforts to meet the goals established for the geographical area where the Contract resulting from this solicitation is to be performed. The hours of minority and female employment and training must be substantially uniform throughout the length of the Contract, and in each trade, and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the Contract, the Executive Order, and regulations in 41 CFR part 60-4. Compliance with the goals will be measured against the total work hours performed.

3. The Contractor shall provide written notification to the Director of the Office of Federal Contract Compliance Programs within 10 working days of award of any construction subcontract in excess of $10,000 at any tier for construction work under the Contract resulting from this solicitation. The notification shall list the name, address, and telephone number of the Subcontractor; employer identification number; estimated dollar amount of the subcontract; estimated starting and completion dates of the subcontract; and the geographical area in which the Contract is to be performed.

4. As used in this Notice, and in the Contract resulting from this solicitation, the "covered area" is The Houston, Texas Standard Metropolitan Statistical Area.
1. As used in these specifications:

   a. "Covered area" means the geographical area described in the solicitation from which this Contract resulted;

   b. "Director" means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority;


   d. "Minority" includes:

      (i) Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);

      (ii) Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin regardless of race);

      (iii) Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and

      (iv) American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).

2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this Contract resulted.

3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U. S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of
any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good efforts to achieve the Plan goals and timetables.

4. The Contractor shall implement the specific affirmative action standards provided in Paragraphs 7a through p of these specifications. The goals set forth in the solicitation from which this Contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. The Contractor is expected to make substantially uniform progress toward its goals in each craft during the period specified.

5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement to refer either minorities or women, shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the non-working training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U. S. Department of Labor.

7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:

a. Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which Contractor's employees are assigned to work. The Contractor, where possible, shall assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.

b. Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions
have employment opportunities available, and maintain a record of the organizations' responses.

c. Maintain a current file of the names, addresses, and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source, or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefor, along with whatever additional actions the Contractor may have taken.

d. Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.

e. Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.

f. Disseminate the Contractor's EEO policy: by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.

g. Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination, or other employment decisions, including specific review of these items with on-site supervisory personnel such as superintendents, general foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.

h. Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written notification to and discussing the
Contractor's EEO policy with other contractors and subcontractors with whom the Contractor does or anticipates doing business.

i. Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students, and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j. Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer, and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k. Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l. Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare, through appropriate training, etc., for such opportunities.

m. Ensure that seniority practices, job classifications, work assignments, and other personnel practices do not have a discriminatory effect by continually monitoring all personnel and employment-related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n. Ensure that all facilities and company activities are nonsegregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o. Document and maintain a record of all solicitations of offers for subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p. Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor union, contractor-community, or other similar group of which the Contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of
these Specifications provided that the Contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female work force participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is under-utilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination, and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in Paragraph 7 of these Specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.B.

14. The Contractor shall designate a responsible official to monitor all employment-related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government, and to keep records. Records shall at least include for each employee the name, address, telephone number, construction trade, union affiliation, if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice, trainee, helper, or laborer),
dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily-understandable and retrievable form; however to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.

15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).
DESCRIPTION OF JOB CATEGORIES

Officials, Managers, and Administrators

Occupations requiring administrative personnel who set board policies, exercise overall responsibility for the execution of these policies, or provide specialized consultation on a regional, district, area basis, or direct individual departments or special phases of a firm's operations.

Includes: Officials, executives, middle management, plant managers, department managers, superintendents, salaried foremen who are members of management, purchasing agents, buyers, bureau chiefs, directors, deputy directors, wardens, examiners, sheriffs, police and fire chiefs, and kindred workers.

Professionals

Occupations which require specialized and theoretical knowledge which is usually acquired through college or experience of such kind and amount as to provide a comparable background.

Includes: Accountants, auditors, airplane pilots and navigators, architects, artists, chemists, designers, dieticians, editors, engineers, lawyers, librarians, mathematicians, natural scientists, registered professional nurses, personnel and labor relations workers, physical scientists, teachers, social workers, doctors, psychologists, economists, systems analysts, employment and vocational rehabilitation counselors, instructors, police and fire captains and lieutenants, and kindred workers.

Paraprofessionals

Occupations in which workers perform some of the duties of a professional or technician in a supportive role, which usually requires less formal training and/or experience normally required for professional or technical status. Such positions may fall within an identified pattern of a "New Careers" concept.

Includes: Library assistants, medical aides, child support workers, police auxiliary, welfare service aides, recreation assistants, homemakers aides, home health aides, and kindred workers.

Technicians

Occupations requiring a combination of basic scientific knowledge and manual skill which can be obtained through about two (2) years of post high school education, such as is offered in many technical institutes and junior colleges, or through equivalent on-the-job training.

Includes: Computer programmers and operators, draftsmen, engineering aides, junior engineers, mathematical aides, licensed practical or vocational nurses,
photographers, radio operators, scientific assistants, surveyors, technical illustrators, technicians (medical, dental, electronics, physical sciences), police and fire sergeants, and kindred workers.

Protective Service Workers

Occupations in which workers are entrusted with public safety, security, and protection from destructive forces.

Includes: Police patrol officers, fire fighters, guards, deputy sheriffs, bailiffs, correctional officers, detectives, marshals, harbor patrol officers, and kindred workers.

Sales Workers

Occupations engaging wholly or primarily in direct selling.

Includes: Advertising agents and salespersons, insurance agents and brokers, real estate agents and brokers, stock and bond salespersons, demonstrators, salespersons and sales clerks, grocery clerks, cashiers, and kindred workers.

Office and Clerical

Occupations in which workers are responsible for internal and external communications, recording and retrieval of data and/or information and other paper work required in an office predominantly non-manual, though some manual work not directly involved with altering or transporting the products is included.

Includes: Bookkeepers, cashiers, collectors (bills and accounts), messengers and office helpers, office machine operators, shipping and receiving clerks, stenographers, typists and secretaries, telegraph and telephone operators, court transcribers, hearing reporters, statistical clerks, dispatchers, license distributors, payroll clerks, and kindred workers.

Skilled Craft Workers

Occupations in which workers perform jobs which require special manual skill through on-the-job training and experience, or through apprenticeship or other formal training programs. These workers exercise considerable independent judgment and usually receive an extensive period of training.

Includes: The building trades, hourly paid foremen and leadmen who are not members of management, mechanics and repairmen, skilled machining occupations, compositors and typesetters, electricians, engravers, job setters (metal), motion picture projectionists, pattern and model makers, stationary engineers, tailors, heavy equipment operators, carpenters, and kindred workers.

Operatives (semi-skilled)
Workers who operate machine or processing equipment or perform other factory-type duties of intermediate skill level which can be mastered in a few weeks and require only limited training.

Includes: Apprentices (auto mechanics), plumbers, bricklayers, carpenters, electricians, mechanics, building trades, metal workers, machinists, printing trades, operatives, attendants (auto service and parking), blasters, chauffeurs, dressmakers and seamstresses (except factory), dryers, furnacemen, heaters (metal), laundry and dry cleaning operatives, milliners, miners, motormen, oilers, greasers, etc. (except auto), painters (except construction and maintenance), photographic process workers, stationary firemen, truck and tractor drivers, weavers (textile), welders and flame cutters, and kindred workers.

**Laborers (unskilled)**

Workers in manual occupations which generally require no special training. These workers perform elementary duties that may be learned in a few days and require the application of little or no independent judgment.

Includes: Garage workers, car washers and greasers, gardeners (except farm) and groundskeepers, longshoremen and stevedores, lumbermen, craftsmen, and wood choppers, laborers performing lifting, digging, mixing, loading, and pulling operations, and kindred workers.

**Service/Maintenance Workers**

Occupations in which workers perform duties which result in or contribute to the comfort, convenience, hygiene, or safety for the general public, or which contribute to the upkeep and care of buildings, facilities or grounds, or public property. Workers in this group may operate machinery.

Includes: Chauffeurs, laundry and dry cleaning operatives, truck drivers, trash collectors, custodial personnel, gardeners and groundskeepers, construction laborers, attendants (hospital and other institutions), professional and personal service, counter and fountain workers, elevator operators, firemen and fire protection, guards, watchmen and doorkeepers, stewards, porters, waiters, and kindred workers.
CERTIFICATION BY PROPOSED SUBCONTRACTOR REGARDING
EQUAL EMPLOYMENT OPPORTUNITY

Name of Prime Contractor: ____________________________
Project WBS & OA Number: __________________________
Address: _________________________________________

GENERAL

In accordance with Executive Order 11246 (30 F.R. 12319-25), the implementing rules
and regulations thereof, and orders of the Secretary of Labor, a certification regarding
Equal Opportunity is required of bidders or prospective contractors and their proposed
subcontractors prior to the award of contracts or subcontracts.

SUBCONTRACTOR'S CERTIFICATION

Subcontractor's Name: ____________________________________________
Address: _______________________________________________________
E-Mail Address: _________________________________________________
IRS Employer Identification Number: ________________________________
Job Description: ________________________________________________
(Work performed by your company for this project)

1. Participation in a previous contract or subcontract.
   a. Subcontractor has participated in a previous contract or
      subcontract subject to the Equal Opportunity Clause. _____YES_____NO
   b. Compliance reports were required to be filed in
      connection with such contract or subcontract. _____YES_____NO
   c. Subcontractor has filed all compliance reports required by Executive Orders
      10925, 11114, 11246, or by regulations of the Equal Employment
      Opportunity Commission issued pursuant to Title VII of the Civil Rights Act
      of 1964. _____YES_____NO
   d. If answer of Item c. is "No", please explain in
detail on reverse side of this certification.

2. Dollar amount of proposed subcontract: _______________________

3. Anticipated performance period in days: ________________________
4. Expected total number of employees to perform the proposed subcontract: 

5. Nonsegregated facilities.

   a. Notice to prospective federally-assisted construction contractors
      (1) A Certification of Nonsegregated Facilities, as required by the May 9, 1967, order (32 F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted to the Contractor prior to the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Opportunity Clause.
      (2) Contractors receiving subcontract awards exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause will be required to provide for the forwarding of this notice to prospective subcontractors for supplies and construction contracts where the subcontracts exceed $10,000 and are not exempt from the provisions of the Equal Opportunity clause.

   b. Certification of non-segregated facilities

      The federally-assisted construction contractor certified that he/she does not maintain or provide any segregated facilities at any of his/her establishments, and does not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor certifies further that he/she will not maintain or provide any segregated facilities at any of his/her establishments, and will not permit employees to perform their services at any location, under his/her control, where segregated facilities are maintained. The federally-assisted construction Contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants, and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin because of habit, local custom, or otherwise. The federally-assisted construction Contractor agrees that (except where he/she has obtained identical certifications from proposed Subcontractors for specific time periods) he/she will obtain identical certifications in duplicate from proposed Subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he/she will retain the duplicate of such certifications in his/her files. The Contractor will include the original in his/her Bid Package.

6. Race or ethnic group designation of bidder. Enter race or ethnic group in
appropriate box:

☐ White  ☐ Black  ☐ Hispanic

☐ Pacific Islander, Asian  ☐ American Indian, Aleut.

7. Gender

☐ Male  ☐ Female

REMARKS:

Certification - The information above is true and complete to the best of my knowledge and belief.

__________________________________________

Company Officer (Please Type)

__________________________________________  ______________

Signature  Date

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.
### CITY OF HOUSTON

**Company Wide EEO Report**

1. Check One
   - ___Prime
   - ___Subcontractor

2. Name and Address

3. FEID No.

4. County

5. TX CSJ DOT Project No. (if Applicable)

6. Contractor’s Beginning Work Date on Project

7. City Of Houston Contract No.

8. This Report is based on Pay Period ending MM/DD/YYYY

### TABLE A

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### TABLE C

**On-The-Job Trainees**

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### 9. TEXAS CONSTRUCTION EMPLOYMENT

- **TABLE B**
  - **On-The-Job Trainees (OJT)**
  - **OJT TOTALS**
  - **M F**

10. IF ANY EMPLOYEES REPORTED IN 'TABLE A' ARE APPRENTICES, NAME OF THE PROGRAM, JOB CATEGORY, COUNT, RACE & SEX.

11. SUMMARIZE ALL HIRES FOR THE ENTIRE ACTIVE MONTH BY JOB CATEGORY, RACE, SEX (USE ADDITIONAL SHEET IF NEEDED).

### 12. PREPARER

### 13. REVIEWER
Certification by Proposed Material Suppliers, Lessor, and Professional Service Providers Regarding Equal Reemployment Opportunity

Company Name: ________________________________ $ ____________________________
(Supplier, Lessor, Professional Service Provider) (Amount of Contract)

Company Address: ________________________________________________________________

Company Telephone Number: __________________ Fax: __________________________

Goods or Service to be provided: __________________________________________________

Web Page/URL Address: __________________________________________________________

Company Tax Identification Number: ______________________________________________

Project No: [WBS/CIP/AIP/File No.]

Project Name: [Legal Project Name]

In accordance with the City of Houston Ordinance 78-1538, Supplier/Lessor/Professional Service Provider represents to be an equal opportunity employer and agrees to abide by the terms of the Ordinance. This certification is required of all Suppliers/Lessors/Professional Service Providers (hereinafter “Supplier”) with contracts in the amount of $10,000.00 or more.

[ ] YES [ ] NO Supplier agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, or age.

[ ] YES [ ] NO Supplier agrees that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin, or age.

[ ] YES [ ] NO Supplier will comply with all provisions of Executive Order No. 11246 and rules, regulations and applicable orders of the Department of Labor or other Federal Agency responsible for enforcement of applicable equal opportunity and affirmative action provisions and will likewise furnish all information and reports required by the Mayor or Contract Compliance Officers for the purpose of investigation to ascertain and effect compliance with the City of Houston’s Office of Affirmative Action and Contract Compliance.

[ ] YES [ ] NO The Supplier shall file and cause their sub-tier contractors to file compliance reports with the City in the form and to the extent as may be prescribed by the Mayor or Contract Compliance Offices. Compliance reports filed at such times as directed shall contain information including, but not limited to, the practice, policies, program, and employment policies.

I hereby certify that the above information is true and correct.

__________________________________________________________ Date
COMPANY OFFICER (Signature)

NAME AND TITLE (Print or type) ___________________________ E-Mail Address

END OF DOCUMENT
I. GENERAL

A. CITY AUTHORITIES

1. The “OBO Director” is the City of Houston’s Office of Business Opportunity Director, or his or her designee.

   City of Houston
   611 Walker Street, 7th Floor
   Houston, Texas 77002

2. The “Contracting Department” for this Project is the City of Houston Department specified in Document 00520 – Agreement.

3. The “Project Manager” for this Project is specified in Document 00550, Contract Approval Notification.

II. REOCCURRING REPORTS THAT MUST BE SUBMITTED DURING THE COURSE OF THE CONTRACT:

A. MWSBE MONTHLY REPORT PROCESS


B. The Contractor shall comply with further, applicable instructions regarding reporting and compliance as provided in Sections III.E and III.I below.

III. BUSINESS ENTERPRISE PROGRAM REQUIREMENTS:

A. PURPOSE

   This Document facilitates implementation of City of Houston, Tex. Code of Ordinances Chapter 15, Article V, § 15-81 et seq., relating to MWSBE contract 00808-1
   07-01-2016

B. POLICY

It is the policy of the City to encourage the full participation of Minority and Women-owned Business Enterprises, Small Business Enterprises, and Persons with Disabilities Business Enterprises in all phases of its procurement activities and to afford them a full and fair opportunity to compete for City contracts at all levels.

C. POLICY ELEMENTS

1. The Contractor agrees to ensure that MWSBE firms have a full and fair opportunity to participate in the performance of City contracts. In this regard the Contractor shall make all reasonable Good Faith Efforts to meet the Contract Goals for this Contract.

2. The Contractor and any Subcontractor shall not discriminate on the basis of race, color, religion, national origin, or sex in the performance of City contracts.

3. Contractor's performance in meeting the Participation Plan Percentage will be monitored during the construction phase of the Contract by the Office of Business Opportunity (“OBO”) and the Contracting Department (the “Department”).

D. PERCENTAGE GOALS

The MWSBE goals and PDBE goals, if any, for the Work are specified in Document 00800 – Supplementary Conditions Goals.

E. CONTRACTOR RESPONSIBILITIES

1. Prior to Award:
   The Bidder shall submit MWSBE documents in accordance with the requirements of Document 00410 – Bid Form Part A.

   a. In accordance with the Code of Ordinances and the OBO Good Faith Efforts Policy (Attachment A), the Department shall approve an Apparent Low Bidder’s MWSBE Participation Plan, Document 00470 (the “Bidder’s Plan” or “Plan”), within three business days
of the Bid Opening only if the Department representative determines that Bidder’s Plan meets the advertised Contract Goal and is administratively complete.

b. If the Department cannot approve the Bidder’s Plan, it shall forward the Plan to OBO, who shall review the Bidder’s Plan, and if applicable, the Bidder's Document 00471 (Record of Good Faith Efforts) and Document 00472 (Pre-Award Deviation Request) and determine whether the Bidder has made Good Faith Efforts to meet the Contract Goals within 10 business days of the Bid Opening.

c. The Bidder may not use MWSBE Suppliers to account for more than 50% of the MWSBE participation plan.

d. If OBO determines that the Bidder has failed to provide a valid participation plan or make Good Faith Efforts or if the Bidder fails to provide documents and associated information required by this Document 00808 or reasonably requested in writing by OBO, OBO may declare the Bidder to be non-responsible.

e. If OBO determines that the Bidder has made Good Faith Efforts, OBO may approve the Bidder’s Contract Goal Deviation request. Thereafter, the Bidder/Contractor shall be bound by the Plan, as approved or modified by OBO.

f. The Contractor shall:

(1) ensure that all MWSBE firms listed in the Plan are certified by the Office of Business Opportunity prior to bid date. Qualified, non-certified firms may obtain priority consideration for certification if no more than two firms are certified with the same capability as the non-certified firm.

(2) execute written contracts with all certified Subcontractors and Suppliers. All such contracts must be executed and sent to OBO and Contracting Department within 30 days after the date of the Notice to Proceed and must include provisions set forth in Articles 3 and 5 of Document 00700, General Conditions; and

(3) designate an MWSBE liaison officer who will administer the Contractor's MWSBE program and who shall document and maintain records of Good Faith Efforts to subcontract with MWSBE Subcontractors and Suppliers.

2. After Award:

a. The Contractor shall submit MWSBE Monthly Utilization Reports, as requested in Article II above.

b. The Contractor shall complete and submit to OBO a deviation request if the Contractor reasonably believes that it will not achieve the Business Enterprise Program Participation Plan Percentage documented in the Plan. The Contractors shall also

00808-3
07-01-2016
submit to OBO, with a copy to the Contracting Department, a Record of Post-Award Good Faith Efforts (Document 00571) for each Certified Firm that the Contractor does not use in accordance with the Approved Plan before the Contractor uses another firm to perform the work.

c. The Contractor shall conform to the Plan unless OBO approves a deviation request. OBO shall approve or reject a request for deviation within five business days of receipt of the request.

d. OBO shall approve a deviation request if:

(1) for a reason beyond the Contractor’s control, the Contractor is unable to use the certified MWSBE firm in the Plan to perform the specified work. In such cases, the Contractor shall use and document Good Faith Efforts to find a similarly qualified, certified MWSBE firm to perform such specified work; or

(2) the Contractor reasonably believes that, due to a change of scope, execution of the work in accordance with the directions from the Contracting Department is unlikely to meet the terms of the Plan. In such cases, the Contractor shall use and document Good Faith efforts to achieve a reasonable amount of MWSBE participation on the remaining work on the Contract.

(3) OBO shall not unreasonably withhold approval of a deviation request.

e. After the Date of Substantial Completion, OBO shall evaluate the Contractor’s Good Faith Efforts towards meeting the Plan, as it may be amended.

f. If the Contractor fails to conform to the Plan and fails to submit a Post-Award Deviation Request or provide documents and associated information required by the Good Faith Efforts Policy or reasonably requested in writing by OBO, OBO may impose sanctions in accordance with Article VI of this Document 00808.

F. ELIGIBILITY OF MWSBE FIRMS FOR SUBCONTRACTING

1. To ensure that the City’s Business Enterprise Program benefits only those firms that are owned and controlled by a minority person(s), a woman (women), a person(s) with a disability, or a small business enterprise, the Office of Business Opportunity will certify the eligibility of MWSBE and PDBE Contractors, Subcontractors, and Suppliers. Contact the OBO Certification Division at 832-393-0600 for information regarding certification.

2. Firms must be certified by OBO at the time of bid in order to be counted towards meeting MWSBE goals. OBO maintains a Certified Minority,
G. DETERMINATION OF MWSBE PARTICIPATION

MWSBE participation shall be counted toward meeting the Contract Goals in response to the following:

1. Contractor may count toward its Contract Goals only those MWSBE Subcontractors/Suppliers performing a Commercially Useful Function.
   a. **COMMERICALLY USEFUL FUNCTION** means a discrete task or group of tasks, the responsibility for performance of which shall be discharged by the MWSBE firm by using its own forces or by actively supervising on-site the execution of the tasks by another entity for whose work the MWSBE firm is responsible. In determining whether a certified firm is performing a commercially useful function, factors including but not limited to the following shall be considered: (1) whether the firm has the skill and expertise to perform the work for which it is being utilized and possesses all necessary licenses; (2) whether the firm is in the business of performing, managing, or supervising the work for which it has been certified and is being utilized; and (3) whether it is performing a real and actual service that is a distinct and verifiable element of the work called for in a contract. Without limiting the generality of the foregoing, a MWSBE will not be considered to be performing a commercially useful function, if it subcontracts more than 50 percent of a contract being counted toward the applicable Contract Goals, unless such subcontracting in excess of 50 percent has been expressly approved by OBO either pre-bid or post award.
   b. OBO shall approve a Plan Deviation Request if the Contractor demonstrates that the industry standard for the type of work involved is to subcontract over 50 percent of the work.

2. Once a firm is certified as a MWSBE firm, the total dollar value of the subcontract awarded to the MWSBE firm is counted toward the Contract Goals, counting only the work in which the MWSBE has performed a Commercially Useful Function. The use of one MWSBE certified firm to meet multiple goals (e.g. MBE, WBE, SBE goals) on a contract is prohibited, unless expressly approved by OBO. Safety and Participation goals do not count as a single goal concerning MWSBE/DBE requirements.

3. Native-American-owned firms that are certified as MBEs cannot be used to
meet MBE contract goals. Native American firms can only be used as SBEs in fulfillment of MBE contracts goals, with any limitations expressly stated in Document 00800.

4. The dollar value of the work performed by a certified Prime Contractor may not be counted toward the MWSBE goal unless the certified Prime Contractor is a part of a joint venture. When the Contractor or Subcontractor is in a joint venture with one or more MWSBE firms, OBO shall determine the percent of participation resulting from such joint venture to be counted toward the Contract Goals. The City may count towards the Contractor’s MWSBE contract goal that portion of the total value of the contract amount paid to an MWSBE joint venturer equal to the distinct, clearly defined portion of the contract work performed by the MWSBE.

5. The Contractor may not use MWSBE Suppliers to account for more than 50% of the MWSBE participation plan. A MWSBE Supplier’s participation will be counted towards the MWSBE goals if all of the criteria below are met. The MWSBE Supplier must:
   a. negotiate price;
   b. determine quality and quantity;
   c. order the materials;
   d. show that the invoice is in the certified firm’s name;
   e. pay for the material itself;
   f. control delivery; and
   g. be certified to provide the supplies in the appropriate NAICS code.

If the listed criteria above are not met, only the entire amount of fees or commissions charged for assistance in the procurement of the supplies and materials, or fees or transportation charges for the delivery of supplies or materials required on a job site will be counted towards the MWSBE goal. To be counted, proof must be provided of the fees paid and the fees must be reasonable and not excessive as compared with fees customarily allowed for similar services.

6. The OBO Policy and Procedures Manual, as amended from time to time, shall apply to the Contract for other determinations regarding counting MWSBE participation not explicitly provided for in the Contract.

H. CONTRACTOR COMPLIANCE

To ensure compliance with MWSBE requirements, OBO and the Department will monitor Contractor's efforts regarding MWSBE Subcontractors/Suppliers during the performance of this Contract. This may be accomplished through the following: job site visits; reviewing of records and reports; and interviews of randomly selected personnel.
I. RECORDS AND REPORTS

1. In accordance with II.A of this Document, the Contractor shall submit an initial report outlining MWSBE participation 40 days after the Notice to Proceed date, and on or before the 15th day of each month thereafter until all MWSBE subcontracting or material supply activity is completed. Each report shall cover the preceding month’s activity. The Contractor shall use the MWSBE Contract Compliance and Monitoring System (B2G Now) to meet this requirement.

2. Contractor shall maintain the following records for review upon request by OBO or the Department:
   a. Copies of executed Subcontractor agreements and purchase orders;
   b. Documentation of payments and other transactions with MWSBE Subcontractors/Suppliers; and
   c. Appropriate explanations of any changes or replacements of MWSBE Subcontractors/Suppliers. All replacement MWSBE Subcontractors/Suppliers must be certified by OBO.
   d. Any other records required by OBO or Contracting Department.

3. If a Participation Plan Percentage is not being met, the monthly report shall include a narrative description of the progress being made in MWSBE participation. If sufficient MWSBE Subcontractors or Suppliers to meet the Participation Plan Percentage are being utilized, they should be identified by name and the dollar amount paid to date for work performed or materials furnished by each MWSBE during the monthly period. Reports are required when no activity has occurred in a monthly period.

4. Contractor shall retain all such records for a period of four years following completion of the Work and shall be available at reasonable times and places for inspection by authorized representatives of the City including the City Controller.

IV. SANCTIONS:

A. SUSPENSION PERIOD AND WAIVER

Pursuant to Section 15-86 of the Code of Ordinances, OBO is authorized to suspend any Contractor who has failed to make Good Faith Efforts for a period of up to, but not to exceed, five years.

B. GUIDELINES FOR IMPOSITION OF SANCTIONS
1. General:
   a. OBO shall not impose any sanction except upon evidence of specific conduct on the part of a MWSBE or Contractor that is inconsistent with, or in direct contravention of, specific applicable requirements for Good Faith Efforts.
   b. Imposition and enforcement of suspensions shall be consistent with applicable state law.

2. Severity of Sanctions:
   a. In determining the length of any suspension, OBO shall consider the following factors:
      (1) Whether the failure to comply with applicable requirements involved intentional conduct or, alternatively, may be reasonably concluded to have resulted from a misunderstanding on the part of the Contractor or MWSBE of the duties imposed on them by Article V of Chapter 15 of the Code of Ordinances and these procedures;
      (2) The number of specific incidences of failure by Contractor or MWSBE to comply;
      (3) Whether the Contractor or MWSBE has been previously suspended;
      (4) Whether the Contractor or MWSBE has failed or refused to provide OBO with any information requested by OBO’s Director or required to be submitted to OBO’s Director pursuant to law or these procedures;
      (5) Whether the Contractor or MWSBE has materially misrepresented any applicable facts in any filing or communication to OBO; and
      (6) Whether any subsequent restructuring of the subject business or other action has been undertaken to cure the deficiencies in meeting applicable requirements.
   b. Suspensions may be for any length of time not to exceed five years. Suspensions in excess of one year shall be reserved for cases involving intentional or fraudulent misrepresentation or concealment of material facts, multiple acts in contravention of applicable requirements, cases where the Contractor or MWSBE has been previously suspended, or other similarly egregious conduct.

C. APPEALS

A decision to implement a suspension may be taken after notice and an opportunity for an informal conciliation conference with OBO and a hearing by
the Contract Compliance Commission. Commission members shall not have participated in the actions or investigations giving rise to the suspension hearing.

D. NOTICE

1. Prior to imposing any suspension, OBO shall deliver written notice to the Contractor or MWSBE setting forth the grounds for the proposed suspension and setting a date, time, and place to appear for an informal conciliation conference with OBO, in addition to information regarding the appearance before the Contract Compliance Commission for a hearing on the matter.

2. Any notice required or permitted to be given hereunder to any Contractor or MWSBE may be given either by personal delivery or by certified United States mail, postage prepaid, return receipt requested, addressed to their most recent address as specified in the records of the Office of Business Opportunity or in the Contract if no address is on file with the Office of Business Opportunity.

E. HEARING PROCEDURES

Proceedings before the Contract Compliance Commission shall be conducted in accordance with Section 15-23 of the Code of Ordinances. If the Commission, in a written decision, finds that a suspension is supported by the evidence presented, the Commission shall submit its recommendation to the Mayor and City Council.
City of Houston
Office of Business Opportunity
Good Faith Efforts Policy

General Policy.

Good Faith Efforts are steps taken to achieve an Contract Goal or other requirements which, by their scope, intensity and usefulness demonstrates the bidder’s responsiveness to fulfill the business opportunity objective prior to the award of a contract, as well as the contractor’s responsibility to put forth measures to meet or exceed the Contract Goal(s) throughout the duration of the contract.

Good Faith Efforts are required to be made and demonstrated by an apparent successful bidder on goal-oriented contracts or proposer on a regulated contract prior to award of a contract. Good Faith Efforts are required on professional services and construction contracts and on procurement of goods and non-professional service contracts with goals. If a bidder, when submitting a participation plan at the time of bid or proposal submission, anticipates it cannot or will not meet the Contract Goal(s) prior to the award, the bidder must demonstrate to Office of Business Opportunity (“OBO”) it has made Good Faith Efforts to meet the Contract Goal(s), to be eligible for the contract award.

Good Faith Efforts shall be evaluated on a case-by-case basis in making a determination whether a bidder or contractor is in compliance with this policy. The efforts employed by a bidder or contractor should be those that one could reasonably expect a bidder or contractor to take if the bidder or the contractor were actively and aggressively attempting to obtain MWSBE participation sufficient to meet the Contract Goal(s). Efforts taken that are mere formalities or other perfunctory acts shall not be considered Good Faith Efforts to meet Contract Goals.

The factors provided herein are representative of the types of actions OBO will consider in determining whether the bidder or contractor made Good Faith Efforts to obtain MWSBE participation to meet the Contract Goal(s). The list of factors described below are not intended to be a mandatory checklist, nor is it intended to be exhaustive or exclusive. OBO may consider other factors or types of efforts that may be relevant in appropriate cases.

If a bidder or contractor fails to submit Good Faith Efforts documentation as provided in this Policy, it waives the right to appeal OBO decisions related to this Policy. OBO will review all the efforts made by the contractor, including the quality and quantity of those efforts.

Pre–Award.
A bidder must submit a participation plan (Document 00470) to OBO at the time the bidder submits the bid. If the participation by certified MWSBE subcontractors documented on the participation plan (“participation”) is less than the Contract Goal(s), a bidder should submit a Record of Good Faith Efforts (Document 00471) with the bid. A bidder should also submit a request for a deviation (Document 00472) if the bidder, having used Good Faith Efforts, reasonably believes that it cannot meet the Contract Goal(s) or a commercially useful deviation.

In making a determination that the bidder has made a good faith effort to meet the Contract Goal(s), OBO shall consider specific documentation\(^1\) concerning the steps taken to obtain MWSBE participation, with a consideration of, by way of illustration and not limitation, whether the bidder demonstrated a genuine effort to comply with the following factors:

1. Attended any pre-bid or pre-proposal meetings scheduled by the City Department;

2. Followed up with MWSBEs that attended the pre-bid or pre-proposal meetings to discuss subcontracting and supplier opportunities and contacted MWSBEs listed in the City’s online directory;

3. Conducted outreach with minority and women focused organizations and associations far in advance of solicitation due date (no less than 10 business days);

4. Identified and designated portions of the work to be performed by MWSBEs to increase the likelihood of meeting the Contract Goals (including where appropriate breaking down the contract into reasonably sized subcontracts to ensure participation);

5. Advertised subcontracting opportunities in news media focused towards minority and women persons far in advance of solicitation due date;

6. Provided MWSBEs with a point of contact that was knowledgeable about the project and possessed decision-making authority to answer questions from interested MWSBEs;

7. Provided a reasonable number of MWSBEs certified with timely written notices via email, mail, and/or fax and/or with documented contact regarding the subcontracting/supplier opportunities. A “reasonable number of MWSBEs” shall be based on the number of MWSBEs available in the directory;

\(^1\) A list of common supporting documentation that may allow Contractors to support their good faith efforts can be found on the Office of Business Opportunity website at www.houstontx.gov/obo.
8. Solicited the MWSBEs within a reasonable amount of time (no less than seven business days) before bid submission, as well as followed up with the MWSBEs solicited to determine if they were interested in submitting a bid or proposal or participating on a team.

9. Provided interested MWSBEs certified to perform the solicited work with prompt access to the plans, specifications, scope of work and requirements of the contract;

10. Negotiated in good faith with interested MWSBEs, and not rejecting MWSBEs as unqualified without sound reasons based on a thorough investigation of their capabilities;

11. Entered into a formal contract, or signing enforceable letters of intent with MWSBEs;

12. Provided an explanation to any MWSBE whose bid or price quotation is rejected, unless another MWSBE is accepted for the same work, as follows:
   a. Where price competitiveness is not the reason for rejection, a written rejection notice including the reason for rejection will be sent to the rejected MWSBE firm;
   b. Where price competitiveness is the reason for rejection, a meeting must be held with the price-rejected MWSBE, if requested, to discuss the rejection;

13. Ensured that MWSBE Supplier participation did not account for more than 50% of the MWSBE participation plan.

14. Made efforts to assist interested MWSBEs in obtaining bonding, lines of credit, insurance required for the contract, and documenting MWSBE denied by bona fide surety agents;

15. Ensured that the conditions and requirements for subcontracts are commensurate with industry standards and would not cause an economic hardship on MWSBEs, such as unnecessary insurance or coupling bid bonds with retainage; and

16. Incorporated efforts not attempted earlier or on previous bids that appear more likely to lead to attaining the Contract Goal. Past performance on similar contracts with similar scopes will also be taken in consideration when determining Good Faith Efforts. A bidder that continues to make same efforts without any significant change in the level of participation may not be making Good Faith Efforts.

Post–Award.

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The contractor must sign the approved participation plan (Document 00470 or Document 00570) prior to starting work on the Project. A contractor should submit a request for deviation from OBO if the contractor, having made Good Faith Efforts, reasonably believes that it will not achieve the Participation Plan Percentage documented in the approved participation plan. Unless OBO approves a deviation, a contractor must submit to OBO a Participation Summary (Document 00660) prior to City Council’s consideration of any close-out, term extension, or change order. If participation is less than anticipated in the approved participation plan, the contractor must submit supporting documentation evidencing their Good Faith efforts, along with the Participation Summary. A contractor that fails to submit a deviation request and Good Faith Efforts documentation waives the right to appeal OBO decisions related to this Policy.

If the contractor is awarded the contract and fails to achieve the established Participation Plan Percentage(s), the contractor must demonstrate to OBO its efforts to meet the Participation Plan Percentage(s) and failure to do so based on circumstances that the contractor could not reasonably control. In determining whether the contractor made Good Faith Efforts to ensure full participation and achievement of the Participation Plan Percentage, OBO shall consider the following factors:

1. Whether the contractor designated an MWSBE liaison officer to administer the Contractor’s MWSBE programs and to be responsible for maintenance of records of Good Faith Efforts.

2. Whether the contractor furnished prompt MWSBE Utilization Reports in a timely and accurate manner through the online Contract Monitoring System or via hard copy.

3. Whether the contractor responded to efforts to resolve disputes with MWSBEs, and genuinely attempted to resolve these issues.

4. Whether the contractor disclosed payment discrepancies timely and within the monthly reporting period;

5. Whether the contractor complied with the participation plan, unless the contractor received a deviation from the OBO Director and whether upon approval, the contractor made Good Faith Efforts to replace a removed MWSBE with another certified firm;

6. Whether MWSBE Supplier participation accounted for more than 50% of the MWSBE participation plan;

7. Whether the contractor furnished prompt written responses to written inquiries from the Director or any employee of OBO regarding the MWSBE’s performance or information germane to the MWSBE’s certification;
8. Whether the contractor ensured that at all times during the performance of any contract or subcontract the MWSBE firm is engaging in a commercially useful function as that term is defined in Chapter 15 of the City of Houston Code of Ordinances;

9. Whether the contractor provided the OBO information, or other material, that was factually accurate and free of material misrepresentation;

10. Whether the contractor furnished prompt responses to requests for information, books and records needed to verify compliance from the department administering the Contract, the City Attorney and the City Controller;

11. Whether the contractor attended all meetings and mediation hearings as requested by the Director or his/her designee; and

12. How the contractor may be affected by change orders, with consideration given to the size of the change orders.

Change Orders.

The requirement to make Good Faith Efforts to achieve the approved Participation Plan Percentage is applicable to change orders. Contractors should make Good Faith Efforts to ensure that the Participation Plan Percentage remains substantially the same after the issuance of change orders. If a contractor cannot maintain substantially the same level of participation provided in the latest approved Participation Plan (Document 00470 or Document 00570) due to a change order, the contractor shall submit to the OBO Director and Contracting Department a Document 00571 (Post-Award Record of Good Faith Efforts) and Document 00572 (Post-Award Plan Deviation Request) in a timely manner that does not cause disruption to the project. In addition to other relevant factors, in evaluating whether Good Faith Efforts were made by the contractor to meet the Participation Plan Percentage despite change orders, the OBO Director shall consider the contractor’s efforts to timely and efficiently deliver the project.

END OF DOCUMENT
WAGE SCALE AND PAYROLL REQUIREMENTS FOR ENGINEERING CONSTRUCTION

Wage Scale Requirements

1.1 Contractor and its Subcontractors must pay the general prevailing wage rates for building construction for each craft or type of worker or mechanic employed in the execution of any building construction or repair under the Contract in accordance with Chapter 2258 of the Texas Government Code and City of Houston, Texas Ordinance Nos. 85-2070, 2000-1114, 2001-152, 2006-91 and 2006-168, and 2009-247 all as amended from time to time. City Council has determined the prevailing wage rate in the locality in which the work is being performed, which is set forth in Exhibit "A".

1.2 This prevailing wage rate does not prohibit the payment of more than the rates stated.

1.3 In bidding, Contractor warrants and represents that it has carefully examined the classifications for each craft or type of worker needed to execute the Contract and determined that such classifications in Exhibit "A" include all necessary categories to perform the work under the Contract.

1.4 The wage scale for engineering construction is to be applied to all site work greater than five feet from an exterior wall of new building under construction or from an exterior wall of an existing building.

1.5 If Contractor believes that an additional classification for a particular craft or type of worker is necessary to perform work under the Contract, it must submit with its bid a request to the Contract Compliance Division of the Office Of Business Opportunity ("OBO") to use an additional labor classification not listed in Exhibit "A" and specify the proposed new classification. OBO shall determine whether a proposed classification is already covered in Exhibit "A", and, if it is, specify which classification is appropriate. OBO’s decision is conclusive. If OBO decides that a new classification is necessary, it will determine the appropriate prevailing wage rate for any resurveyed, amended, new, or additional craft or type of worker not covered by Exhibit "A". Such determination must be decided in accordance with procedures established by OBO, and in compliance with Chapter 2258 of the Texas Government Code and City of Houston, Texas Ordinance Nos. 85-2070, 2000-1114, 2001-152, 2006-91, 2006-168 and 2009-247 subject to City Council approval.

1.6 Contractor must not use any labor classification not covered by Exhibit "A" until such classification is established and approved for use by OBO.

1.7 A Contractor or Subcontractor who violates Chapter 2258 of the Texas Government Code must pay to the City, $60 per each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates set forth in Exhibit "A".
1.8 The City may withhold money required to be withheld under Chapter 2258 of the Texas Government Code from the final payment to Contractor or earlier payments if City Council makes a determination that there is good cause to believe that Contractor has not complied with these provisions and Chapter 2258 of the Government Code, in which case the City may withhold the money at any time subsequent to the finding by City Council.

1.9 Contractor and Subcontractors must keep records specifying:

(1) the name and classification of each worker employed under the Contract; and

(2) the actual per diem wages paid to each worker, and the applicable hourly rate.

The records must be open at all reasonable hours for inspection by the officers and agents of the City.

1.10 The hourly cost of salary for non-exempt workers for labor in excess of 40 hours per worker per week, shall be calculated at 1.5 times the worker’s base pay for the applicable craft and level.

**Certified Payroll Requirements**

2.1 Employees are paid weekly and payrolls are submitted weekly using the City of Houston’s electronic payroll submission module, unless the prime Contractor has been instructed to do otherwise by the Office of Business Opportunity. When no work is done after a Contractor has started work, the Contractor is required to submit a weekly compliance statement indicating no work was performed. The payrolls must reflect the exact work and classification of the workers, the exact amount that they were paid. Workers must be paid the contracted amount (prevailing wage rates). The Contractor will be penalized $60.00 a day for each employee who is underpaid per Texas Government Code §2258.023 for all contracts.

2.2 Payrolls must be submitted electronically & indicate whether the worker worked inside or outside the building area when both wage rates are applicable to the contract.

2.3 Payrolls must be submitted each week until all work by the contractor is complete and the electronic payroll submission is marked as final in the system.

2.4 Payrolls must cover a seven day period from the start of the work week and must be consecutive seven day periods until all work is complete.

2.5 Payrolls must have employees’ names, addresses, last four digits of the social security numbers, and job classifications. The job classifications must be the same as the classifications on the prevailing wage rate schedule.

2.6 A payroll deduction authorization form must be submitted for each employee for any deductions other than Federal and FICA taxes.

2.7 Employees must be paid overtime (time and a half) for all hours worked over 40 hours a week on both federally and City-funded contracts.
2.8 The Contractor has the responsibility to comply with all Internal Revenue Service rules and regulations. Contractors who submit certified payrolls with Owner Operators (truckers) must submit a signed tax liability statement from Owner Operator acknowledging their responsibility for Federal Income Tax and FICA reporting obligations.

2.9 If the Contractor wants to use the apprentice wage rates for an employee, the apprenticeship certificates must be submitted to the Office of Business Opportunity in advance of the employee working on the project and appearing on the payroll. You must comply with the listed number of journeymen to apprentices as listed.

2.10 A poster of the Prevailing Wage Rate Schedule should be clearly displayed on each job site from the time the project starts until the work is completed, or in case of annual service agreements, in the Contractor's office.

2.11 The Contractor shall submit the “Certificate from Contractor Appointing Officer or Employee to Supervise Payment of Employees” (Exhibit “B”) to the Monitoring Authority listed in Document 00495 prior to final execution of the contract.

2.12 During the course of the work, ALL Subcontractors shall submit the “Certificate from Subcontractor Appointing Officer or Employee to Supervise Payment of Employees” (Exhibit “C”) to the Monitoring Authority listed in Document 00495.

2.13 Upon completion of the Project, as part of the contract-awarding department's total clearance process, the Office of Business Opportunity's Contract Compliance Section must review whether the Wage Rate and Payroll Requirements were met and report the results to the department.

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## LABOR CLASSIFICATIONS AND PREVAILING WAGE RATES FOR ENGINEERING CONSTRUCTION 2017

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* Apprentices- must be in an approved USDOL Program and cannot exceed ratios
Engineering Prevailing Wages Classification Definitions

**Asphalt Distributor Operator**
Drives distributor truck, sets spray bars and operates valves and levers to control distribution of bituminous material for highway surfacing. May oil, grease or otherwise service and make adjustments to equipment as needed. Performs other related duties.

**Asphalt Paving Machine Operator**
Operates paving machine that spreads and levels asphaltic concrete on highway subgrade. Controls movement of machine, raises and lowers screed, regulates width of screed. May, oil, grease, service and make adjustments to equipment as needed. Performs other related duties.

**Asphalt Raker**
Distributes asphaltic materials evenly over road surface by raking and brushing material to correct thickness; directs Laborers when to add or take away material to fill low spots or to reduce high spots. Performs other related duties.

**Asphalt Shoveler**
A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, applies coating of oil to inside face of forms, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

**Broom or Sweeper Operator**
Operates a self-propelled machine to sweep and clean roadway surfaces. May oil grease, service and make adjustments to equipment as needed. Performs other related duties.

**Bulldozer Operator**
Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material. May operate a ripper attachment to break up rock or other hard material. May use a push block on front of tractor to push load scrapers. May oil, grease, or otherwise service and make minor repairs to equipment as needed. Performs other related duties.

**Carpenter, Rough**
Works from plans to build, assemble, fit together, align, plum, and set in place forms for molding concrete structures. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks form while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools Performs other related duties.

**Concrete Finisher, Paving**
Finishes the exposed surfaces of fresh concrete paving, median barrier and every element of concrete structures to the final grade and contour structures to the final grade and contour with the use of straight edges and steel trowels. Operates bridge deck finishing machine. Finishes concrete curbs and gutters. Finishes exposed surface of concrete after forms have been removed by patching imperfections with fresh concrete, rubbing surface with abrasive stone, and directing others in removing excess or defective concrete with power tools. Performs other related duties.

**Concrete Finisher, Structures**
A worker semi-skilled in concrete finishing who assists Concrete finisher by performing specific or general duties of lesser skill and keeping Concrete Finisher supplied with materials, tools, and supplies; cleaning working area an equipment; and holding materials and tools. Performs other related duties.

**Concrete Paving Curbing Machine Operator**
Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

**Concrete Paving Finishing Machine Operator**
Operates self - propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh
concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Paving Joint Sealer Operator
Cleans and seals joints requiring a hot or cold sealing compound in concrete paving, sidewalks, driveway and approach slabs. May oil, grease or make necessary repairs adjustments to equipment as needed. Performs other related duties.

Concrete Paving Saw Operator
Operates a water-cooled power saw with either or an abrasive blade to saw expansion and contraction joints in concrete paving. May also be used to saw asphaltic pavements. May oil grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Concrete Paving Spreader Operator
Operates self-propelled machine(s) which may or may not travel on concrete paving forms, spreading and leveling fresh concrete to grade by use of augers and screeds. May oil, grease or otherwise service and make adjustments to equipment as necessary. Performs other related duties.

Concrete Rubber
Finishes the exposed surface of concrete masonry after the forms have been removed by patching holes and broken corners with fresh concrete, rubbing surface with abrasive stone to remove rough spots, and removing high spots and defective concrete with hand chisel and hammer or pneumatic chisel and powered abrasive stone. Performs other related duties.

Crane, Clamshell, Backhoe, Derrick, Dragline, Shovel Operator
A worker who operates a lattice boom type crane can hoist and move materials, raise and lower heavy weights and perform other related operations. May be crawler type or rubber tired. May include placement of rock riprap, clamshell, dragline, pipe and pile driving operations. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Crusher and Screed Plant Operator
Operates a crusher or screening plant through which rock is run to break it into crushed stone for construction or to control flow of materials not needed. May include minor repairs and may service and make necessary adjustments to equipment as needed. Performs other related duties.

Electrician *3 Journeyman 2 Apprentice
Plans and directs the layout of metal electrical conduit, installs wiring systems, switch-panels, buss bars, works on overhead distribution systems and underground distribution systems. Performs other related duties.

Flagger
A worker who directs traffic in or around a construction site. May use signs or devices to direct traffic. May help assemble, position and clean devices or equipment used to direct traffic. Must be able to effectively communicate with the public. May require certain level of training by TXDOT specifications. Performs other related duties.

Form Builder/Setter, Structures
Fits together, aligns and sets to grade metal and wooden forms for placement of concrete. Forms may be wood, steel, aluminum, fiberglass or any other type of material. Checks forms while concrete is placed. May install miscellaneous materials integral to concrete structures. May set precast concrete elements. Prepares for slipforming traffic rail and median barrier. May install permanent metal deck forms. May work with power tools. Performs other related duties.

Form Liner, Paving & Curb
Fits together, panels align and sets to grade metal and wooden forms for placement of concrete. Works with survey crew to set stringline for panels or moles. Performs other related duties.

Form Setter, Paving & Curb
Fits together, align and set to grade metal and wooden forms for placement of concrete paving and curbs. Works with survey crew to set stringline for paving, curb and gutter curb. Performs other related duties.

Foundation Drill Operator, Crawler Mounted
Operates a hole-drilling machine that is crawler mounted. May include geotechnical operations such as soils nails, rock nails, tiebacks, anchors and jet grouting. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
Foundation Drill Operator, Truck Mounted
Operates a hole drilling machine that is mounted on the rear of a rubber tired vehicle or truck. May include soils nails, rock nails, tiebacks, anchors and jet grouting. Drive truck from location to location or may have laborer who drives truck. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Front End Loader Operator
Operates a rubber tired, skid steer or crawler type tractor with an attached scoop type bucket on front end. Machine is used to load materials from stockpiles, excavation, charging batch plants, loading and unloading trucks. May be used with attachments in lieu of the bucket. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Laborer, Common
A general term used on construction work covering many unskilled classifications requiring work of a physical nature. A laborer works with all crews doing everything from pick and shovel work to cleaning up lumber with hammer, shoveling and placing concrete, uses air tools, cleans concrete joints and fills joints with sealing compound from bucket or with hose and nozzle from a central source, may help set and strip forms, unloads and transports reinforcing steel, cures newly poured concrete, helps lower pipe into ditch for pipelayers, builds fences, works with dirt crew keeping construction layout stakes out of the way of dirt moving equipment.

Laborer, Utility
Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

Manhole Builder
Constructs a means of permanent access to water and sewer lines for maintenance purposes. This work consists of laying brick or concrete slab at bottom of ditch up to an approximate grade line near the surface of the ground. Brick or block is normally laid to form a nearly circular manhole. Brick or block is laid in by eyesight and is normally to a plumb line. Chipped or culled brick can be used quite often. No effort may be made to keep mortar off the face of the brick and joints are not pointed. May apply coating of concrete to interior and exterior surface. Performs other related duties.

Mechanic
Assembles, set up, adjusts and maintains and repairs all types of construction equipment and trucks. He may perform the duties of a welder in repair of equipment. Performs other related duties.

Milling Machine Operator, Fine Grade
Operates a power-driven milling machine that planes material of the to roadbed and discharges the material into a hauling unit or a windrow. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Mixer Operator
Performs a variety of manual duties, usually working in a utility capacity by working on multiple projects and tasks where demands require workmen with varied experience and ability to work without close direction. Unloads and transports reinforcing steel. May occasionally place and tie reinforcing steel. Directs common laborers in pouring concrete. Erects shoring and bracing. Assists in installation of pipe. Installs, operate and maintains dewatering systems. May assist equipment operators in positioning machines, verifying grades and signaling operators. Directs truck drivers and scraper operators to dumping positions to maintain grades as directed. Uses power tools and air tools. May work as lead man in a labor crew. His performance of a wide variety of construction jobs distinguishes him from a helper assigned to a specific craft. Installs and maintains erosion control. Is more or less a general utility construction worker. May be second step in learning a skill, and may later become a helper in a specific classification. Performs other related duties.

Motor Grader Operator, Rough
Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.
Motor Grader Operator
Operates a motor grader. Equipment is used to grade excavation and embankment and to lay asphalt, base and other materials. May blade haul roads and do other general motor grader work, but does not perform finish grade work to close specification tolerances. This operator may be a learner in the first phase of learning the skills of motor grader work. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Oiler
A learner or semi-skilled worker who under the direction of the watch engineer. May oil and grease or otherwise service all engines and necessary equipment as needed. He may clean and paint engine room as needed. Performs other related duties.

Painter, Structures
Paints and stains structural steel and concrete surfaces of bridges, retaining walls, or other structures. Directs cleaning and abrasive blasting of surfaces prior to painting or staining. Performs other related duties.

Pavement Marking Machine Operator
Operates machine used in laying paint stripes or markers on all types of paving. Loads machine with appropriate materials and may walk or ride on machine. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Piledriverman
Sets in place, aligns, plumbs directs driving of timber, concrete, steel, pipe and any other type of piling. Sets, drives and pulls steel, concrete and other types of sheet piling. Rigs pile and leads and bracing. Signals operator. Splices piles before and after driving. Directs pile cutoff. May direct jetting or drilling equipment in connection with installing piles to grade. Performs other related duties.

Piplayer
Installs concrete, clay, steel, ductile iron, plastic, corrugated pipe and any other type of pipe for storm drainage, water lines, gas lines and sanitary sewer lines. Lays underground communication and electrical ducts. May install and set electrical ground boxes, hand holes, manholes, inlets and other structures. Caulks joints, makes threaded and flanged connections. Installs valves and other accessories. Performs other related duties.

Reinforcing Steel Setter, Paving
Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

Reinforcing Steel Setter, Structure
Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power tools. Performs other related duties.

Roller Operator, Pneumatic, Self-Propelled
Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Roller Operator, Steel Wheel, Flat Wheel/Tamping
Operates a self-propelled machine with either steel wheels or pneumatic tires which is used to compact earth fills, subgrade, flexible base and all other types of materials except bituminous. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Roller Operator, Steel Wheel, Plant Mix Pavement
Operates a self-propelled machine with either steel wheels pneumatic tires, which is used to compact and smooth all bituminous materials. May oil, grease or otherwise service and make necessary adjustments to equipment as needed. Performs other related duties.

Scraper Operator
Operates a self-contained wheeled tractor scraper both self loading or assisted by crawler tractors or other scrapers.
City of Houston Standard Document
Wage Scale and Payroll Requirements
for Engineering Construction

Used to excavate and transport earth or other materials. May oil, grease or otherwise service and make necessary
adjustments to equipment as needed. Performs other related duties.

Servicer
Drives a truck, which carries various fuels, oils, greases and filters. Must have knowledge of and is responsible for the
correct oiling and greasing and changing of filters on equipment according to the manufacturers’ specifications. Uses
compressed air grease guns, wrenches and other tools. May make adjustments to clutches, brakes and other mechanical
items. Keeps record of service preventive maintenance records. May have laborer assisting him. May require CDL if
driving truck on public highways. Performs other related duties.

Sign Installer (PGM)
Sets forms, reinforcing steel, anchor bolts and pours concrete for Sign foundations. Fabricates and erects pipe and angle
Frameworks by bolting, welding or other means prior to installation of signs that are normally prefabricated. Works from
plans in location and drilling holes for proper location and alignment of signs. May direct hoisting of signs into place.
Fastens signs to framework by bolting and other means. Locates and sets lighting brackets. May perform other work
associated with signing projects. Supervises sign erector helper. Performs other related duties.

Spreader Box operator
Operates spreader box by adjusting hopper and strike off blade so that the gravel, stone or other material may be spread
in a specific depth on road surface during seal coat and surface treatment operations. May oil, grease or otherwise
service and make necessary adjustments to equipment as needed. Performs other related duties.

Structural Steel Worker
Works from plans to lay out and install reinforcing steel within forms or in mats of concrete paving. May direct unloading
of material. Determines rigging required to complete work. Gives direction to reinforcing steel worker (helper) or common
or utility laborers. May install miscellaneous materials integral to concrete structure or paving. May work with power
tools. Performs other related duties.

Tractor operator, Crawler Type
Operates a crawler tractor with a bulldozer mounted in front of chassis to level, distribute and push earth or other material.
May operate a ripper attachment to break up rock or other hard material. May use a push block on front of tractor to push
load scrapers. May oil, grease, or otherwise service and make minor repairs to equipment as needed. Performs other
related duties.

Truck driver, single Axle, Light
Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have
various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May
services and make necessary adjustments for proper operation equipment. Performs other related duties.

Truck driver, Single Axle-Light
Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have
various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May
services and make necessary adjustments for proper operation equipment. Performs other related duties.

Traveling Mixer Operator
Drives a gasoline or diesel truck upon which is mounted a concrete mixer. Operates concrete mixer and dumps concrete
on the grade, into forms or into concrete pumps or buckets. Cleans mixer drum. May require CDL license for on highway
use. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

Truck driver, Single Axle, Heavy
Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have
various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May
services and make necessary adjustments for proper operation equipment. Performs other related duties.

Truck driver, Single Axle-Light
Drive a light capacity truck for transporting loads of construction material. The truck is of single rear axle type, may have
various kinds of beds attached, such as dump, flat bed, tank, etc. May require CDL license for driving on highway. May
services and make necessary adjustments for proper operation equipment. Performs other related duties.
Truck Driver, Tandem Axle, Semi-Trailer
Drives a diesel-powered tractor pulling a semi trailer hauling materials. Hauls dirt, rock, aggregates or other material. May require CDL license for driving on highway. May service and make necessary adjustments for proper operation of equipment. Performs other related duties.

Work Zone Barricade Servicer
Fabricates, erects and maintains temporary traffic control devices, including arrow boards, signs, barricades, channelizing devices, barrels and all message boards. May operates a truck during traffic control operations.

WELDERS - Receives rate for craft being performed to which welding is incidental.
CERTIFICATE FROM CONTRACTOR APPOINTING OFFICER OR EMPLOYEE TO SUPERVISE PAYMENT OF EMPLOYEES

Project Name: __________________________________________________________

E-Mail Address: ________________________________________________________

Project WBS#: __________________________ Date ______________________

(I) (We) hereby certify that (I am) (we are) the **Prime Contractor** for

______________________________

(specify type of job)

in connection with construction of the above-mentioned Project, and that (I) (we) have appointed __________________________, whose signature appears below, to supervise the payment of (my) (our) employees beginning __________________________, 20____; that he/she is in a position to have full knowledge of the facts set forth in the payroll documents and in the statement of compliance required by the Copeland Act and the City of Houston, which he/she is to execute with (my) (our) full authority and approval until such time as (I) (we) submit to the City of Houston a new certificate appointing some other person for the purposes hereinabove stated.

_________________________________________ Phone: _____________

(Identifying Signature of Appointee)

Attest: _____________________________________________________________

(Name of Firm or Corporation)

By: ________________________________ By: ________________________________

(Signature) (Signature)

___________________________ (Title) _____________________________ (Title)

NOTE: This certificate must be executed by an authorized officer of a corporation or by a member of a partnership, and shall be executed prior to and be submitted with the first payroll. Should the appointee be changed, a new certificate must accompany the first payroll for which the new appointee executes a statement of compliance required by the Copeland Act and the City of Houston.
CERTIFICATE FROM SUBCONTRACTOR APPOINTING OFFICER OR EMPLOYEE TO SUPERVISE PAYMENT OF EMPLOYEES

Project Name ____________________________________________________________

__________________________________________________________

E-Mail Address:________________________________________________________

Project WBS#:____________________________________Date____________

(I) (We) hereby certify that (I am) (we are) the Sub Contractor for __________

______________________________________________________________

(Specify work to be performed by subcontractor for this project)

in connection with construction of the above-mentioned Project, and that (I) (we) have appointed ____________, whose signature appears below, to supervise the payment of (my) (our) employees beginning _____________, 20___; that he/she is in a position to have full knowledge of the facts set forth in the payroll documents and in the statement of compliance required by the Copeland Act and the City of Houston, which he/she is to execute with (my) (our) full authority and approval until such time as (I) (we) submit to the City of Houston a new certificate appointing some other person for the purposes hereinabove stated.

______________________________________________________________ Phone:___________

(Identifying Signature of Appointee)

Attest: __________________________________________________________

(Name of Firm or Corporation)

By:__________________________ By:__________________________

(Signature) (Signature)

__________________________ ______________________________

(Title) (Title)

NOTE: This certificate must be executed by an authorized officer of a corporation or by a member of a partnership, and shall be executed prior to and be submitted with the first payroll. Should the appointee be changed, a new certificate must accompany the first payroll for which the new appointee executes a statement of compliance required by the Copeland Act and the City of Houston.

END OF DOCUMENT
1.0 DOCUMENT INCLUDES

A. Trench Safety Geotechnical Information: Geotechnical information obtained for use in design of the trench safety system is included as an attachment to this document.

2.0 RELATED DOCUMENTS

A. Section 02260 - Trench Safety Systems.

END OF DOCUMENT
PAY OR PLAY PROGRAM REQUIREMENTS

I. Pay or Play Program Overview

A. Purpose
The Pay or Play Program was established with Ordinance 2007-534 on July 1, 2007 and is governed by Executive Order 1-7. The Pay or Play Program (POP Program) creates a more level playing field and enhances fairness in the bid process between competing contractors that choose to offer health benefits to their workforce and those who do not. The program also recognizes and accounts for the fact that there are cost associated with health care of the uninsured citizens of the Houston and Harris County area.

B. Program Elements

1. Covered contracts:
   I.) Advertised after July 1, 2007 or which is executed on or after the effective date of this Executive Order.
   II.) Contracts valued at or above $100,000.00 (contract) and $200,000.00 (sub-contract) including contingencies, amendments, supplemental terms and/or change orders.
   III.) Professional Service, Construction, and Service type contracts.

2. Contracts not covered:
   I.) Any contract in which the primary purpose is procurement of property, goods, supplies, and or equipment.
   II.) An inter-governmental contract, inter-governmental agreement or purchasing cooperative.

3. Covered employees: This program applies to employees of a covered contractor or subcontractor, including contract labor, who are over age 18, work at least 30 hours per week and work any amount of time under a covered city contract or subcontract.

4. Pay or Play Option:
   I.) “Pays” by contributing $1.00 per covered employee per regular hour for work performed under the contract with the City; or
   II.) “Plays” by providing health benefits to covered employees. Health benefits must meet or exceed the following standards:
   • The employer will contribute no less than $150 per covered employee per month toward the total premium cost.
   • The employee contribution, if any amount, will be no greater than 50% of the monthly premium cost and no more than $150 per month.
*Note: (1) A contractor is deemed to have complied with section 5.4 of E.O. 1-7 with respect to a covered employee who is not provided health benefits if the employee refuses the benefits and the employee's contribution to the premium is no more than $40 per month. (2) If applicable the contractor has the option to both Pay and Play.

5. Exemptions/Waivers: The City of Houston will award a contract to a contractor that neither Pays nor Plays only if the contractor has received an approved waiver (Form POP-4 requested by City departments only).

6. Administration: Contractor performance in meeting Pay or Play program requirements will be managed by the contracting department. The Office of Business Opportunity (OBO) has administrative oversight of the program, including audit responsibilities (department compliance). Questions about the program should be referred to the Department POP Liaison an updated contact list is available on [http://www.houstontx.gov/obo/popforms.html](http://www.houstontx.gov/obo/popforms.html) or call Gracie Orr with the Office of Business Opportunity at 832-393-0633.

II. Documentation and Reporting Requirements

A. Document that must be signed and returned to administering department with the bid/proposal.

1.) City of Houston Pay or Play Program Acknowledgment Form (Form POP-1) acknowledges bidder/proposers’ knowledge of the program and its requirements, and the intention to comply.

B. Documents that must be signed and returned to administering department within a period designated by the department’s Contract Administrator, upon notification of low bidder or successful proposer status:

1.) Certification of Compliance with Pay or Play Program (Form POP-2)

   *Note - Contractors that opt to “play” must provide proof of coverage, including document from insurance provider, and names of covered employees.

2.) List of Subcontractors (Form POP-3)

   *Note- Review the affidavit statement at the bottom of this form for further important POP Compliance information.

C. Contractors reporting requirements:

1.) Contractors that opt to Pay
   Provide monthly reports to administering department, detailing names of employees, hours worked, exemptions (if any) and amount owed. (Form POP-5)
2.) Contractors that opt to Play
   Provide periodic reports to the contract administrator showing proof of coverage (insurance premium invoice or insurance card) reporting schedule will be determined by administering department based on length of contract. (Form POP-7)

3.) Employee Waiver Request
   Contractor may request POP program waiver by submitting the request on POP-8 if the employee is less than 18 years old, employee has other health coverage such as through spouse or parents, or Medicare/Medicaid.

   *Note proof of coverage must be provided in the form of a copy of the employee’s insurance card. (Remove social security numbers if applicable)

4.) Contractors shall submit an initial report with the second invoice to the department. Payments based on monthly reports are due to the contracting department with submission of the following month’s invoice. Payments may be made out to the City of Houston preferably via cashier check or business check.

III. Compliance and Enforcement

The Office of Business Opportunity will audit program compliance. Contractors willfully violating or misrepresenting POP program compliance will be subject to corrective and/or punitive action, including but not limited to the assessment of fines and penalties and/or debarment. The Pay or Play Program Requirements Form and all other POP Forms are available for downloading from the City of Houston’s Website at http://www.houstontx.gov/obo/popforms.html.
Document 00910

ADDENDUM NO. _____

Date of Addendum: ___________________  
***Enter date by hand when signed for release***

PROJECT NAME: «LegalPrjName»

PROJECT NO:  WBS No. «WBSNo»

BID DATE: «BidDate» (There is no change to the Bid Date.)

FROM: _____ «CityEngineer»___, P.E., City Engineer
       City of Houston, __ «Department»____
       «DeptAddr»________________________
       Houston, Texas  77002
       Attn: ___ «PrjMgrName»__, Project Manager

TO:    Prospective Bidders

This Addendum forms a part of the Bidding Documents and will be incorporated into the Contract documents, as applicable. Insofar as the original Project Manual and Drawings are inconsistent, this Addendum governs.

******************************************************************************
Use the following heading and select the appropriate wording for postponement of the Bid Date. Delete the statement beside Bid Date above which indicates that the Bid Date is unchanged. If change in Bid Date, issue as separate addendum. Delete this section entirely if there is no change in Bid Date.
******************************************************************************

CHANGE IN BID DATE

The Bid Date for this Project has been changed from __________ to __________.

[Time of day and place for submittal of bid remains the same]. [Time of submittal has been changed from __________ to __________. The place for submittal remains the same].

The bid date for this project has been indefinitely postponed.

00910-1
02-01-2004
Addendum

This Addendum uses the change page method: remove and replace or add pages, or Drawing sheets, as directed in the change instructions below. Change bars ( | ) are provided in the outside margins of pages from the Project Manual to indicate where changes have been made; no change bars are provided in added Sections. Reissued Drawing Sheets show the Addendum number below the title block and changes in the Drawing are noted by a revision mark and enclosed in a revision cloud.

Number each item of the Addendum beginning with 1 through the total number of change items in the Addendum. Sample entries are provided in brackets.

CHANGES TO PREVIOUS ADDENDA

Reference Addendum Number and item number to correct clarifications or make minor corrections of changes issued by previous Addenda.

ADDENDUM NO. __________
[1. Item 5. Change to read as follows:]

CHANGES TO PROJECT MANUAL

Follow this format to sequence changes to the Project Manual.

BIDDING REQUIREMENTS

Give the individual change instructions for each item of change by Document number and title. List changes in order of Document number.


CONTRACT FORMS

00910-2
02-01-2004

CONDITIONS OF THE CONTRACT


SPECIFICATIONS

[5. Section 02050 - Demolition. Add section including pages 02050-1 through 02050-3.]

CHANGES TO DRAWINGS

[6. Delete Sheet S-9, Beam Schedule, and replace with Sheet S-9-A.]

CLARIFICATIONS

[7. Document 00210 - Supplementary Instructions to Bidders states that no substitutions will be considered during the bidding phase. Substitutions will be considered during the first 15 percent of the Contract Time or first 90 days of the Contract, whichever is less, as stated in Document 00700 - General Conditions.]

END OF ADDENDUM NO. _____

DATED: ____________________________

«ADName»
«Title»
«Department»

«Initials1»

END OF DOCUMENT
NOTICE OF ADDENDUM NO. ______

Date of Addendum: ___________________
***Enter date by hand when signed for release***

PROJECT NAME: [Legal Project Name]

PROJECT NO: [WBS No.]

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

FROM: [Assistant Director’s Name], [AD’s Title]
City of Houston, [Contracting Department]
[Street Address of Contracting Department]
Houston, Texas [Zip Code]
Attn: [Project Manager’s Name] , Project Manager

TO: Prospective Bidders

******************************************************************************
Use the following heading and select the appropriate paragraph for postponement of the Bid Date. Delete the statement beside Bid Date above that indicates that the Bid Date is unchanged. Delete section entirely if there is no change in Bid Date.
******************************************************************************

CHANGE IN BID DATE

The Bid Date for this Project has been changed from ____________ to ____________.
[Time of day and place for submittal of bid remains the same]. [Time of submittal has been changed from ____________ to ____________]. The place for submittal remains the same.

***[OR]***

The bid date for this project has been indefinitely postponed. Another Addendum will be issued to reset the Bid Date or to cancel bidding on this Project.

The referenced Addendum forms a part of the Bidding Documents and will be incorporated into the Contract documents, as applicable.
Written questions regarding this Addendum may be submitted to the Project Manager following the procedures specified in Document 00200 – Instructions to Bidders. Immediately notify the City Engineer through the named Project Manager upon finding discrepancies or omissions in the Bid Documents.

********************************************************************************

An Addendum Synopsis is not required. You may delete, edit, or amplify the following list, as appropriate.

********************************************************************************

This Addendum includes:

**ADDENDUM SYNOPSIS**

Changes to Previous Addendum
Changes to Project Manual
  Bidding Requirements
  Contract Forms
  Condition of the Contract
  Specifications
Changes to Drawings
Clarifications

DATED: ___________________________

[Assistant Director]
[AD’s Title]
[Contracting Department]

END OF DOCUMENT
REQUEST FOR INFORMATION

1. PROJECT No.: [WBS No.]

2. RFI No.: ____________________________

3. PROJECT NAME: [Legal Project Name]

4. CONTRACTOR: [Contractor Name]

5. CONTRACT No.: ____________________________

6. SPECIFICATION Nos.: ____________________________

7. DRAWING Nos.: ____________________________

8. RESPONSE CODE: [ ] CRITICAL [ ] ROUTINE

9. DATE RESPONSE REQUIRED: __________

10. INFORMATION REQUIRED:

11. CONTRACTOR (Signature) ____________________________ TITLE ____________________________ DATE ____________________________

12. RESPONSE:

13. PROJECT MANAGER (Signature) ____________________________ DATE ____________________________

14. If Contractor believes the response given in Item 12 requires an adjustment in Contract Price or Contract Time, Contractor shall submit a timely proposal so as not to delay Contractor’s Work in accordance with General Conditions, Article 7 - Changes in the Work.

END OF DOCUMENT
Section 02081

CAST-IN-PLACE CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete manholes for sanitary sewers, water lines and storm sewers, including box sewers.

B. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for manholes is on a unit price basis for each manhole installed.

2. Payment for Type C manhole with BB inlet top is on a unit price basis for each.

3. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


L. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed design mix and test data for each type and strength of concrete.

C. Submit manufacturer's data and details of following items for approval:

1. Frames, grates, rings, and covers.

2. Materials to be used in fabricating drop connections.

3. Materials to be used for pipe connections at manhole walls.

4. Materials to be used for stubs and stub plugs.

5. Plugs to be used for sanitary sewer hydrostatic testing.

6. Installation instructions for forms.
PART 2  P R O D U C T S

2.01  CONCRETE

   A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

   B. Provide Class A concrete with minimum compressive strength of 4000 psi unless otherwise indicated on Drawings.

2.02  REINFORCING STEEL

   A. Conform to requirements of Section 03315 - Concrete for Utility Construction.

2.03  MORTAR

   A. Conform to requirements of Section 04061 - Mortar

2.04  MISCELLANEOUS METALS

   A. Provide cast-iron frames, grates, rings, and covers conforming to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

2.05  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.

2.06  PIPE CONNECTIONS

   A. Sanitary Sewers.

      1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:

         a. External clamps: Type 304 stainless steel

         b. Internal, expandable clamps on Standard manholes: Type 304 stainless steel, 11 gauge minimum

         c. Internal, expandable clamps on corrosion-resistant manholes:

            (1) Type 316 stainless steel, 11 gauge minimum

            (2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C213
2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene waterstop meeting physical property requirements of ASTM C 923, such as Pres-Seal WS Series, or approved equal.

B. Storm Sewers: Use non-shrink grout for storm sewer pipe connections to concrete manholes, unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Water Lines

1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Pres-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 option for connecting exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.07 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, such as Adeka Ultraseal P 201, or approved equal.

B. Provide external sealing material from Canusa Rapid Seal manhole encapsulation system, or approved equal.

C. Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.08 CORROSION-RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes are indicated on the Drawings, refer to City of Houston Approved Product List for liner and/or coating materials.

2.09 BACKFILL MATERIALS

A. Conform to the requirements of Section 02317 - Excavation and Backfill for Utilities.
2.10 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based non-shrink grout requiring only addition of water.

B. Provide grout meeting requirements of ASTM C 1107 and having minimum 28-day compressive strength of 7000 psi.

2.11 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament-wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.

2. Joints and Fittings: Provide epoxy-bodied fittings and join pipe to fittings with epoxy adhesive, according to pipe manufacturer's instructions.

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Use Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B flange bolts.

4. Coating: Provide 2-component, aliphatic polyurethane coating, using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Provide Amershield, Tnemec 74, or approved equal. Project Manager selects color from manufacturer's standard colors.

2.12 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings.

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.

3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density at ±3% optimum moisture content according to ASTM D 698 prior to placement of material and base section. If it does not meet the moisture-density requirement, condition the subgrade until the required moisture-density requirement is met or treat as an unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

3.02 MANHOLES

A. Construct manholes to dimensions shown on Drawings. Commence construction as soon as possible after pipes are laid. On monolithic sewers, construct manholes at same time sewer is being constructed.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

C. Cast manhole foundations and walls monolithically. Use cold joint with approved waterstop when manhole flow line depth exceeds 12 feet. No other joints will be allowed unless shown on Drawings. Wrap cold joints with external sealing material, minimum 6-inch with.

D. For concrete containing micro silica admixtures, place, finish, and cure concrete for manholes following procedures in Section 03315 - Concrete for Utility Construction
E. Top of manhole elevations shown on Drawings are approximate, based on current pavement and natural ground conditions as determined from elevations measured on 50-foot spacing. 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.

F. For water lines place concrete for manhole base on 12” thick (minimum) foundation of cement stabilized sand. Compact cement stabilized sand in accordance with requirements of 02321 – Cement Stabilized Sand.

G. For manholes located over large diameter water lines, place base on a foundation of cement stabilized sand extending from bottom of manhole to bottom of trench. Manhole base is to be a minimum of 12-inches above water line.

3.03 PIPE CONNECTIONS

A. Install approved resilient connectors at each pipe entering and exiting water line and sanitary sewer manholes in accordance with manufacturer's instructions.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetrations both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other solid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on interior or exterior of manhole. When necessary, fill space with compressible material to ensure resilient connector will maintain full flexibility where evidence of reduced flexibility is encountered.

D. Where new manhole is to be constructed on existing sewer, a rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe spring line using adhesive recommended and supplied by waterstop manufacturer.

E. Do not construct joints on sanitary sewer pipe within wall sections of manholes. Use approved connection material.

F. Construct pipe stubs with resilient connectors for future connections at locations and with material indicated on Drawings. Install approved stub plugs at interior of manhole.

G. Test connection for watertight seal before backfilling.

3.04 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 inch 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 flow at pipe-manhole connections. Conform to following criteria.

   B. Form invert channels with Class A concrete if not integral with manhole base. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.05 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 connection when sewer line enters manhole higher than 24 inches above invert of manhole.

3.06 STUBS FOR FUTURE CONNECTIONS

   A. In manholes where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.07 ADJUSTMENT RINGS AND FRAME

   A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces to be joined with non-shrink grout. Set cast iron frame on adjustment ring in a bed of approved sealant material. Install a sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

   B. Wrap manhole frame and adjustment rings 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. 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.

3.08 BACKFILL

A. After concrete obtains adequate strength, place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities. Use embedment zone backfill material for adjacent utilities, as shown in City of Houston Standard Details 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 02911 - Topsoil. Seed in accordance with Section 02921 - Hydro-mulch Seeding, or sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 FIELD QUALITY CONTROL

A. Conduct leakage testing of Sanitary Sewer manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.10 PROTECTION

A. Protect manholes from damage until subsequent work has been accepted. Repair or replace damaged elements of manholes at no additional cost to City.

END OF SECTION
PART 1   GENERAL

1.01 SECTION INCLUDES

   A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines. Manhole bases maybe round or square.

   B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes are specifically indicated in Drawings.

   C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.02 MEASUREMENT AND PAYMENT

   A. Unit Prices

      1. Payment for normal depth manholes, up to 8 feet deep, is on a unit price basis for each manhole installed. Manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes. Manholes for water lines are measured from top of cover to inside base of manhole.

      2. Payment for shallow depth manholes is on a unit price basis for each manhole installed. Shallow manholes have a depth of 5 feet or less measured from top of titlcover to sewer invert.

      3. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than 8 feet. Sewer manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes. Manholes for water lines are measured from top of cover to inside base of manhole.

      4. Payment for normal depth corrosion resistant manholes is on a unit price basis for each manhole installed.

      5. Payment for standard manhole drops is on a unit price basis for each drop installed. Standard manhole drops include both internal and external drops.

      6. Payment for watertight manholes, including external vent pipe is on a unit price basis for each.
7. Payment for air-release manhole with valves and fittings installed is on a unit price basis for each manhole with air-release valves and fittings installed.

8. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.

9. Pay estimates for partial payments will be made as measured above according to the following schedule for sanitary sewer manholes:

   1. Estimate for 90 percent payment will be authorized when the manhole is completely installed and surrounding soil backfilled

   2. Estimate for 100 percent payment will be authorized when manhole has been tested as specified in Section 02533 - Acceptance Testing for Sanitary Sewers

10. Refer to Section 01270 - Measurement and Payment for unit price procedures

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

1.03 REFERENCES

A. ASME B 16.1 - 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


F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections

E. ASTM C 890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

F. ASTM C 913 – Standard Specifications for Precast Concrete Water and Wastewater Structures.

G. ASTM C 923 - Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

I. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft)


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


O. AWWA C 213 - Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

P. American Association of State Highway and Transportation Officials (AASHTO)

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. 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/or ASTM C 890 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 sanitary sewer hydrostatic testing

9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches

C. 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 which 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 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide tops to support cast iron casting meeting AASHTO M-306 Section 5 loading, and receive manhole frame & covers, as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Project Manager.

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, ASTM C 890 and/or ASTM C 913 for depth as shown on Drawings and to resist following loads.

1. AASHTO M-306 H-20 / HS-20 design live loading loads as referred to in AASHTO M-306 applied to manhole cover and transmitted down to transition and base slabs

2. Unit soil weight of 120 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, ASTM C 890 and/or ASTM C 913 and following:

1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.

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 askets conforming to ASTM C 443 and/or ASTM C-990.

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 03315 - 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 02321 - 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 03315 - Concrete for Utility Construction.

2.04 MORTAR

A. Conform to requirements of Section 04061 - Mortar.

2.05 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Section 02090 - Frames, Grates, Rings and Covers.

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. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:

   a. External clamps: Type 304 stainless steel

   b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.

   c. Internal, expandable clamps on corrosion-resistant manholes:

      1) Type 316 stainless steel, 11 gauge minimum

      2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213

2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:

1. Provide watertight connections in accordance with ASTM C 923 and ASTM F 2510 as applicable for flexible (hdpe and cmp) pipe. Rigid (concrete) pipe to manhole connections do not have to comply with ASTM C 923 and may grouted instead.
C. Water Lines
1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel -up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.08 SEALANT MATERIALS

A. Approved products in accordance with Section 01630 - Product Substitution Procedures.

B. Sealing material between precast concrete adjustment ring and manhole, between each adjustment ring, and between adjustment ring and manhole cover frame shall be a hydrophilic elastic sealant, which adheres to both concrete and metal, or approved equal.

C. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

D. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.09 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes are indicated on Drawings, refer to City of Houston Approved Product List for liner and/or coating materials.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Section 02317 - 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.
2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer’s recommendations.

2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive

3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.

4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by Project Manager from manufacturer’s standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of sanitary storm sewer manholes, including adjustment of manholes to grade. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings:

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer’s recommended hardware.

2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.
3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.

B. Provide approved petroleum-based tape encapsulating bolts in access manhole.

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, at ±3% optimum moisture content according to ASTM D 698 prior to placement of foundation material and base section. If it does not meet the moisture-density requirement, condition the subgrade until the required moisture-density requirement is met or treat as an unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by Project Manager.

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 02321 - Cement Stabilized Sand.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify Project Manager for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24-inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

C. For manholes located over large diameter water lines, place precast base on a foundation of cement stabilized sand extending from bottom of manhole to bottom of trench. Manhole base is to be a minimum of 12-inches above water line.
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.

3.05 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes 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. 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. Grout storm sewer connections to manhole when connecting a rigid (concrete) pipe to a concrete manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. C. Install approved resilient connectors at each flexible (hdpe or cmp) pipe connection as per ASTM C-923 and/or ASTM F 2510 to a concrete manhole.

D. 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.
E. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

F. 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 shall be at least equal to the 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 invert of manhole.

3.08 INVERTS FOR STORM SEWERS

A. When precast, square or rectangular structures are used for sewer manholes, 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; 1½ inches per foot maximum

2. Depth of bench to invert: one half of 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, after all connections have been made

1. Use 5 sack premix (bag) concrete or Class A concrete for inverts, with minimum compressive strength of 4000 psi.

3.09 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.010 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete or HDPE adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings 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.

3.11 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities. 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 springline 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 02911 - Topsoil. Seed in accordance with Section 02921 - Hydromulch Seeding. When shown on Drawings, sod disturbed areas in accordance with Section 02922 - Sodding.
3.12 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

3.13 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to City.

END OF SECTION
Section 02085

VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Valve boxes for water service.
B. Meter boxes for water service.
C. Meter vaults for water service.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. No separate payment will be made for valve boxes under this Section. Include payment in unit price for Section 02511 - Water Lines.
   2. No separate payment will be made for meter boxes under this Section. Include payment in unit price for Section 02512 - Water Tap and Service Line Installation.
   3. Payment for each size of meter vaults is on unit price basis per vault. Payment will be made for each vault installed, regardless of depth.
   4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturers’ product data for following items for approval:
   1. Each type of valve box and lid.
   2. Each type of meter box and cover.
   3. Each type of meter vault frame and cover.

C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in State of Texas.

D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from City of Houston Detail Drawings.

E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 PRODUCTS

2.01 VALVE BOXES

A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast letter “W” into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.

C. Unless otherwise specified, uncoated cast iron.

D. Riser Pipe.
   1. Provide 6-inch PVC, DR 18, riser pipes in accordance with Section 02506 - Polyvinyl Chloride Pipe or
2. 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Section 02501 – Ductile Iron Pipe and Fittings.

3. Provide single section of pipe.

E. Concrete for valve box placement:

1. For locations in new concrete pavement, provide strength and mix design of new pavement.

2. For other locations, provide concrete for sidewalks conforming to requirements of Section 02751 - Concrete Paving.

2.02 METER BOXES

A. Provide meter boxes for 5/8-inch through 1-inch meters of the following materials:

1. Non-traffic bearing locations: Cast iron, concrete or plastic.

2. Traffic bearing locations: Cast iron.

B. Provide meter boxes for 1 1/2-inch and 2-inch meters of cast iron.

C. Provide meter box with reading lid. Provide lids with spring-type latching devices. Lids shall contain sufficient metal that meter box can be easily located with metal detector. Cast words “CITY OF HOUSTON” and "WATER METER" into lid with letters of 1/2-inch height and raised 3/32 inch.

D. Meter box dimensions shall conform to the following approximate dimensions:

1. Length: At top – 15 1/2 inches; at bottom 20 inches

2. Width: At top – 12 1/2 inches; at bottom 14 3/4 inches

3. Height: 12 inches

E. Extensions: Meter box extensions 3 inches and 6 inches in height shall be available from manufacturer as standard item.

2.03 CAST-IRON METER BOXES

A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.
B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.

C. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

2.04 CONCRETE METER BOXES

A. Concrete Meter Boxes: Made of Class A concrete, with minimum 4000 psi compressive strength, conforming to requirements of Section 03315 - Concrete for Utility Construction. Construct to dimensions shown on Drawings.

B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

2.05 PLASTIC METER BOXES

A. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:

<table>
<thead>
<tr>
<th>ASTM</th>
<th>REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>D 256</td>
<td>Impact Strength = 1.9 ft.-lb./inch (Izod, Notched)</td>
</tr>
<tr>
<td>D 256</td>
<td>Impact Strength = 6.4 ft.-lb./inch (Izod, Un-Notched)</td>
</tr>
<tr>
<td>D 638</td>
<td>Tensile Strength (2.0 min.) = 3400 psi</td>
</tr>
<tr>
<td>D 648</td>
<td>Deflection Temperature = 170 degrees F</td>
</tr>
<tr>
<td>D 790</td>
<td>Flexural Modulus = 90,000 psi</td>
</tr>
</tbody>
</table>

B. Meter boxes shall meet the following test requirements:

1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.

2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8- inch.

C. Meter box body, without lid, shall weigh approximately 7 pounds.
2.06 METER VAULTS

A. Meter vaults may be constructed of precast concrete, cast-in-place concrete to the specified dimensions in the City of Houston Detail Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Section 03315 - Concrete for Utility Construction with minimum compressive strength of 4000 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Section 03315 Concrete for Utility Construction.

D. Grates and Covers: Conform to requirements of Section 02091 – Non Metallic Frames, Grates, Rings, and Covers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Obtain approval from Project Manager for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.02 VALVE BOXES

A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.

1. Install with bell on top of valve

2. Place riser pipe in plumb, vertical position

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.

C. Set, align, and adjust valve box so that lid is level with final grade.

D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by City, repaint covers black.
3.03 METER BOXES

A. Install cast iron or plastic boxes in accordance with manufacturer’s instructions.

B. Construct concrete meter boxes to dimensions shown on City of Houston Detail Drawings.

C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.

D. Do not locate under paved areas unless approved by Project Manager. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

3.04 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on City of Houston Detail Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults. Interior meter vault depth is not allowed to exceed more than 4 feet unless approved by OCE.

B. Precast Meter Vaults:

1. Install precast vaults in accordance with manufacturer’s recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to requirements of Section 02320 - Utility Backfill Materials.

2. Seal lifting holes with cement-sand mortar or non-shrink grout.

C. Meter Vault Floor Slab:

1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.

2. Precast floor slab elements may be used for precast vault construction

D. Cast-in-Place Meter Vault Walls:

1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.

2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
3. Set frame for cover in concrete

3.05 FRAME AND COVER FOR METER VAULTS

A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:

1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above natural grade

2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2-inch

3.06 BACKFILL

A. Provide bank run sand in accordance with Section 02320 - Utility Backfill Materials and backfill and compact in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION
Section 02090
FRAMES, GRATES, RINGS, AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

C. Trench Drainage

D. Tree Grates

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.

2. Payment to rack over existing manhole is on a unit price basis for each manhole.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures

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

1.03 REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials

1. Standard Specification for Highway Bridges

2. M306: Drainage, Sewer, Utility, and Related Castings

3. M105: Gray Iron Castings


D. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

E. AWS - D 12.1 Welding Reinforcing Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City of Houston details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 PRODUCTS

2.01 CASTINGS

A. All castings shall be made from gray cast iron conforming to the requirements of AASHTO M105 class 35b or ductile iron conforming to the requirements ASTM A536 70-50-05.

B. Castings intended for traffic service shall be clean castings capable of withstanding an application of 40,000 pound proof load as described in Section 5 of AASHTO M306 (includes items such as frames, grates, rings, covers, trench drainage, etc.)

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings.

D. All castings shall be manufactured in accordance with the requirement of Section 4 of AASHTO M306.

E. Unless otherwise indicated, all gray iron castings shall be provided uncoated.

F. Each individual casting shall include all markings as shown on the specification drawings and shall be identified by the producing foundry showing the following: Name of producing foundry; country of manufacturer preceded by the words “Made in,” such as “Made in USA”; material designation, heat identification and cast date (MM/DD/YY), casting lettering as required by the purchaser. If a casting is melted and poured at one foundry and labeled with the name of another organization, manufacturer, or foundry the casting shall include the name of the producing foundry and the organization the casting is produced for. The name of the producing foundry and the organization the product is made for shall have lettering of...
equal size, be in close proximity to each other, and be easily identified from the same side of
the casting. The casting shall also include any additional markings as required in Section 9 of
AASHTO M306 and Section 17 of AASHTO M105.

2.02 TESTING 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 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. The manufacturer shall report and certify material information obtained from separately cast
test bars. If there are more than three test bar failures in a calendar year the manufacturer
shall report this to the purchaser and shall discontinue supplying product. In order to resume
supplying product, documentation that a new Quality System is in place to ensure material
compliance must be submitted to and accepted by the purchaser.

2.03 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum
of four bolts and gasket designed to seal cover to frame. Supply approved watertight
manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear
opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover
with pattern shown on Drawings.

C. Where indicated on Drawings provide security enabled covers or grates, to be secured with
the addition of Cam locks and lock lugs to inhibit opening and removal of cover or grate
without proper authorized tool. Supply approved security feature Frames, Cover or Grates.

2.04 FABRICATED RING GRATES

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.05 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming Section 2.01.

B. One piece casting with dimensions to fit frame and cover.
PART 3  E X E C U T I O N

3.01  INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Houston standard detail, “Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch”. Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions, ring grates, and trench drainage, for application in wastewater collection system and facilities.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.

2. Payment to rack over existing manhole is on a unit price basis for each manhole.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures

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

1.03  REFERENCES

A. AASHTO - American Association of State Highway and Transportation Officials

1. 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 A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

C. ASTM C501 – Standard Testing for Wear and Abrasion

E. ASTM C1028 – Standard Testing for Coefficient of Friction

F. TCEQ Chapter 217 Design Criteria for Waste Water Systems Section 217.55 Manhole Covers

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

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 casting assemblies that are not included in Drawings or standard City of Houston details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 PRODUCTS

2.01 MANHOLE RING AND COVER

A. All rings and covers units shall be made from high strength nonmetallic fiber reinforced polymer / composite materials. The material shall be a resin thermoset matrix that can be reinforced with continuous filament engineered fabrics, fiber rovings, short fiber filaments, or equivalent nonmetallic reinforcing structure(s). Seatings shall be encapsulated or bonded with a continuous dampener to reduce wear, shock, noise, malodors and infiltration.

B. Rings and covers intended for traffic service shall be capable of withstand proof testing AASHTO M306: Proof Testing (includes items such as frames, grates, rings, covers, trench drainage, etc.).

C. Fabricate rings and covers to conform to shapes, dimensions, and with wording or logos shown on Drawings.

D. All rings and covers shall be manufactured in accordance with the requirements of AASHTO M306.

E. Covers shall be provided with a positive lock mechanism as shown on City of Houston Standard Detail for Non-Metallic Covers. Lock will have indicators to show when Lock is fully engaged. Other equivalent locking mechanisms must be approved by the City of Houston.
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 of the required tests and inspections. All testing shall be conducted in the United States using purchaser approved reliable facilities. The manufacturer/supplier shall maintain complete records of all such tests and inspections. All testing shall be paid for by the manufacturer/supplier.

B. Frames and Covers shall be “Proof Tested” in accordance with AASHTO M306.

C. 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. 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.

D. Ultraviolet resistance: ASTM G154 Cycle 1 for 1000hrs. Specimens shall be tested for ultimate flexural strength, retaining at least 75% of control values for load and deflection at failure.

E. Coefficient of Friction: Shall be greater than 0.6 when tested in accordance to ASTM C1028.

F. 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 average of four test cycles shall have a calculated wear index of >300.

G. 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 FABRICATED RING GRATES

A. Fabricate ring grates from reinforcing steel conforming to ASTM A36.

B. Conform to welds connecting bars to AWS D 1.1.

2.04 GRADE ADJUSTMENT RINGS

A. Conform to Section 2.01.

B. One piece unit with dimensions to fit frame and cover.

C. Physical properties shall comply with ASTM D 2240-05 with a Shore Durometer of 77A ±5
D. Adjustment Risers shall be of uniform quality, free from cracks, holes, and any other surface debris. Riser rings shall be available in ½” height increments. 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

PART 3 EXECUTION

3.01 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set units accurately at required locations to proper alignment and elevation. Keep units plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Houston standard detail, “Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch”. Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION
SECTION 02136

WASTE MATERIAL HANDLING, TESTING AND DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

Handling, testing and disposal of hazardous and non-hazardous waste material.

A. Material present inside of existing tanks to be repaired or demolished, i.e., silt, sludge and other residue deposits generated by normal water production usage of the tanks.

B. Existing coatings removed from existing tanks.

C. Spent abrasives used and debris generated in the execution of the work.

D. All spent thinners, coating materials or other products brought on site for execution of work that require disposal as a hazardous or non-hazardous waste.

E. Soil that may be contaminated due to the execution of the work.

F. Petroleum soaked sand foundation material removed from demolished tank sites.

1.02 MEASUREMENT AND PAYMENT

A. No separate measurement and payment will be made for handling, testing or disposal of non-hazardous or hazardous material, debris or material identified as contaminated material on the site prior to the bid date except as indicated in section 1.02 B and 1.02 C. The Contractor shall include the cost for this work in the Contract bid price for work of which this is a component part.

B. Payment for hazardous waste material handling, removal, testing, transporting and disposal of material identified as hazardous after the bid date will be paid for at the unit price bid for "Hazardous Waste Handling, Removal, Transporting" if such an item is provided in the contract.

C. Removal and disposal of potentially petroleum soaked sand foundation material will be measured per cubic yard which shall include testing, removing, storing, transporting and disposing of material and will be paid for at the unit price bid for "Removal and Disposal of Potentially Petroleum Soaked Sand". Basis of payment will be Class I Industrial Waste having a Total Petroleum Hydrocarbon (TPH) level greater than 1500 ppm.
1.03 REFERENCES

The following is a list of applicable requirements to this project. It is not intended to be a complete listing of all laws and regulations to which the Contractor must comply.

A. Environmental Protection Agency - Code of Federal Regulations

2. 40 CFR 261, Appendix II EPA - Toxicity Characteristic Leaching Procedure
3. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste
4. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste
5. 40 CFR Part 264 - Standards for Owner and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
6. 40 CFR Part 265 - Interim Status for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
7. 40 CFR 265, Subpart C EPA - Preparedness and Prevention
8. 40 CFR 265, Subpart D EPA - Contingency Plan and Emergency Procedures
9. 40 CFR 265.16 EPA - Personnel Training
10. 40 CFR Part 268 - Land Disposal Restrictions
11. 49 CFR Parts 173,178 and 179: (USDOT/ Hazardous Materials, Shipping, Containers.)
12. 40 CFR Part 355 - Emergency Planning and Notification

B. EPA Methods

1. 3050 - Acid Digestion of Sediment, Sludge, and Soils
2. SW 846 - Test Methods for Evaluating Solid Waste - Physical/Chemical Methods

C. Texas Commission on Environmental Quality

1. TAC Title 30, Chapter 305 "Consolidated Permits"
2. TAC Title 30, Chapter 335 "Industrial Solid Waste and Municipal Hazardous Waste"
3. TAC Title 30, Chapter 343 "Oil and Hazardous Substances"
D. TWC Technical Guidelines
   1. Document #1, Waste Evaluation/Classification

E. NIOSH Methods
   1. 7082 Lead

F. Society for Protective Coatings
   1. SSPC 91-18 - Industrial Lead Paint Removal Handbook

1.04 SUBMITTALS

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

B. Submittals shall conform to appropriate codes for regulatory requirements.

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

1.05 TESTING AND IDENTIFICATION

A. The Owner is the Generator of the debris for permitting purposes, and will obtain the EPA Identification number, but the Contractor is responsible for assuring that all testing, handling, storage, transportation, and disposal requirements are properly implemented, including satisfactory training of job site personnel and the cleaning of all reusable items and equipment prior to removal from the site.

B. Prior to the bid date, if testing has been performed by the City and if hazardous material has been identified in the debris material in an existing tank, the paint to be removed from an existing tank, the work site soil, or the foundation material, the material or test results will be indicated in section 01110. It is the responsibility of the Contractor to properly test and to determine if any wastes generated as a result of this project are hazardous in accordance with 40 CFR Part 261.

1.06 DEFINITIONS

(Note Definitions applicable to this section are also presented elsewhere.)

A. Hazardous Waste (lead paint debris): Waste that is classified as hazardous due to its concentrations of regulated hazardous substances. Paint debris is classified as hazardous waste if, after testing by the Toxicity Characteristic Leaching Procedure (TCLP), the leachate contains any
of the 8 metals or other substances in concentrations at or above limits established in 40 CFR 261.

B. Lead Containing Dust and Debris: Dust and debris generated during the project which contains lead in any amount, including but not limited to pulverized paint, spent abrasive, filters (wet and dry), and containment materials upon which lead is still present.


D. TACB: Texas Air Control Board. Texas State Agency joined into the TCEQ and responsible for writing and enforcement of rules and regulations relating to air quality.

E. TCEQ: Texas Commission on Environmental Quality. State of Texas Commission responsible for planning, oversight, monitoring and management of natural resources.

F. TCLP: Toxicity Characteristic Leaching Procedure. Laboratory tests conducted on wastes that determine the amount of hazardous materials that leach out into a test solution. The test is intended to simulate the properties of water as it leaches through a solid waste landfill. TCLP testing is defined in 40 CFR 261, Appendix II.

G. TWC: Texas Water Commission. Texas State Agency joined into the TCEQ and responsible for writing and enforcement of rules and regulations relating to water quality and solid waste programs.

PART 2 NOT USED

PART 3 EXECUTION

3.01 WASTE HANDLING AND STORAGE

A. All chemicals to be brought on site by the contractor must be stored and used in a safe and proper manner in accordance with all applicable Federal, State and local laws and regulations as well as the manufacturers recommendations. Material Safety Data Sheets (MSDSs) shall be maintained on-site for all hazardous chemicals used.

B. Hazardous wastes are to be handled and stored according to the requirements of TAC 30 Chapter 335 "Industrial Solid Waste and Municipal Hazardous Waste" and 40CFR Part 262, with regard to on-site storage, and 40CFR Part 264 with regard to required notices, site security, personnel training, contingency planning and emergency procedures, recordkeeping and reporting, time of storage, amount of material stored, and use of proper containers. Hazardous waste will be stored in covered containers in accordance with the requirements of 40 CFR 262 and 49 CFR 172,178 and 179.

C. The contractor shall provide proper, segregated storage for hazardous and non-hazardous
materials to be used in the work area in order to ensure safe work conditions.

D. All material, waste and debris from removal of lead containing coatings, including those products and materials employed for chemical paint stripping, shall be considered hazardous waste and handled accordingly, until such time that testing and analysis indicates otherwise.

1. Sampling of materials for TCLP testing of initial containers of debris shall be completed prior to or during filling. Until the TCLP test results are received, the containers shall be labeled as lead-containing debris. Hazardous waste labels shall be applied after the test results are received, if the debris tests hazardous.

2. Hazardous waste shall not be stored at the project site for more than 90 days. Non-hazardous wastes shall be removed at a minimum of once per month (30 days).

3. Special attention shall be given to the time of storage, storage conditions, amount of material stored at any one time, use of proper containers, and personnel training.

E. Hazardous waste shall be placed on pallets over protected ground, be located in a secure area enclosed by a fence with signs around the perimeter, and be shielded adequately to prevent dispersion of the waste by wind or water. Under no circumstances shall the waste be stored within a flood plain area. Any evidence of improper storage shall be cause for immediate shutdown of the project until corrective action is taken. The storage area shall be within a security fence with a locked gate.

3.02 ENVIRONMENTAL CONTAMINATION

The contractor shall not contaminate the air, soils or surface and ground waters with any hazardous waste. Spills, releases and discharges of hazardous or toxic materials which inadvertently occur shall be reported in accordance with 40 CFR 265 and TAC 30 Chapter 343.

A. Contingency Plan and Training: The Contractor shall comply with TCEQ Title 30 Regulations and EPA 40 CFR 265, Subpart C in the event of a spill or release of waste, EPA 40 CFR 265 Subpart D, and TCEQ regulations.

B. All personnel associated with the handling of hazardous waste shall complete a formal training program in accordance with 40 CFR 265.16 and TCEQ Title 30 Regulations. Training records of all employees must be maintained and kept on file.

3.03 WASTE CLASSIFICATION

A. Testing

1. All solid waste generated by the paint removal activities shall be tested in accordance with 40 CFR 261, Appendix II, Method 1311 Toxicity Characteristic Leaching Procedure (TCLP), to determine if it is hazardous.
2. In the case of wet methods of preparation, the use of chemical strippers, or containerized hygiene water, all liquids and sludge shall also be tested. When chemical strippers are used, the testing shall include pH to determine corrosivity. All waste water shall be tested for total lead.

3. Representative samples of the debris for each waste stream generated from the work on this project shall be collected. A minimum of four of the samples representative of each waste stream shall be analyzed to establish a waste is non-hazardous. Note that more than four initial samples of each waste stream shall be collected in order to obtain the four representative samples for analysis. Results from one test sample are sufficient to identify a waste as hazardous.

4. The collection of the initial representative samples of each waste stream and selection of the minimum of four for testing shall be accomplished using a random sampling technique and shall comply with the following: a minimum of one representative sample for each 55 gallons of waste, or a minimum of four representative samples for each gondola or roll-off box of waste. Samples shall be collected in accordance with SW-846, "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods”.

5. Sampling and testing shall be performed by a certified laboratory acceptable to the Owner. The name, address, and qualifications of the laboratory shall be provided for approval. The Owner shall be provided with copies of the test results as soon as they are received by the Contractor.

B. Classification

1. Lead paint debris is classified as hazardous waste if, after testing by TCLP, the leachate contains any of the 8 metals or other hazardous substances in concentrations at or above limits established in 40 CFR 261:

   - Arsenic - 5.0 mg/L
   - Barium - 100.0 mg/L
   - Cadmium - 1.0 mg/L
   - Chromium - 5.0 mg/L
   - Lead - 5.0 mg/L
   - Mercury - 0.2 mg/L
   - Selenium - 1.0 mg/L
   - Silver - 5.0 mg/L

2. The above includes only the eight (8) characteristic metals listed by EPA among which are elements typically associated with paints. Other substances may be present which may cause debris to be classified as hazardous waste as defined in 40 CFR 261 (such as a pH <=2.0 or >=12.5 resulting in corrosivity), and must be taken into account.
3.04 DISPOSAL

A. The contractor shall arrange to have wastes and debris transported from the site in accordance with all City Ordinances and State and Federal Laws. If wastes and/or debris is determined to be hazardous, transporting to be in accordance with TAC 30 Chapter 335 -Industrial Solid Waste and Municipal Hazardous Waste, 40CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste and the applicable sections of 49 CFR Parts 171 through 179.

B. Manifest and Reporting: The Contractor shall comply with all of the manifesting, certification, and reporting requirements of EPA 40 CFR 262, 40 CFR 268, and Texas regulations, including certificates of final disposal for each shipment.

C. Copies of all records and reports, test sample chain of custody forms, TCLP and other test results shall be provided to the Owner.

D. The contractor shall dispose of wastes and debris at a licensed site acceptable to the Owner. Hazardous wastes and debris shall be disposed of in accordance with 40CFR Part 265 and 40CFR Part 268 Land Disposal Restrictions. Manifesting of hazardous wastes shall be in accordance with 40CFR Part 262, Subpart B.

E. Waste water resulting from surface preparation, washing, personal hygiene or decontamination shall not be discharged without testing and through arrangement with the local Publicly Owned Treatment Works (POTW) or other approved means.

END OF SECTION
SECTION 02201

SITE PREPARATION, GRADING, RESTORATION AND CLEAN UP FOR WATER STORAGE TANKS

PART 1 GENERAL

1.01 SECTION INCLUDES

This Section covers the clearing, grubbing, grading, final clean-up, and restoration of the site in preparation for hydro mulch or sodding, and move out.

1.02 MEASUREMENT AND PAYMENT

No separate measurement and payment for worked performed under this Section. The Contractor shall include the cost for this work in the contract bid price for work of which this is a component part.

1.03 REFERENCES

A. Federal Seed Act Regulations (Department of Agriculture)

1.04 SUBMITTALS

A. Submit product data in accordance with Section 01330 - Submittal Procedures.

B. Submit seed to engineer for approval. Submit certification from supplier that each type of seed conforms to these specifications and the requirements of the Texas Seed Law. Certification shall accompany seed delivery.

C. Submit a certificate stating that fertilizer complies with these specifications and the requirements of the Texas Fertilizer Law.

1.05 SEQUENCE OF WORK

A. Restoration of each site shall be completed immediately after all tank work is completed and the tank has been tested and returned to service.

B. After obtaining approval from the City Engineer of satisfactory site restoration, Contractor shall hydro mulch all areas disturbed during construction. The hydro mulch seeding requirements, together with other necessary related work, shall conform to the requirements of this Section.
C. All fences, walks, driveways or other permanent facilities are to be completed in place before the finished hydro mulch is applied.

PART 2 PRODUCTS

2.01 MATERIALS

A. All seed must meet the requirements of U.S. Department of Agriculture Rules and Regulations as set forth in Federal Seed Act and Texas Seed Law. Type of seed, purity and germination requirements, date of application and planting dates are as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Application Rate</th>
<th>Planting Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hullled Common Bermuda Grass 98/88</td>
<td>40</td>
<td>January 1 to April 15</td>
</tr>
<tr>
<td>Unhulled Common Bermuda Grass 98/88</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Annual Rye Grass (Gulf)</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Hullled Common Bermuda Grass 98/88</td>
<td>40</td>
<td>April 15 to October 1</td>
</tr>
<tr>
<td>Unhulled Common Bermuda Grass 98/88</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Annual Rye Grass</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

B. Fertilizer:

Fertilizer shall be water soluble with analysis of 10% nitrogen, 20% phosphoric acid and 10% potash. Rate of application shall be 750 pounds per acre except during the period of April 15 through September 1, when the rate shall be reduced to 600 pounds per acre.

C. Mulch:

Mulch shall be virgin wood cellulose fiber made from whole wood chips.

Within the fiber material at least 20% of the fibers will be 10.7 mm in length and 0.27 mm in diameter. Rate of application shall be 2000 pounds per acre. Soil stabilizers such as Terra type III, (or approved equal) shall be applied at a rate of 40 pounds per acre in the flatter portions of the disturbed areas.
PART 3 EXECUTION

3.01 DESCRIPTION

A. The work covered by this Section consists of furnishing all labor, materials, equipment, supplies, supervision, tools, and performing all work necessary for clearing and protection of facilities during construction and top soil ing, finish grading, seeding, fertilizing, watering, maintenance, and clean-up of disturbed areas within the individual water plant areas at the completion of work, in accordance with these specifications and as shown on drawings.

B. Fences shall be relocated or installed as shown on drawings. All damage to existing fencing occurring during construction activities shall be repaired or replaced at the Contractor's expense to a condition equal to or better than existing prior to such damage. Fencing relocated for the convenience of accommodating construction activities shall be returned to its original location at the completion of the work.

C. Silt fencing and four (4) foot safety fencing is to be installed as indicated on the plans.

D. All sites shall be restored to a condition equal to or better than that existing prior to construction activities. All holes and open excavations shall be filled and compacted to the density of the surrounding area. Level all washes, ruts, depressions, and mounds to provide a smooth finish with no large debris, dirt clods, or lumps of size that would interfere with the operation of a standard rotary lawnmower.

3.02 MAINTENANCE

The hydro mulch seeding shall be adequately watered until established. Any areas damaged by erosion or areas that do not have acceptable turfing shall be reapplied to the satisfaction of the Engineer.

END OF SECTION
Section 02221

REMOVING EXISTING PAVEMENTS, STRUCTURES, WOOD, AND DEMOLITION DEBRIS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, brick pavement and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks and driveways.

C. Removing pipe culverts, sewers, and sewer leads.

D. Removing waterlines and water services lines including asbestos cement pipe per OSHA guidelines.

E. Removing existing inlets and manholes.

F. Removing and disposing of pre-stressed concrete beams and drill shafts.

G. Removing miscellaneous structures of concrete or masonry.

H. Removing existing bridge.

I. Removing existing wood and demolition debris.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removing and disposing of asphaltic surfacing with or without base, regardless of thickness encountered, is on square yard basis measured between lips of gutters.

2. Payment for removing and disposing of reinforced concrete pavement, with or without asphalt overlay, regardless of its thickness, is on square yard basis measured from back-to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.

3. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on square yard basis.
4. Payment for removing and disposing of concrete sidewalks and driveways is on square yard basis.

5. Payment for removing asphaltic pavement surface by milling shall be in accordance with Section 2960.

6. Payment for removing and disposing of miscellaneous concrete and masonry is on cubic yard basis of structure in place.

7. Payment for removing and disposing of pipe culverts, sewers, and sewer leads, is on linear foot basis for each diameter and each material type of pipe removed.

8. Payment for removing and disposing of waterlines and water service lines including asbestos cement pipe is on linear foot basis for each diameter pipe and each material type of pipe removed.

9. Payment for removing and disposing of existing inlets is on unit price basis for each inlet removed.

10. Payment for removing and disposing of prestressed concrete piles and drill shafts is on linear foot basis.

11. Payment for removing and disposing of existing bridge, including piles and abutments to minimum of 4 feet below ground level, is on a lump sum basis.

12. Payment for removing and disposing of existing manholes is on unit price basis for each manhole removed.

13. Payment for removing and disposing of miscellaneous wood and demolition debris is on cubic yard basis.

14. No payment for saw cutting of pavement, curbs, or curbs and gutters will be made under this section. Include cost of such work in unit prices for items listed in bid form requiring saw cutting.

15. No payment will be made for work outside maximum payment limits indicated on Drawings, or for pavements or structures removed for Contractor's convenience.

   a. For utility installations: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings. Limits of measurement will be as shown on Street Cut Pavement Replacement Rules.

16. Refer to Section 01270 - Measurement and Payment for unit price procedures

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

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.


PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain advance approval from Project Manager for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

C. For removal of asbestos-containing materials, or materials that could potentially contain asbestos, comply with the following:

1. Crew members must be trained in accordance with OSHA 29 CFR 1926.1101 – Asbestos.


3. If negative exposure assessment not conducted, or if results are above PEL, provide respiratory protection in accordance with Paragraph 3.02 of this Section.

3.02 PROTECTION

A. Protect following from damage or displacement:

1. Adjacent public and private property.

2. Trees, plants, and other landscape features designated to remain.

3. Utilities designated to remain.
4. Pavement and utility structures designated to remain.

4. Bench marks, monuments, and existing structures designated to remain.


3.03 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to minimum depth of 2 inches.

D. When street and driveway saw cut location is greater than one-half of pavement lane width, remove pavement for full lane width or to nearest longitudinal joint as directed by Project Manager.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.

F. Where existing end of pipe culvert or end of sewer is to remain, install 8-inch-thick masonry plug in pipe end prior to backfill in accordance with requirements of Section 02316 - Excavation and Backfill for Structures.

G. Labeling of Asbestos Cement (AC) Pipe:

1. Label leak-tight container with warning statement of hazardous asbestos content in accordance with OSHA 29 CFR 1926.1101 and as noted below.

2. Label waste material with following warning:

   DANGER
   CONTAINS ASBESTOS FIBERS
   MAY CAUSE CANCER
   CAUSES DAMAGE TO LUNGS
   DO NOT BREATHE DUST
   AVOID CREATING DUST

3. Neatly print labels in letters of sufficient size and contrast so label is easily visible and legible.

3.04 BACKFILL
3.05 DISPOSAL

A. Inlet frames, grates, and plates; and manhole frames and covers, may remain City property. Disposal shall be in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove from site, debris resulting from work under this section in accordance with requirements of Section 01576 - Waste Material Disposal.

C. For asbestos-containing materials:
   1. Comply with 40 CFR Part 61 and 30 TAC Sections 330.137(b) for Industrial Class 1 waste.
   2. Inspect load to ensure correct packaging and labeling.
   3. Line vehicles with two layers of 6-mil polyethylene sheeting.
   4. Remove asbestos-containing waste from site daily.
Section 02222

ABANDONMENT OF SEWERS

PART 1    GENERAL

1.01 SECTION INCLUDES

A. Abandonment in place of existing sewers, junction structures, manholes, and force mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for grout fill and abandonment of existing sewers, including boxes and elliptical shaped sewers, is on linear foot basis for each diameter of sewer being abandoned. Measurement will be along centerline of sewer from centerline to centerline of manholes.

2. Payment for grout fill and abandonment of sewer manholes or junction structure is by each manhole or junction structure abandoned in conformance with this Section.

3. Payment will be full compensation for all material, equipment, and labor required for complete abandonment grouting, including air venting, testing, temporary plugs, fill lines, excavations, and incidentals.

4. No separate payment will be made for plugging and abandoning sewer force mains. Include cost of such abandonment in related work.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

6. Acceptability of grout material is based on achieving average strength within range of 75 to 150 psi as defined in Paragraph 2.01B.1. Grout that is out of range after placement may be accepted with price adjustment of 1.0 percent price deduction for each psi average compressive strength below 75 psi and 0.5 percent price deduction for each psi average compressive strength above 150 psi, as applicable to material volume represented by test series. Shrinkage in grout material placements shall be remedied by Contractor according to Paragraph 3.04H without additional compensation.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.
1.03 DEFINITIONS

A. Abandonment. Sewer abandonment consists of demolition and removal of portion of manholes existing within specified depth of surface, and abandonment in place of sewer lines and manholes as specified in this Section.

B. Flowable Fill. Flowable fill (abandonment grout) shall be controlled low-strength material consisting of fluid mixture of cement, fly ash, aggregate, water and with admixtures as necessary to provide workable properties. Placement of flowable fill may be by grouting techniques in sewer pipes or other restricted areas, or as mass placement by chutes or tremie methods in unrestricted locations with open access. Long-term hardened strength shall be within specified range.

C. Ballast. Large aggregate either replaced with voids subsequently filled with flowable fill injected by grouting method; or in areas with open access, placed individually and sequentially at same time as flowable fill placement.

D. Backgrouting. Secondary stage pressure grouting to ensure that voids have been filled within abandoned sewer. Backgrouting will only be required at critical locations indicated on Drawings or if there is evidence of incomplete flowable fill placements.

1.04 REFERENCE STANDARDS


D. ASTM C 937 - Standard Specification for Grout Fluidifier for Pre-placed Aggregate Concrete.


F. ASTM C 1017 - Standard Specification for Chemical Admixture for Use in Producing Flowing Concrete.

G. ASTM C 1107 - Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

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

2. Use of ballast. Provide percentage of ballast of total placement and size limits for ballast if fill is intended to be used with ballast.

3. Aggregate gradation of fill. Aggregate gradation of mix (excluding ballast) shall be used as pilot curve for quality control during production.

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

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

6. Initial time of set.

7. Bleeding and shrinkage.

8. Compressive strength.

C. Technical information for equipment and operational procedures including projected slurry injection rate, grout pressure, method of controlling grout pressure, bulkhead and vent design, and number of stages of grout application.

D. Experience record for proposed crew, showing minimum of 100 cubic yards of flowable fill placed using proposed or similar equipment and methods.

E. At least 60 days prior to commencing abandonment activities, submit plan for abandonment, describing proposed grouting sequence, bypass pumping requirements and plugging, if any, and other information pertinent to completion of work.

PART 2 PRODUCTS

2.01 FLOWABLE FILL

A. Design Mix Criteria. Provide design of one or more mixes to meet design criteria and conditions for placement. Present information required by Paragraph 1.05B in mix design report including following:

1. Cement: ASTM C 150 Type I or II. Volume and weight per cubic yard of fill. Provide minimum cement content of 100 pounds per cubic yard.

2. Fly ash: ASTM C 618 Class C or F. Volume and weight per cubic yard of fill. Provide minimum Fly ash content of 200 pounds per cubic yard.
3. Potable water: Volume and weight per cubic yard of fill. Amount of water determined by mix design testing.

4. Aggregate gradation: 100 percent passing 3/8-inch sieve and not more than 10 percent passing No. 200 sieve. Mix design report shall define pilot gradation based on following sieve sizes 3/8-inch, Nos. 4, 8, 16, 30, 50, 100, and 200. Do not deviate from pilot gradation by more than plus or minus 10 percentage points for any sieve for production material.

5. Aggregate source material: Screened or crushed aggregate, pit or bank run fine gravels or sand, or crushed concrete. If crushed concrete is used, add at least 30 percent of natural aggregate to provide workability.

6. Admixtures: Use admixtures meeting ASTM C 494 and ASTM C 1017 as needed to improve pumpability, to control time of set, and reduce bleeding.

7. Fluidifier: Use fluidifier meeting ASTM C 937 as necessary to hold solid constituents in suspension. Add shrinkage compensator if necessary.

8. Performance additive: Use flowable fill performance additive, such as Darafill or approved equal, to control fill properties.

B. Flowable Fill Requirements

1. Unconfined compressive strength: minimum 75 psi and maximum 150 psi at 56 days as determined based on an average of three tests for same placement. Present at least three acceptable strength tests for proposed mix design in mix design report.


4. Water bleeding for fill to be placed by grouting method in sewers: not to exceed 2 percent according to ASTM C 940.

5. Minimum wet density: 90 pounds per cubic foot.

2.02 BALLAST

A. Ballast Material: Natural rock or concrete pieces with minimum size equal to at least 10 times maximum aggregate size of flowable fill and maximum size of 24 inches. Maximum dimension shall not be more than 20 percent of minimum dimension of space to be filled.

B. Ballast Composition: Free of regulated waste material.
2.03 PLUGS FOR FORCE MAINS

A. Grout Plugs: Cement-based dry-pack grout conforming to ASTM C 1107, Grade B or C.

B. Manufactured Plug: Commercially available plug or cap specifically designed and manufactured to be used with pipe being abandoned.

PART 3 EXECUTION

3.01 PREPARATION

A. Have fill mix design reports and other submittals required by Paragraph 1.05 accepted by Project Manager prior to start of placement. Notify Project Manager at least 24 hours in advance of grouting with flowable fill.

B. Select fill placement equipment and follow procedures with sufficient safety and care to avoid damage to existing underground utilities and structures. Operate equipment at pressure that will not distort or imperil portion of work, new or existing.

C. Clean sewer lines and video with closed circuit television to identify connections, locate obstructions, and assess condition of pipe. Locate previously unidentified connections, which have not been redirected and reconnected as part of this project, and report them to Project Manager. During placement of fill, compensate for irregularities in sewer pipe, such as obstructions, open joints, or broken pipe to ensure no voids remain unfilled.

D. Perform demolition work prior to starting fill placement. Clean placement areas of sewers and manholes of debris that may hinder fill placement. Remove excessive amounts of sludge and other substances that may degrade performance of fill. Do not leave sludge or other debris in place if filling more than 2 percent of placement volume. Dispose of waste material in compliance with Section 01576 - Waste Material Disposal.

E. Remove free water prior to starting fill placement.

3.02 EQUIPMENT

A. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design.

B. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

3.03 DEMOLITION OF SEWER MANHOLES, PIPELINE STRUCTURES, AND FORCE MAINS PRIOR TO ABANDONMENT

A. Remove manhole frames and covers and castings from other existing pipeline structures. Deliver castings to nearest City of Houston maintenance facility for future use. Alternatively,
salvaged castings may be used upon approval by Project Manager, for constructing new manholes on this project.

B. Demolish and remove precast concrete adjustment rings and corner section, or brick and mortar corbel and chimney, or other pipeline structure, to minimum depth of 4 feet below finished grade. Structure may be removed to greater depth, but not deeper than 18 inches above crown of abandoned sewer.

C. When adjacent sewer lines are not to be filled, place temporary plugs in each line connecting to manhole, in preparation for filling manhole.

D. Excavate overburden from force mains to be abandoned at locations indicated on Drawings, conforming to Section 02317 - Excavation and Backfill for Utilities. Cut existing force main, when necessary, to provide an end surface perpendicular to axis of pipe and suitable for plug to be installed. Remove force main piping material remaining outside of segment to be abandoned.

3.04 INSTALLATION

A. Abandon sewer lines by completely filling sewer line with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.

B. Place flowable fill to fill volume between manholes. Continuously place flowable fill from manhole to manhole with no intermediate pour points, but not exceeding 500 feet in length.

C. Have filling operation performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.

D. Temporarily plug sewer lines which are to remain in operation during pouring/pumping to keep lines free of flowable fill.

E. Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

F. Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill sewer from downstream end, to discharge at upstream end.

G. Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.
H. Remediate placement of flowable fill which does not fill voids in sewer, in manhole or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface. Pressure grout shall conform to Section 02431 - Tunnel Grout.

I. Plug each end of force main being abandoned.

J. Force main abandonment
   1. Clean inside surface of force main at least 12 inches from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.
   2. When using grout plug, place temporary plug or bulkhead approximately 12 inches inside pipe. Fill pipe end completely with dry-pack grout mixture.
   3. When using manufactured plug or cap, install fitting as recommended by manufacturer's instructions, to form water tight seal.

K. Backfill to surface, above pipe or structures left in place, with flowable fill in restricted areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement. Place and compact backfill, other than flowable fill, in compliance with Section 02317 - Excavation and Backfill for Utilities.

L. Collect and dispose of excess flowable fill material and other debris in accordance with Section 01576 - Waste Material Disposal.

3.05 FIELD QUALITY CONTROL
   A. Provide batch plant tickets for each truck delivery of flowable fill. Note on tickets addition of admixtures at site.
   B. Check flow characteristics and workability of fill as placement proceeds.
   C. Obtain at least three test cylinders for each placement area for determination of 56-day compressive strength and bleeding. Acceptance of placement will be based on average strength of three tests.
   D. Record volume of ballast together with flowable fill placement for same space to demonstrate that voids have been filled.

3.06 PROTECTION OF PERSONS AND PROPERTY
   A. Provide safe working conditions for employees throughout demolition and removal operations. Observe safety requirements for work below grade.
B. Maintain safe access to adjacent property and buildings. Do not obstruct roadways, sidewalks or passageways adjacent to work.

END OF SECTION
PART 1   GENERAL

1.01   SECTION INCLUDES

   A. Removing surface debris and rubbish.

   B. Clearing site of plant life and grass.

   C. Removing trees and shrubs.

   D. Removing root system of trees and shrubs.

   E. Fence removal.

1.02   MEASUREMENT AND PAYMENT

   A. Unit Prices.

      1. Payment for clearing and grubbing is on per acre basis.

      2. No separate payment will be made for clearing and grubbing of wastewater projects, include payment in unit prices for related items.

      3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03   REGULATORY REQUIREMENTS

   A. Conform to applicable codes for disposal of debris.

   B. Coordinate clearing work with utility companies.

PART 2   PRODUCTS - Not Used
PART 3  EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.02 PROTECTION

A. Protect following from damage or displacement:
   1. Living trees located 3 feet or more outside of intersection of side slopes and original ground line.
   2. Plants other than trees and landscape features designated to remain.
   3. Utilities designated to remain.
   4. Bench marks, monuments, and existing structures designated to remain.

3.03 CLEARING

A. Remove stumps, main root ball, and root system to:
   1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.
   2. Depth of 24 inches below finished surface of required cross section for other areas.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse.

3.04 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Section 01576 - Waste Material Disposal.

B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION
Section 02260

TRENCH SAFETY SYSTEM

PART  G E N E R A L

1.01 SECTION INCLUDES

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

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

C. This Standard Specification Section replaces previously published Section 01561-Trench Safety System.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

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

2. No payment will be made under this section for trench safety systems for structural excavations, tunnel shafts, auger pits, or excavation for trenchless installations, and also for any necessary non trenchless installations included in the aforementioned methods of construction unless included as a bid item in Documents 00410 – Bid Form. Include payment for trench safety systems in applicable structural or utility installation sections.

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

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

1.03 DEFINITIONS

A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.
B. The trench safety system requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and these installation to dimensions equivalent of a trench as defined.

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

D. Trench Safety Program is the safety procedures governing the presence and activities of individuals working in and around trench excavations.

1.04 SUBMITTALS

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

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

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

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

E. Submit certification that trench safety system will not be subjected to loads exceeding those which the system was designed to withstand according to the available construction and geotechnical information.

1.05 REGULATORY REQUIREMENTS

A. Install and maintain trench safety systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

B. A reproduction of the OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209 is available upon request to Contractors bidding on City projects. The City assumes no responsibility for the accuracy of the reproduction. The Contractor is responsible for obtaining a copy of this section of the Federal Register.
C. Legislation that has been enacted by the Texas Legislature with regard to Trench Safety Systems, is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., §756.021 (Vernon 1991).

D. Reference materials, if developed for a specific project, will be issued with the Bid Documents, including the following:

1. Document 00830 - Trench Safety Geotechnical Information: Geotechnical information obtained for use in design of the trench safety system.

1.06 INDEMNIFICATION

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

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

PART PRODUCTS - Not Used

PART EXECUTION

3.01 INSTALLATION

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

B. Install specially designed trench safety systems in accordance with the Contractor’s trench excavation safety program for the locations and conditions identified in the program.

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

3.02 INSPECTION

A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the trench safety systems to ensure that the installed systems and operations meet OSHA 29CFR and other personnel protection regulations requirements.
B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until the necessary precautions have been taken by Contractor to safeguard personnel entering the trench.

C. Maintain a permanent record of daily inspections.

3.03 FIELD QUALITY CONTROL

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

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Excavation and compaction of materials for roadways.

B. Excavation and compaction of materials for roadside ditches.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for roadway excavation, with or without subgrade, is on cubic yard basis. Unless specified otherwise under the borrow (off-site) material or embankment fill work item, measurement for payment shall be based on the cut quantity shown on the drawing.

2. No payment will be made for material excavated under the following conditions:

   a. More than 2 feet outside of vertical planes behind back of curbs

   b. For portion within limits of trench for utilities 24-inch and greater constructed by open-cut methods

   c. As indicated otherwise on Drawings.

3. Measurement for the bid item “Regrade Ditches” is on a linear foot basis. No separate payment will be made for reshaping and regrading roadway ditch shoulder slope and side slope adjacent to installed temporary pavement upon removal of temporary pavement.

4. If specified, off-site borrow material including placement and compaction will be paid by final in-place quantity on cubic yard basis.

5. If specified and shown on the drawing, embankment fill including placement and compaction will be paid by final in-place quantity on cubic yard basis.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES


C. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 3017 - Standard Test Method for Water content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).


PART 2 PRODUCTS

2.01 MATERIALS

A. Provide topsoil conforming to requirements of Section 02911 - Topsoil.

B. Provide backfill which is excavated material, graded free of roots, lumps greater than 6 inches, rocks larger than 3 inches, organic material, and debris.

C. Provide structural backfill which is select material meeting following requirements:

1. Plasticity index: not less than 12 nor more than 20.

2. Maximum liquid limit: 45

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, and datum. Coordinate with Section 01725 - Field Surveying.

B. Identify and flag surface and aerial utilities.

C. Notify utility companies to remove or relocate utilities.

D. Identify, stake, and flag known utility locations below grade. Make temporary or permanent relocation of underground pipes, ducts, or utilities where indicated on Drawings.

E. Upon discovery of unknown or badly deteriorated utilities, or concealed conditions, discontinue work. Notify Project Manager and obtain instructions before proceeding in such areas.
F. Obtain approval of top soil quality before excavating and stockpiling.

3.02 PROTECTION

A. Protect the following from damage or displacement:
   1. Trees, shrubs, lawns, existing structures, and other features outside of grading limits.
   2. Utilities either above or below grade, which are to remain.

3.03 TOPSOIL REMOVAL

A. Strip off topsoil from area to be excavated to minimum depth of 6 inches, unless indicated otherwise on Drawings.

B. Stockpile topsoil in designated location for reuse. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.04 SOIL EXCAVATION

A. Excavate to lines and grades shown on Drawings.

B. Remove unsuitable material not meeting specifications. Backfill with embankment materials and compact to requirements of Section 02330 - Embankment.

C. Record location and plug and fill inactive water and oil wells. Conform to Texas Department of Health, Texas Natural Resource Conservation Commission, and Texas Railroad Commission requirements. Notify Project Manager prior to plugging wells.

D. At intersections, grade back at minimum slope of one inch per foot. Produce smooth riding junction with intersecting street. Maintain proper drainage.

E. When area is inadvertently over excavated, fill area in accordance with requirements of Section 02330 - Embankment at no additional cost to City.

F. Remove material not qualified for use and excess soil not being reused from site in accordance with requirements of Section 01576 - Waste Material Disposal.

3.05 COMPACTION

A. Maintain optimum moisture content of subgrade to attain required density.

B. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:
1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.

2. Other areas: Minimum density of 90 percent of maximum dry density.

3.06 TOLERANCES

A. Top of Compacted Surface: Plus or minus 1/2 inch in cross section, or in 16-foot length.

3.07 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Test and analysis of soil materials will be performed in accordance with ASTM D 4318, ASTM D 2216, and ASTM D 698.

C. Compaction testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017.

D. A minimum of three tests will be taken for each 1000 linear feet per lane of roadway.

E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no additional cost to City.

3.08 PROTECTION

A. Prevent erosion at all times. Maintain ditches and cut temporary swales to allow natural drainage in order to avoid damage to roadway. Do not allow water to pond.

B. Distribute construction traffic evenly over compacted areas, where practical, to aid in obtaining uniform compaction. Protect exposed areas having high moisture content from wheel loads that cause rutting.

C. Maintain excavation and embankment areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density.

END OF SECTION
Section 02316

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Excavation, backfilling, and compaction of backfill for structures.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for structural excavation and backfill under this Section. Include payment in unit price or lump sum for construction of structures.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  DEFINITIONS

A. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material: Suitable soil materials are those meeting specification requirements. Unsuitable soils meeting specification requirements for suitable soils after treatment with lime or cement shall be considered suitable, unless otherwise indicated.

C. Select Material: Material as defined in Section 02320 - Utility Backfill Materials.

D. Backfill: Material meeting specified quality requirements, placed and compacted under controlled conditions around structures.
E. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

F. Foundation Base: For foundation base material, use crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

G. Foundation Subgrade: Foundation subgrade is surface of natural soil which has been excavated and prepared to support foundation base or foundation backfill, where needed.

H. Ground Water Control Systems: Installations external to excavation such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.

I. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from excavation. Remove rain water and surface water which accidentally enters excavation as part of excavation drainage.

J. Excavation Drainage: Removal of surface and seepage water in excavation by sump pumping and using French drains surrounding foundation to intercept water.

K. Over-Excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below foundation as shown on Drawings, and backfilled with foundation backfill material.

L. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins.

1.04 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600kN-m/m³)).


D. ASTM D 3017 - Standard Test Method for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).

F. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

G. TxDOT Tex-110-E - Particle Size Analysis of Soils.


1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit work plan for excavation and backfill for each structure with complete written description which identifies details of proposed method of construction and sequence of operations for construction relative to excavation and backfill activities. Use descriptions, with supporting illustrations, sufficiently detailed to demonstrate to Project Manager that procedures meet requirements of Specifications and Drawings.

C. Submit excavation safety system plan.
   1. Submit excavation safety system plan in accordance with applicable OSHA requirements for excavations.
   2. Submit excavation safety system plan in accordance with requirements of Section 02260 - Trench Safety System, for excavations that fall under State and Federal trench safety laws.

D. Submit ground and surface water control plan in accordance with requirements in this Section and Section 01578 - Control of Ground Water and Surface Water.

E. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

F. Submit project record documents under provisions of Section 01785 - Project Record Documents. Record location of utilities, as installed, referenced to survey benchmarks. Include location of utilities encountered or rerouted. Give horizontal dimensions, elevations, inverts and gradients.

1.06 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.
B. Perform embedment and backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Perform excavation with equipment suitable for achieving requirements of this Specification.

B. Use equipment which will produce degree of compaction specified. Compact backfill within 3 feet of walls with hand operated equipment. Do not use equipment weighing more than 10,000 pounds closer to walls than a horizontal distance equal to depth of fill at that time. Use hand operated power compaction equipment where use of heavier equipment is impractical or restricted due to weight limitations.

2.02 MATERIAL CLASSIFICATIONS

A. Use backfill materials conforming to classifications and product descriptions of Section 02320 - Utility Backfill Materials. Use classification or product description for backfill applications as shown on Drawings and as specified.

PART 3 EXECUTION

3.01 PREPARATION

A. Conduct an inspection to determine condition of existing structures and other permanent installations.

B. Set up necessary street detours and barricades in preparation for excavation if construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning devices at all times for streets and intersections where work is in progress, or where construction work is considered hazardous to traffic movements.

C. Perform work in accordance with OSHA standards. Employ an excavation safety system as specified in Section 02260 - Trench Safety Systems.

D. Remove existing pavements and structures, including sidewalks and driveways, in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

E. Install and operate necessary dewatering and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

3.02 PROTECTION
A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Prevent erosion of excavations and backfill. Do not allow water to pond in excavations.

E. Maintain excavation and backfill areas until start of subsequent work. Repair and recompact slides, washouts, settlements, or areas with loss of density at no additional cost to City.

3.03 EXCAVATION

A. Perform excavation work so that underground structure can be installed to depths and alignments shown on Drawings. Use caution during excavation work to avoid disturbing surrounding ground and existing facilities and improvements. Keep excavation to absolute minimum necessary. No additional payment will be made for excess excavation not authorized by Project Manager.

B. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding in such areas.

C. Immediately notify agency or company owning any line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.

D. Avoid settlement of surrounding soil due to equipment operations, excavation procedures, vibration, dewatering, or other construction methods.

E. Provide surface drainage during construction to protect work and to avoid nuisance to adjoining property. Where required, provide proper dewatering and piezometric pressure control during construction.

F. Conduct hauling operations so that trucks and other vehicles do not create dirt nuisance in streets. Verify that truck beds are sufficiently tight and loaded in such a manner such that objectionable materials will not spill onto streets. Promptly clear away any dirt, mud, or other materials that spill onto streets or are deposited onto streets by vehicle tires.

G. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed, replace those which are damaged or destroyed by Work.

H. Provide sheeting, shoring, and bracing where required to safely complete Work, to prevent excavation from extending beyond limits indicated on Drawings, and to protect Work and
adjacent structures or improvements. Use sheeting, shoring, and bracing to protect workmen and public conforming to requirements of Section 02260 - Trench Safety Systems.

I. Prevent voids from forming outside of sheeting. Immediately fill voids with grout, cement stabilized sand, or other material approved by Project Manager and compact to 95 percent standard density.

J. After completion of structure, remove sheeting, shoring, and bracing unless shown on Drawings to remain in place or directed by Project Manager in writing that such temporary structures may remain. Remove sheeting, shoring and bracing in such a manner as to maintain safety during backfilling operations and to prevent damage to Work and adjacent structures or improvements.

K. Immediately fill and compact voids left or caused by removal of sheeting with cement stabilized sand or other material approved by Project Manager and compact to 95 percent standard density.

3.04 HANDLING EXCAVATED MATERIALS

A. Classify excavated materials. Place material which is suitable for use as backfill in orderly piles at sufficient distance from excavation to prevent slides or cave-ins.

B. Provide additional backfill material in accordance with requirements of Section 02319 - Borrow, if adequate quantities of suitable material are not available from excavation and trenching operations at site.

3.05 DEWATERING

A. Provide ground water control per Section 01578 - Control of Ground Water and Surface Water.

B. Keep ground water surface elevation minimum of 2 feet below bottom of foundation base.

C. Maintain ground water control as directed by Section 01578 - Control of Ground Water and Surface Water and until structure is sufficiently complete to provide required weight to resist hydrostatic uplift with minimum safety factor of 1.2.

3.06 FOUNDATION EXCAVATION

A. Notify Project Manager at least 48 hours prior to planned completion of foundation excavations. Do not place foundation base until excavation is accepted by Project Manager.

B. Excavate to elevations shown on Drawings, as needed to provide space for foundation base, forming level undisturbed surface, free of mud or soft material. Remove pockets of soft or otherwise unstable soils and replace with foundation backfill material or material as directed by Project Manager. Prior to placing material over it, recompact subgrade where indicated on
Drawings, scarifying as needed, to 95 percent of maximum Standard Dry Density according to ASTM D 698. If specified level of compaction cannot be achieved, moisture condition subgrade and recompact until 95 percent is achieved, over-excavate to provide minimum layer of 24 inches of foundation backfill material, or other means acceptable to Project Manager.

C. Fill unauthorized excessive excavation with foundation backfill material or other material as directed by Project Manager.

D. Protect open excavations from rainfall, runoff, freezing groundwater, or excessive drying so as to maintain foundation subgrade in satisfactory, undisturbed condition. Keep excavations free of standing water and completely free of water during concrete placement.

E. Remove soils which become unsuitable due to inadequate dewatering or other causes, after initial excavation to required subgrade, and replace with foundation backfill material, as directed by Project Manager, at no additional cost to City.

F. Place foundation base, or foundation backfill material where needed, over subgrade on same day that excavation is completed to final grade. Where base of excavations are left open for longer periods, protect them with seal slab or cement-stabilized sand.

G. Use filter fabric as specified in Section 02621 - Geotextile to separate crushed aggregate, and other free draining Class I materials from native soils or select material backfill. Overlap fabric minimum of 12 inches beyond where another material stops contact with soil.

H. Place crushed aggregate, and other Class I materials, in uniform layers of 8-inch maximum thickness. Perform compaction by means of at least two passes of vibratory compactor.

3.07 FOUNDATION BASE.

A. Place foundation base after subgrade is properly prepared, including placement of foundation backfill where needed. Use foundation base consisting of 12-inch layer of crushed stone aggregate or cement stabilized sand. Alternately, seal slab with minimum thickness of 4 inches may be placed. Extend foundation base minimum of 12 inches beyond edge of structure foundation, unless shown otherwise on Drawings.

B. Where foundation base and foundation backfill are of same material, both can be placed in one operation.

3.08 BACKFILL

A. Complete backfill to surface of natural ground or to lines and grades shown on Drawings. Remove forms, lumber, trash and debris from structures. Deposit backfill in uniform layers and compact each layer as specified.

1. Unless otherwise shown on Drawings, for structures under pavement or within one foot back of curb, use cement stabilized sand up to the top of the proposed structure. Use suitable on-site material (random backfill) up to 12 inches below pavement base.
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or subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.

2. Unless otherwise shown on Drawings, for structures not under pavement, use random backfill of suitable material up to the surface.

B. Do not place backfill against concrete walls or similar structures until laboratory test breaks indicate that concrete has reached minimum of 85 percent of specified compressive strength. Where walls are supported by slabs or intermediate walls, do not begin backfill operations until slab or intermediate walls have been placed and concrete has attained sufficient strength.

C. Remove concrete forms before starting backfill and remove shoring and bracing as work progresses.

D. Maintain backfill material at no less than 2 percent below nor more than 2 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698 below paved areas. Compact fill to at least 90 percent around structures below unpaved areas.

E. Where backfill is placed against sloped excavation surface, run compaction equipment across boundary of cut slope and backfill to form compacted slope surface for placement of next layer of backfill.

F. Place backfill using cement stabilized sand in accordance with Section 02321 - Cement Stabilized Sand.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Tests will be performed initially on minimum of one different sample of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity.

C. In-place density tests of compacted subgrade and backfill will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions:

1. Minimum of one test for every 50 to 100 cubic yards of compacted backfill material as directed by Project Manager.

2. A minimum of three density tests for each full work shift.

3. Density tests will be performed in all placement areas.
4. Number of tests will be increased when inspection determines that soil types or moisture contents are not uniform or when compacting effort is variable and not considered sufficient to attain uniform density.

5. Identify elevation of test with respect to natural ground.

6. Record approximate depth of lift tested.

D. At least one test for moisture-density relationships will be initially performed for each type of backfill material in accordance with ASTM D 698. Perform additional moisture-density relationship test once a month or whenever there is noticeable change in material gradation or plasticity.

E. When tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at Contractor's expense.

3.10 DISPOSAL OF EXCESS MATERIAL

Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION
Section 02317

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

2. When Project Manager directs Contractor to over excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6” Over Excavation of Trench Bottom.

   a. No payment will be paid if Project Manager does not direct Contractor to over excavate trench bottom.

   b. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01578 - Control of Ground Water and Surface Water.

3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.
B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12 inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4 inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, eductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01578 - Control of Ground Water and Surface Water.
K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.
   a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.
   b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings, and backfilled with foundation bedding.
Q. Foundation Bedding: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation bedding is placed and compacted as backfill to provide stable support for bedding. Foundation bedding materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 02260 - Trench Safety Systems.

S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by cave in, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

V. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jetting is used to slough off and vacuum away soil.

W. Large Diameter Water Line (LDWL): Water line that is 24-inches in diameter or larger.

X. Emergency Action Plan (EAP): The EAP document should include a discussion of procedures for timely and reliable detection, classification (level of emergency) and response procedure to a potential emergency condition associated with a large diameter water line.

Y. Subsurface Utility Exploration (SUE): Non-destructive excavation, unless otherwise approved by project manager.

1.04 REFERENCES


D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.


H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).


K. TxDOT Tex-110-E - Particle Size Analysis of Soils.


1.05 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

B. For proposed utility adjacent to or across existing LDWL:

1. Conduct a meeting between contractor, Drinking Water Operations and Utility Maintenance Branch prior to beginning excavation to coordinate the EAP in the event a water line shut down becomes necessary.

2. Notify Drinking Water Operations a minimum of 1 week prior to beginning construction activities.

3. Notify Drinking Water Operations a minimum of 48 hours prior to beginning SUE work near LDWL.
4. Unless otherwise approved by City Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or City Holiday.

5. A City Inspector must be present during SUE or construction activities occurring within four feet or one diameter of the LDWL, whichever is greater, from a LDWL or appurtenance.

1.06 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit planned typical method of excavation, backfill placement and compaction including:
   1. Trench widths.
   2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.
   3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 02320 - Utility Backfill Materials.

D. Submit trench excavation safety program in accordance with requirements of Section 02260 - Trench Safety System. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.

E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

F. Submit 11 inch by 17 inch or 12 inch by 18 inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

G. For installation of proposed utility adjacent to or across existing LDWL, prepare and submit the following to Drinking Water Operations prior to beginning construction activities. Obtain approval from Drinking Water Operations prior to commencing prelocate or utility work near LDWL.
   1. Trench details, shoring system designs, installation sequences, and flowable fill mix designs.
2. Emergency Action Plan (EAP) to address contingency plans in the event of damage to or failure of LDWL. Include the following:
   a. Contact personnel and agencies including primary and secondary telephone numbers,
   b. Contractor’s hierarchy of responsible personnel,
   c. Traffic control measures, and
   d. Identification of resources to be available on or near project site in event of damage to or failure of LDWL.

1.07 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01454 - Testing Laboratory Services and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 02320- Utility Backfill Materials.

1.08 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a premanufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12 inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.
D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.02 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 02320 - Utility Backfill Materials and Section 02321 – Cement Stabilized Sand.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621- Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

PART 3 EXECUTION

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12 or C76 as applicable, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

3.02 PREPARATION

A. Establish traffic control to conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02260 - Trench Safety Systems.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.
D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02221 - Removing Existing Pavements and Structures, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01578 - Control of Ground Water and Surface Water. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01725 - Field Surveying.

3.03 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris, are based on best information available but are only approximate locations. Unless otherwise approved by Project Manager, at Critical Locations shown on Drawings, perform vacuum excavation to field verify horizontal and vertical locations of such lines within a zone 2 feet vertically and 4 feet horizontally of proposed work exclude water jetting at PCCP water line.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.

2. Notify Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours notice prior to field excavation or related work.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12 inch by 18 inch copy of Drawings. For large diameter water lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

D. LDWL Prelocate Requirements:
1. Field-locate LDWL, appurtenances and laterals connected directly to LDWL through use of non-probing method such as a vacuum truck (non-water jetting method) at no greater than 50 foot intervals. Locate upstream and downstream of proposed work or utility installation.

2. Record crown and side of LDWL adjacent to proposed work or utility installation. Record LDWL locations horizontally and vertically using same coordinate system employed on proposed utility drawings.

3. Tie horizontal and vertical coordinates into project baseline. Submit recordings performed by R.P.L.S to City a minimum of 14 days prior to mobilizing to site

3.04 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01562 - Tree and Plant Protection.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement failures or potholes occur, repair, re-compact, and pave those areas at no additional cost to City.

E. Contingency plans for proposed work or utility installation adjacent to or across a LDWL:

1. Conduct on-site emergency drill prior to commencing proposed utility installation, and at three month intervals to assure EAP is current.

2. In the event a LDWL shut down becomes necessary, secure site and provide assistance to City personnel to access pipe and isolation valves as needed.

3.05 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.
C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Excavate trench so that pipe is centered in trench.

<table>
<thead>
<tr>
<th>Nominal Pipe Size, Inches</th>
<th>Minimum Trench Width, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 18</td>
<td>O.D. + 18</td>
</tr>
<tr>
<td>18 to 30</td>
<td>O.D. + 24</td>
</tr>
<tr>
<td>36 to 42</td>
<td>O.D. + 36</td>
</tr>
<tr>
<td>Greater than 42</td>
<td>O.D. + 48</td>
</tr>
</tbody>
</table>

Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.

2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.

3. Leave sheeting driven into or below pipe embedment zone in place to preclude loss of support of foundation and embedment materials, unless otherwise directed by Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.

4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.
G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re-compact after shield is moved if soil is disturbed.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.

5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber-tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company’s line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company’s representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy-acetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company’s representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.
L. Excavation and shoring requirements for proposed work or utility installation adjacent to or across a LDWL:

1. Identify LDWL area in field and barricade off from construction activities. Allow no construction related activities including, but not limited to, loading of dump trucks and material staging or storage, on top of LDWL.

2. Employ a groundwater control system when performing excavation activities within ten feet of LDWL to:
   a. Effectively reduce hydrostatic pressure affecting excavations,
   b. Develop substantially dry and stable subgrade for subsequent construction operations,
   c. Prevent loss of fines, seepage, boils, quick condition or softening of foundation strata, and
   d. Maintain stability of sides and bottom of excavations.

3. When edge of proposed trench or shoring is within a distance equal to one diameter of LDWL from outside of wall of LDWL, valve or appurtenance:
   a. Maintain minimum of four (4) feet horizontal clearance and minimum of two (2) feet vertical clearance between proposed utility and LDWL.
   b. Auger Construction
      i. Maintain minimum of four (4) feet horizontal clearance between proposed utility and LDWL.
      ii. Dry auger method required when auger hole is 12-inches and larger in diameter.
   c. Open Cut Construction and Auger pits
      i. Perform hand excavation when within four (4) feet of LDWL.
      ii. Employ hydraulic or pneumatic shoring system. Do not use vibratory or impact driven shoring or piling.
      iii. Expose no more than 30-feet of trench prior to backfilling.
      iv. A maximum of one (1) foot of vertical trench shall be un-braced at a time to maintain constant pressure on face of excavated soil.
      v. Upon removal of shoring system, inject flowable fill into void space left behind by shoring system. Comply with Standard Specification 02322 - Flowable Fill.
d. When edge of utility excavation is greater than one diameter of LDWL from outside wall of LDWL, use a shielding system as required by Project Manager and proposed utility standards and practices.

3.06 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02320 - Utility Backfill Materials. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Section 02320 - Utility Backfill Materials.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01504 - Temporary Facilities and Controls. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6 inches with approval by Project Manager. Place non-woven geotextile fabric and then compact 12 inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, when directed by Project Manager, in accordance with Paragraph 3.07B above. Removal of unstable or unsuitable material may be required if approved by Project Manager;

1. Even though Contractor has not determined material to be unsuitable, or

2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01578 - Control of Ground Water and Surface Water.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.
B. Place embedding including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedding materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedding zone unless means to maintain density of compacted embedding material are used. If moveable supports are used in embedding zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedding materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedding material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water lines construction embedding, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02320 - Utility Backfill Material. Adhere to the following subparagraph numbers 1 and 2.

1. Class I, II and III Embedment Materials:
   a. Maximum 6 inches compacted lift thickness.
   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.
   c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement Stabilized Sand (where required for special installations):
a. Maximum 6 inches compacted thickness.

b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.

c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.

K. For Sanitary Sewers adhere to subparagraph number 1 and 2. For Storm Sewers provide cement stabilized sand per paragraph 2. This provision does not apply to Storm Sewers constructed of HDPE pipe installed under pavement.

1. Class I Embedment Materials.

a. Maximum 6-inches compacted lift thickness.

b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.

c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.

2. Class II Embedment and Cement Stabilized Sand.

a. Maximum 6-inches compacted thickness.

b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.

c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

L. For Storm Sewers constructed of HDPE pipe and installed under pavement provide flowable fill pipe embedment as specified in Section 02322 Flowable Fill.
M. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.

B. For water lines, under pavement and to within one foot back of curb, use backfill materials described below:
   1. For water lines 20 inches in diameter and smaller, use bank run sand or select backfill materials up to pavement base or subgrade.

   2. For water lines 24 inches in diameter and larger, backfill with suitable on-site material (random backfill) up to 12 inches below pavement base or subgrade. Place minimum of 12 inches of select backfill below pavement base or subgrade.

C. For sewer pipes (Storm and Sanitary), use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand for pipes of nominal sizes 36 inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42 inches in diameter and larger, under pavement or natural ground, backfill from 12 inches above top of pipe to 12 inches below pavement with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12-inch backfill directly under pavement. For backfill materials reference Section 02320 - Utility Backfill Materials. This provision does not apply where a Storm Sewer is constructed of HDPE pipe.

D. For Storm Sewers constructed of HDPE pipe and installed under pavement provide flowable fill as specified in Section 02322 Flowable Fill. For Storm Sewers constructed of HDPE pipe and not installed under pavement provide cement stabilized sand.

E. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5 feet or more above crown of pipe. Remove trench supports within 5 feet from ground surface.

F. Unless otherwise shown on Drawings. Use one of the following trench zone backfills under pavement and to within one foot of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.

   1. Class I, II, or III or combination thereof:
a. Place in maximum 12-inch thick loose layers.
b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement-Stabilized Sand:
   a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12 inches.
   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.
   c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Class IVA and IVB (Clay Soils):
   a. Place in maximum 8-inch thick loose lifts.
   b. Compaction by vibratory Sheepfoot roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
   c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone. This provision does not apply to HDPE storm sewers.

1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.


3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.

4. Moisture content as necessary to achieve density.
H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Below paved areas or where shown on Drawings, encapsulate manhole with cement stabilized sand; minimum of 2 foot below base, minimum 2 foot around walls, up to pavement subgrade or natural ground. Compact in accordance with Paragraph 3.09.F.2 of this Section

B. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

C. For LDWL projects, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum of 2 feet around walls, up to within 12 inches of pavement subgrade or natural ground. For manholes over water line, extend encapsulation to bottom of trench. Compact in accordance with Paragraph 3.09 F.2 of this Section.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to City.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Project Manager.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.
1. For open cut construction projects and auger pits: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.

2. A minimum of three density tests for each full shift of Work.

3. Density tests will be distributed among placement areas. Placement areas are: foundation, bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at same frequency as first test series, including verification tests.

8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, re-compact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01576 - Waste Material Disposal.
Section 02318

EXTRA UNIT PRICE WORK FOR EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Measurement and payment applicable to extra unit price work items for excavation and backfill made necessary by unusual or unforeseen circumstances encountered during utility installations.

B. Extra unit price work for excavation and backfill is paid only when authorized in advance by Project Manager.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. Excavation Around Obstructions: Payment for excavation around obstructions is on cubic yard basis, measured in place, without deduction for volume occupied by portions of pipes, ducts, or other structures left in place across trenches excavated under this item.

2. Extra Hand Excavation: Payment for extra hand excavation is on cubic yard basis, measured in place.

3. Extra Machine Excavation: Payment for extra machine excavation is on cubic yard basis, measured in place.

4. Extra Placement of Backfill Material: Payment for extra placement of backfill material is on cubic yard basis, measured in place, for material installed as part of Work. At discretion of Project Manager, measurement of cubic yards may be calculated from volume of Extra Hand Excavation or Extra Machine Excavation for which replacement is made, minus volume of any Extra Placement of Granular Backfill authorized in conjunction with Work.

5. Extra Placement of Granular Backfill: Payment for extra placement of granular backfill material is on cubic yard basis, measured in place.

6. Extra Select Backfill: Payment for extra select backfill is on cubic yard basis, measured in place for a theoretical minimum trench width. The project Manager may authorize extra select backfill when soil from the excavation work does not include adequate quantities for placement of suitable on-site material (random backfill).
7. Refer to Section 01270 – Measurement and payment for unit price procedures.

1.03 DEFINITIONS

A. Excavation Around Obstructions: Excavation necessitated by obstruction of pipes (other than service connections 3 inches in diameter or less), ducts, or other structures, not shown on Drawings, and of an unusual or unforeseen nature which interfere with installation of utility piping by normal methods of excavation or auguring.

B. Extra Hand Excavation: Excavation by manual labor made necessary by unusual or unforeseen circumstances at locations approved in advance by Project Manager.

C. Extra Machine Excavation: Excavation by machine at or near project site to perform related work not included in original project scope but added for convenience of City, as approved in advance by Project Manager.

D. Extra Replacement of Backfill Material: Handling, backfill, and compaction of excavated material authorized under extra work bid items for Extra Hand Excavation or Extra Machine Excavation. Placement and compaction shall conform to requirements specified for excavation and backfill in Sections 02316 – Excavation and Backfill for Structures and 02317 – Excavation and Backfill for Utilities.

E. Extra Placement of Granular Backfill: Hauling, placing, and compacting granular backfill materials as approved by Project Manager in conjunction with Extra Replacement of Backfill Material. Materials placed under this item shall conform to requirements for Bank Run Sand, Cement Stabilized Sand, Concrete Sand, Gem Sand, Crushed Stone, or Crushed Concrete specified for backfill material in Sections 02316 – Excavation and Backfill for Structures and 02317 – Excavation and Backfill for Utilities.

F. Extra Select Backfill: Unsuitable material removed from the project and select backfill material hauled to the project, or conditioning unsuitable material on the site to make it select backfill. Provide select backfill material specified in Section 02320 – Utility Backfill Materials.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION
PART 1  G E N E R A L

1.01  SECTION INCLUDES

A. Soil materials for embankment or backfill.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for borrow is on cubic yard basis calculated by theoretical quantities using average end area method based on Drawings.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES


1.04  SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit location and description of proposed borrow area for approval.

C. Submit material samples for testing.

PART 2  P R O D U C T S

2.01  SOIL MATERIAL
A. Grade borrow material used for embankment or backfill free of lumps greater than 6 inches, rocks larger than 3 inches, organic material, chemical waste or other contamination, and debris. Take borrow material from sources approved by Project Manager.

B. Use material with plasticity index not less than 12, nor more than 20 when tested in accordance with ASTM D 4318. Maximum liquid limit shall be 45, unless approved by Project Manager. Do not use blend of cohesive and granular soils to achieve required plasticity index.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Project Manager and testing laboratory 5 days in advance of opening borrow source to permit obtaining samples for qualification testing. When material does not meet specification requirements, locate another source of borrow.

B. Clear approved source area of trees, stumps, brush, roots, vegetation, organic matter, and other unacceptable material before excavation.

3.02 TESTS

A. Test and analyze soil materials in accordance with ASTM D 4318 and ASTM D 2216 under provisions of Section 01454 - Testing Laboratory Services.

3.03 EXCAVATION

A. Provide adequate drainage of surface water so that surface water run off does not enter borrow pit excavation.

3.04 HAULING

A. Use covered trucks. Conform to requirements of Section 01555 - Traffic Control and Regulation.

3.05 EMBANKMENT

A. Conform to requirements of Section 02330 - Embankment.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:
   1. Concrete sand
   2. Gem sand
   3. Pea gravel
   4. Crushed stone
   5. Crushed concrete
   6. Bank run sand
   7. Select backfill
   8. Random backfill
   9. Cement stabilized sand

C. Material Handling and Quality Control Requirements.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for backfill material. Include payment in unit price for applicable utility installation.

2. Payment for backfill material, when included as separate pay item or when directed by Project Manager, is on cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings, or as directed by Project Manager.

3. Payment for backfill of authorized over-excavation is in accordance with Section 02318 - Extra Unit Price Work for Excavation and Backfill.
4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 DEFINITIONS

A. Unsuitable Material:

1. Materials classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.

4. Materials contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material:

1. Materials meeting specification requirements.

2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.
G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.

H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Section 02317 - Excavation and Backfill for Utilities for other definitions regarding utility installation by trench construction.

1.04 REFERENCES

H. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
K. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.
L. TxDOT Tex-460-A - Material Finer Than 75 μm (No.200) Sieve In Mineral Aggregates (Decantation Test for Concrete Aggregates).
1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.03, Material Testing.

D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.

E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

1.06 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.03B.

B. Verification tests of backfill materials may be performed by City in accordance with Section 01454 - Testing Laboratory Services and in accordance with Paragraph 3.03.

PART 2 PRODUCTS

2.01 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:

1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
   a. Plasticity index: non-plastic.
   b. Gradation: $D_{60}/D_{10}$ - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.

2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
2.02 PRODUCT DESCRIPTIONS


b. Gradations:
   1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
   2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.
   3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.

3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
   a. Plasticity index: greater than 7.
   b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.

   a. Plasticity Indexes:
      1) Plasticity index: greater than 7, and above A line.
      2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
   b. Liquid limit: less than 50.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.

5. Class IVB: Fat clays (CH)
   a. Plasticity index: above A line.
   b. Liquid limit: 50 or greater.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.

6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.
A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by Project Manager. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.

2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.

3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Project Manager, provided that physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:

1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.

2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 8</td>
<td>80 to 100</td>
</tr>
<tr>
<td>No. 16</td>
<td>50 to 85</td>
</tr>
<tr>
<td>No. 30</td>
<td>25 to 60</td>
</tr>
<tr>
<td>No. 50</td>
<td>10 to 30</td>
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</tbody>
</table>
F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8&quot;</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>60 to 80</td>
</tr>
<tr>
<td>No. 8</td>
<td>15 to 40</td>
</tr>
</tbody>
</table>

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>85 to 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>10 to 30</td>
</tr>
<tr>
<td>No. 8</td>
<td>0 to 10</td>
</tr>
<tr>
<td>No. 16</td>
<td>0 to 5</td>
</tr>
</tbody>
</table>

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by Project Manager.

2. Non-plastic fines.

3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.

4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.

5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.

7. Gradations, as determined in accordance with Tex-110-E.

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Passing by Weight for Pipe Embedment by Ranges of Nominal Pipes Sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt;15&quot;</td>
</tr>
<tr>
<td>1&quot;</td>
<td>95 - 100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>60 - 90</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>25 - 60</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>-</td>
</tr>
<tr>
<td>No. 4</td>
<td>0 - 5</td>
</tr>
<tr>
<td>No. 8</td>
<td>-</td>
</tr>
</tbody>
</table>

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Section 02951 - Pavement Repair and Restoration to meet plasticity criteria.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) when allowed by applicable backfill installation specification. Refer to Section 02316 - Excavation and Backfill for Structures and Section 02317 - Excavation and Backfill for Utilities.

K. Cement Stabilized Sand: Conform to requirements of Section 02321 - Cement Stabilized Sand.

L. Concrete Backfill: Conform to Class B concrete as specified in Section 03315 - Concrete for Utility Construction.

M. Flexible Base Course Material: Conform to requirements of applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Recycled Crushed Concrete Base Course.

2.03 MATERIAL TESTING

A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from
current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:

2. Plasticity of material passing No. 40 sieve
3. Los Angeles abrasion wear of material retained on No. 4 sieve
4. Clay lumps
5. Lightweight pieces
6. Organic impurities

B. Production Testing. Provide reports to Project Manager from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.

C. Assist Project Manager in obtaining material samples for verification testing at source or at production plant.

PART 3 EXECUTION

3.01 SOURCES

A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.
B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Project Manager may obtain samples for verification testing.

C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Project Manager, expense for sampling and testing required to change to different material will be credited to City through change order.

D. Bank run sand, select backfill, and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete work from off-site sources.
E. City does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.

3.02 MATERIAL HANDLING

A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.

B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Project Manager in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.03 FIELD QUALITY CONTROL

A. Quality Control

1. The Project Manager may sample and test backfill at:

   a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.

   b. On-site stockpiles.

   c. Materials placed in Work.

2. The Project Manager may re-sample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: City’s testing laboratory will provide verification testing on backfill materials, as directed by Project Manager. Samples may be taken at source or at production plant, as applicable.

END OF SECTION
Section 02321

CEMENT STABILIZED SAND

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cement stabilized sand.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring cement stabilized sand.

2. Refer to Paragraph 3.04 for material credit.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.


I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory


L. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)


1.04 SUBMITTALS

A. Conform to requirements of Section 01330- Submittal Procedures.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

1.05 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.

2. Determine minimum cement content from production data and statistical history. Provide no less than 1.1 sacks of cement per ton of dry sand.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Section 02320 - Utility Backfill Materials, and the following requirements:
1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.

2. Deleterious materials:
   a. Clay lumps, ASTM C 142 - less than 0.5 percent.
   b. Lightweight pieces, ASTM C 123; less than 5.0 percent.
   c. Organic impurities, ASTM C 40, color no darker than standard color.

3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.02 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.03 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:
   1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.
   2. Complete molding of samples within 4 hours after addition of water.
   3. Perform strength tests (average of two specimens) at 48 hours and 7 days.
   4. Perform cement content tests on each sample.
   5. Perform moisture content tests on each sample.
   6. Plot average 48-hour strength vs. cement content.
   7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).
B. Test raw sand for following properties at point of entry into pug-mill:
   1. Gradation
   2. Plasticity index
   3. Organic impurities
   4. Clay lumps and friable particles
   5. Lightweight pieces
   6. Moisture content
   7. Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula:

\[ f', \% \geq \text{1/2 standard deviation} \]

PART 3  EXECUTION

3.01  PLACING

A. Place sand-cement mixture in maximum 12-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is ±3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

C. Where potable water lines cross wastewater line, embed wastewater line with cement stabilized sand in accordance with Texas Administrative Code §290.44(e)(4)(B):
   1. Provide minimum of 10% cement per cubic yard of cement stabilized sand mixture, based on loose dry weight volume. Use at least 2.5 bags of cement per cubic yard of mixture (2 sacks per ton of dry sand).
2. Unless otherwise shown on Drawings, embed wastewater main or lateral minimum of six inches above and below.

3. Use brown coloring in cement stabilized sand for wastewater main or lateral bedding for identification of pressure rated wastewater mains during future construction.

3.02 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purpose.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number
2. Time material was batched
3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number  
8. Indication of compliance / non-compliance  
9. Mixture identification  
10. Truck and ticket numbers  
11. The time of molding  
12. Moisture content at time of molding  
13. Required strength  
14. Test method designations  
15. Compressive strength data as required by ASTM D 1633  
16. Supplier mixture identification  
17. Specimen diameter and height, in.  
18. Specimen cross-sectional area, sq. in.

3.03 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:

1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.

2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor’s expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48 hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Project Manager, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.
G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.04 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula:

\[
\text{Credit per Cubic Yard} = \frac{30.00 \times 2 \times (100 \text{ psi} - \text{Actual psi})}{100}
\]

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to City.

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<thead>
<tr>
<th>Supplier:</th>
<th>City Stabilized Sand</th>
<th>Plant No:</th>
<th>1 - Main Street</th>
<th>Date of Tests:</th>
<th>January 1, 1997</th>
</tr>
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<tbody>
<tr>
<td>Item</td>
<td>Raw Sand</td>
<td>1.1 Sack</td>
<td>100 psi</td>
<td>1.5 Sack</td>
<td>2.0 Sack</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>10.9</td>
<td>15.7</td>
<td>14.0</td>
<td>13.8</td>
<td>13.7</td>
</tr>
<tr>
<td>Cement Feed Dial Setting</td>
<td>--</td>
<td>2.25</td>
<td>2.5</td>
<td>2.75</td>
<td>3.75</td>
</tr>
<tr>
<td>Silo Pressure (psi)</td>
<td>--</td>
<td>4</td>
<td>4</td>
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<tr>
<td>Batch Time</td>
<td>10:00</td>
<td>10:10</td>
<td>10:15</td>
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<tr>
<td>Sample Time</td>
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<td>10:10</td>
<td>10:15</td>
<td>10:20</td>
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<td>Molding Time</td>
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<td>12:30</td>
<td>12:45</td>
<td>1:00</td>
<td>1:15</td>
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<tr>
<td>Cement Content (sacks/ton)</td>
<td>--</td>
<td>1.1</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
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<tr>
<td>Compressive Strength at 48 hrs. (avg of 2)</td>
<td>--</td>
<td>80</td>
<td>120</td>
<td>160</td>
<td>220</td>
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<tr>
<td>Compressive Strength at 7 days(avg of 2)</td>
<td>--</td>
<td>135</td>
<td>200</td>
<td>265</td>
<td>365</td>
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CITY OF HOUSTON
STANDARD SPECIFICATION
CEMENT STABILIZED SAND

<table>
<thead>
<tr>
<th>Sieve size</th>
<th>Percent Passing</th>
<th>COH Spec. Section 02320</th>
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<tbody>
<tr>
<td>3/8 Inch</td>
<td>100</td>
<td>--</td>
</tr>
<tr>
<td>No. 16</td>
<td>100</td>
<td>--</td>
</tr>
<tr>
<td>No. 40</td>
<td>100</td>
<td>--</td>
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<tr>
<td>No. 50</td>
<td>99</td>
<td>--</td>
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<tr>
<td>No. 100</td>
<td>41</td>
<td>--</td>
</tr>
<tr>
<td>No. 200</td>
<td>11</td>
<td>0 to 15</td>
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**Raw Sand Tests**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>City of Houston</th>
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<tbody>
<tr>
<td>Plasticity Index</td>
<td>Non-Plastic</td>
<td>4 Maximum</td>
</tr>
<tr>
<td>Organic Impurities</td>
<td>Passing</td>
<td>No Darker Than</td>
</tr>
<tr>
<td>Clay Lumps &amp; Friable Parts (%)</td>
<td>0.0</td>
<td>0.5 % Maximum</td>
</tr>
<tr>
<td>Lightweight Pieces (%)</td>
<td>0.0</td>
<td>5.0 % Maximum</td>
</tr>
<tr>
<td>Classification</td>
<td>SP-SM</td>
<td>SW, SP, SW-SM, SP-SM, SM</td>
</tr>
</tbody>
</table>

**Compressive Strength vs Cement Content**

48 hr Strength

7 day Strength

TARGET

END OF SECTION
CITY OF HOUSTON
STANDARD SPECIFICATION

FLOWABLE FILL

Section 02322

FLOWABLE FILL

PART 1  GENERAL

1.01  SECTION INCLUDES

A. Flowable Fill for furnishing, mixing, transporting and placing flowable fill.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for flowable fill under this Section. Include cost in unit prices for work, as specified in Section 01270 – Measurement and Payment.

1.03  REFERENCES

A. ASTM C 31 – Making and Curing Concrete Test Specimens in the field.

B. ASTM C 39 – Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 40 – Organic Impurities in Fine Aggregates for Concrete.

D. ASTM C 94 - Ready-Mixed Concrete.

E. ASTM C 150 - Portland Cement.

F. ASTM C 192 – Making and Curing Concrete Test Specimens in the Laboratory.

G. ASTM C 260 – Air-Entraining Admixtures for Concrete.

H. ASTM C 494 - Chemical Admixtures for Concrete.

I. ASTM C 618 – Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Concrete.


1.04  SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.
B. Submit proposed mix design

C. Submit a copy of delivery tickets accompanied by batch tickets, providing the information required by ASTM C 94 to Engineer in the field at time of delivery.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide material conforming to:

1. Cement- ASTM C 150, Type I.

2. Fly Ash – ASTM C 618, Class C, with a minimum CaO content of 20 percent.

3. Water- ASTM C 94.

4. Fine Aggregate – Natural or manufactured fine aggregate, or a combination there of, free from deleterious amounts of salt, alkali, vegetable matter or other objectionable material. The plasticity index shall be 4 or less when tested in accordance with ASTM D 4318. Organic impurities, when tested in accordance with ASTM C 40, shall not show a color darker then the standard color. It is intended that the fine aggregate be fine enough to stay in suspension in the mortar to the extent required for proper flow. The fine aggregate shall conform to the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10</td>
</tr>
</tbody>
</table>

If flowable mixture cannot be produced, the fine aggregate may not be approved.

5. Admixtures – ASTM C 260 and /or C 494.

2.02 MIX DESIGN

A. Mix design shall state the following information:

1. Mix design number or code designation to order the concrete from the supplier.

2. Design strength at 7 days (unless otherwise noted on the Plans).

3. Cement type and brand.

4. Fly ash type and brand.
5. Admixtures type and brand.

6. Proportions of each material used.

B. Minimum strength requirement is 100 psi in 7 days unless otherwise noted on the Plans.

PART 3 EXECUTION

3.01 BATCHING, MIXING AND TRANSPORTATION

A. Batch, mix and transport flowable fill in accordance with ASTM C 94, except when directed otherwise by the Engineer.

B. Mix flowable fill in quantities required for immediate use. Do not use portions which have developed initial set or which are not in place within 90 minutes after the initial water has been added.

C. Do not mix flowable fill while the air temperature is at or below 35 degrees F. without prior approval of the Engineer.

3.02 PLACEMENT

A. Seal off the area to be repaired.

B. Monitor and control the fluid pressure during placement of flowable fill prior to set. Take appropriate measures to avoid excessive pressure that may damage or displace structures or cause flotation. Cease operations if flowable fill is observed leaking from the repair area. Repair or replace damaged or displaced structures at no additional cost.

3.03 TESTING AND INSPECTION

A. Refer to Section 01457 – Construction Tests and Inspection.

3.04 CLEAN UP

A. Clean up excess flowable fill discharged from the work area and remove excess flowable fill from pipes at no additional cost.

B. Refer to Section 02120 – Material Disposal.

END OF SECTION
Section 02330

EMBANKMENT

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Construction of embankments with excess excavated material and borrow.

1.02  MEASUREMENT AND PAYMENT

A.  Unit Prices.

1.  No separate payment will be made for embankment under this section. Include payment
    in unit price for excavation or borrow.

2.  Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES

A.  ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soils
    Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).

B.  ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by
    Nuclear Methods (Shallow Depth).

C.  ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by
    Nuclear Methods (Shallow Depth).

PART 2  PRODUCTS

2.01  MATERIALS

A.  Refer to Section 02315 - Roadway Excavation for acceptable excess materials from roadway
    excavation.

B.  Refer to Section 02317 - Excavation and Backfill For Utilities for acceptable excess
    materials from utility excavation and trenching.
C. Refer to Section 02319 - Borrow for acceptable borrow materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify borrow and excess excavated materials to be reused are approved.

B. Verify removals and clearing and grubbing operations have been completed.

3.02 PREPARATION

A. Backfill test pits, stump holes, small swales and other surface irregularities. Backfill and compact in designated lift depths to requirements for embankment compaction.

B. Record location and plug and fill inactive water and oil wells. Conform to Texas State Health Department, Texas Commission on Environmental Quality and Texas Railroad Commission requirements. Notify City Engineer prior to plugging wells.

C. Excavate and dispose of unsuitable soil and other unsuitable materials which will not consolidate. Backfill and compact to requirements for embankment. Unsuitable soil is defined in Section 02316 - Excavation and Backfill for Structures and Section 02320 - Utility Backfill Materials.

D. Backfill new utilities below future grade. Conform to requirements of Sections 02317 - Excavation and Backfill For Utilities, 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, and 02532 - Sanitary Sewage Force Mains.

3.03 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other features outside of embankment limits.

B. Protect utilities above and below grade, which are to remain.

C. Conform to protection requirements of Section 02315 - Roadway Excavation.

3.04 PLACING EMBANKMENT

A. Do not conduct placement operations during inclement weather or when existing ground or fill materials exceed 3 percent of optimum moisture content. Contractor may manipulate wet material to facilitate drying, by disking or windrowning.
B. Do not place embankment fill until density and moisture content of previously placed material comply with specified requirements.

C. Scarify areas to be filled to minimum depth of 4 inches to bond existing and new materials. Mix with first fill layer.

D. Spread fill material evenly, from dumped piles or windrows, into horizontal layers approximately parallel to finished grade. Place to meet specified compacted thickness. Break clods and lumps and mix materials by blading, harrowing, disking or other approved method. Extend each layer across full width of fill.

E. Each layer shall be homogeneous and contain uniform moisture content before compaction. Mix dissimilar abutting materials to prevent abrupt changes in composition of fill.

F. Layers shall not exceed the following compacted thickness:
   1. Areas indicated to be under future paving or shoulders, to be constructed within 6 months: 6 inches when compacted with pneumatic rollers, or 8 inches when compacted with other rollers.
   2. Other areas: 12 inches

G. For steep slopes, cut benches into slope and scarify before placing fill. Place increasingly wider horizontal layers of specified depth to level of each bench.

H. Build embankment layers on back slopes, adjacent to existing roadbeds, to level of old roadbed. Scarify top of old roadbed to minimum depth of 4 inches and recompact with next fill layer.

I. Construct to lines and grades shown on Drawings.

J. Remove unsuitable material and excess soil not being used for embankment from site in accordance with requirements of Section 01576 - Waste Material Disposal.

K. Maintain moisture content of embankment materials to attain required density.

L. Compact to following minimum densities at moisture content of optimum to 3 percent above optimum as determined by ASTM D 698, unless otherwise indicated on Drawings:
   1. Areas under future paving and shoulders: Minimum density of 95 percent of maximum dry density.
   2. Other areas: Minimum density of 90 percent of maximum dry density.
3.06  TOLERANCES

A.  Top of compacted surface: Plus or minus 1/2 inch in cross section or 16 foot length.

3.07  FIELD QUALITY CONTROL

A.  Compaction Testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017 under provisions of Section 01454 - Testing Laboratory Services.

B.  A minimum of three tests will be taken for each 1000 linear feet per lane of roadway or 500 square yards of embankment per lift.

C.  If tests indicate work does not meet specified compaction requirements, recondition, recompact, and retest at no cost to City.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foundation course of lime stabilized subgrade material.
   1. Application of lime slurry to subgrade.
   2. Mixing, compaction, and curing of lime slurry, water, and subgrade into a stabilized
      foundation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. Measurement and payment for lime stabilized subgrade is on a square yard basis
      compacted in place to proper density. Separate measurement will be made for each
      required thickness of subgrade course.

      a. Limits of measurement shall match actual pavement replaced, but no greater than
         maximum pavement replacement limits shown on Drawings. Limits for
         measurement will be extended to include installed lime stabilized subgrade material
         that extends 2 foot beyond outside edge of pavement to be replaced, except where
         proposed pavement section shares common longitudinal or transverse edge with
         existing pavement section. No payment will be made for lime stabilized subgrade in
         areas beyond these limits.

      b. Limits of measurement and payment shall match pavement replacement limits shown
         on Drawings, except as noted in Paragraph 1.02.A.1.a, or as approved by Project
         Manager.

   2. Measurement and payment for lime is by ton of 2000 pounds dry weight basis. Calculate
      weight of dry solids for lime slurry based on percentage by dry weight solids.

   3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in
   this Section is included in total Stipulated Price.
1.03 DEFINITION

B. Moist Cure: Curing soil and lime to obtain optimum hydration.

C. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.04 REFERENCES

A. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).


D. TxDOT Tex-101-E (Part III) - Preparation of Soil and Flexible Base Material for Testing.

E. TxDOT Tex-140-E - Measuring Thickness of Pavement Layer.

F. TxDOT Tex-600-J - Sampling and Testing Hydrated Lime, Quicklime, and Commercial Lime Slurry.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification that hydrated lime, quicklime, or commercial lime slurry complies with specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

1.06 DELIVERY, STORAGE AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.
PART 2  PRODUCTS

2.01  WATER

A. Use clean, clear water, free from oil, acids, alkali, or vegetation.

2.02  LIME

A. Type A - Hydrated Lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide as listed in chemical composition chart.

B. Type B - Commercial Lime Slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.

C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:


D. Conform to the following requirements:
CHEMICAL COMPOSITION

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<tr>
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<th>TYPE</th>
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<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Active lime content, % by weight Ca(OH)$_2$+CaO</td>
<td>90.0 min$^1$</td>
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<tr>
<td>Unhydrated lime content, % by weight CaO</td>
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</tr>
<tr>
<td>Free water content, % by weight H$_2$O:</td>
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SIZING

Wet Sieve, as % by weight residue retained:

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<td>0.2 max$^2$</td>
<td>8.0 max$^3$</td>
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<td>No. 30</td>
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<td>4.0 max$^2$</td>
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Dry sieve, as % by weight residue retained:

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<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
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</thead>
<tbody>
<tr>
<td>1-inch</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
</tr>
<tr>
<td>1/2-inch</td>
<td>-</td>
<td>-</td>
<td>10.0 max</td>
</tr>
</tbody>
</table>

Notes:
1. Maximum 5.0% by weight CaO shall be allowed in determining total active lime content.
2. Maximum solids content of slurry.
3. Total active lime content, as CaO, in material retained on No. 6 sieve shall not exceed 2.0% by weight of original Type C lime.

E. Deliver lime slurry to job site as commercial lime, or prepare at job site by using hydrated lime or quicklime. Provide slurry free of liquids other than water and of consistency that can be handled and uniformly applied without difficulty.

F. Lime containing magnesium hydroxide is prohibited.

2.03 SOIL

A. Soil to receive lime treatment may include borrow or existing subgrade material, existing pavement structure, or combination of all three. Where existing pavement or base material is encountered, pulverized or scarify material so that 100 percent of sampled material passes 2-inch sieve.
PART 3  EXECUTION
3.01 EXAMINATION
   A. Verify compacted subgrade will support imposed loads.
   B. Verify subgrade lines and grades.

3.02 PREPARATION
   A. Complete backfill of utilities prior to stabilization.
   B. Cut material to bottom of subgrade using an approved cutting and pulverizing machine meeting following requirements:
      1. Cutters accurately provide smooth surface over entire width of cut to plane of secondary grade.
      2. Provide cut to depth as specified or shown in the Drawings.
   C. Alternatively, scarify or excavate to bottom of stabilized subgrade. Remove material or windrow to expose secondary grade. Obtain uniform stability.
   D. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting as directed by Project Manager.
   E. Pulverize existing material so that 100 percent passes a 1-3/4-inch sieve.

3.03 LIME SLURRY APPLICATION
   A. Apply slurry with distributor truck equipped with an agitator to keep lime and water in consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on same working day.
   B. Minimum lime content shall be 5 percent of dry unit weight of subgrade as determined by ASTM D 698

3.04 PRELIMINARY MIXING
   A. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain homogeneous friable mixture free of clods and lumps.
   B. Shape mixed subgrade to final lines and grades.
C. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.05C can be met during preliminary mixing:
   1. Seal subgrade as precaution against heavy rainfall by rolling lightly with light pneumatic rollers.
   2. Cure soil lime material for 24 to 72 hours or as required to obtain optimum hydration. Keep subgrade moist during cure.

3.05 FINAL MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.

B. Add water to bring moisture content of soil mixture to optimum or above.

C. Mix and pulverize until all material passes 13/4-inch sieve; minimum of 85 percent, excluding non-slacking fractions, passes 3/4-inch sieve; and minimum of 60 percent excluding non-slacking fractions passes No. 4 sieve. Test according to TxDOT Tex-101-E, Part III using dry method.

D. Shape mixed subgrade to final lines and grades.

E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.06 COMPACTION

A. Aerate or sprinkle to attain optimum moisture content to 3 percent above optimum, as determined by ASTM D 698 on material sample from roadway after final mix with lime.

B. Start compaction immediately after final mixing.

C. Spread and compact in two or more equal layers where total compacted thickness is greater than equipment manufacturer’s recommended range of mixing and compaction.

D. Compact with approved heavy pneumatic or vibrating rollers, or combination of tamping rollers and light pneumatic rollers. Begin compaction at bottom and continue until entire depth is uniformly compacted.

E. Do not allow stabilized subgrade to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompingating.

F. Compact subgrade to minimum density of 95 percent of maximum dry density, according to ASTM D 698, at moisture content of optimum to 3 percent above optimum, unless otherwise indicated on Drawings:
G. Seal with approved light pneumatic tired rollers. Prevent surface hair line cracking. Rework and recompact at areas where hairline cracking develops.

3.07 CURING

A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. Subgrade may be opened to traffic after 2 days when adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base or surface within 14 days after final mixing and compaction. Restart compaction and moisture content of base material when time is exceeded.

3.08 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16-foot length.

C. Depth of lime stabilization shall be plus or minus one inch of specified depth for each 1000-foot roadway section.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Test soils, lime, and mixtures as follows:

1. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318, using the wet preparation method.

2. Sampling and testing of lime slurry shall be in accordance with TxDOT Tex-600-J, except using a lime slurry cup.

3. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.
4. Moisture-density relationship will be established on material sampled from roadway, after stabilization with lime and final mixing, in accordance with ASTM 698, Moist preparation Method.

C. In-place depth will be evaluated for each 1000-foot roadway section and determined in accordance with TxDOT Tex-140-E in hand excavated holes. For each 1000-foot section, 3 phenolphthalein tests will be performed. Average stabilization depth for 1000-foot section will be based on average depth for three tests.

D. Perform compaction testing in accordance with ASTM D 2922. Three tests will be performed for each 1000-foot roadway section.

E. Pulverization analysis will be performed as required by Paragraph 3.05C on material sampled during mixing of each production area. Three tests will be performed per 1000-foot roadway section or a minimum of once daily.

3.10 REWORK OF FAILED SECTIONS

A. Rework sections that do not meet specified thickness.

B. Perform the following steps when more than 72 hours have lapsed since completion of compaction.

1. Moist cure for minimum of 3 days after compaction to required density.

2. Add lime at rate of 25 percent of specified rate at no additional cost to City.

3. Moisture density test of reworked material must be completed by laboratory before field compaction testing can be completed.

3.11 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course. Protect asphalt membrane from being picked up by traffic.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION
PART 1   GENERAL

1.01 SECTION INCLUDES

   A. Foundation course of lime/fly ash stabilized subgrade material.
      1. Application of lime slurry and fly ash to subgrade
      2. Mixing, compaction, and curing of lime, slurry, fly ash, water and subgrade into a
         stabilized foundation

1.02 MEASUREMENT AND PAYMENT

   A. Unit Prices.
      1. Measurement and payment for lime/fly ash stabilized subgrade is on a square yard basis
         compacted in place to proper density. Separate measurement will be made for each
         required thickness of subgrade course.

         a. Limits of measurement shall match actual pavement replaced, but no greater than the
            maximum pavement replacement limits shown on Drawings. Limits for
            measurement will be extended to include installed lime/fly ash stabilized subgrade
            material that extends 2 foot beyond outside edge of pavement to be replaced, except
            where proposed pavement section shares a common longitudinal or transverse edge
            with existing pavement section. No payment will be made for lime/fly ash stabilized
            subgrade in areas beyond these limits.

         b. Limits of measurement and payment shall match pavement replacement limits shown
            on Drawings, except as noted in Paragraph 1.02.A.1.a, or as approved by Project
            Manager

      2. Payment for hydrated lime and quicklime is by ton of 2000 pounds dry-weight basis
      3. Payment for commercial lime slurry is by ton of 2000 pounds of lime calculated on
         percentage by weight of dry solids for grade of slurry
      4. Payment for fly ash is on unit price basis per ton
      5. Refer to Section 01270 - Measurement and Payment for unit price procedures
B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.03 DEFINITIONS

A. Moist Cure: Curing soil lime/fly ash material to obtain optimum hydration.

B. 1000-Foot Roadway Section: 1000 feet per lane width or approximately 500 square yards of compacted subgrade for other than full-lane-width roadway sections.

1.04 REFERENCES


1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification that fly ash, hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of materials to work site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Conform to requirements of Section 02336 - Lime Stabilized Subgrade.

B. Quicklime can be dangerous; exercise extreme caution if used for Work. Become informed about recommended precautions in handling, storage and use of quicklime.

PART 2 PRODUCTS

2.01 MATERIALS

A. Water: clean, clear and free from oil, acids, alkali, or vegetable matter.

B. Conform to requirements of Section 02336 - Lime Stabilized Subgrade for Type A hydrated lime, Type C quicklime, and Type B commercial lime slurry.
C. Fly ash: Residue or ash remaining after burning finely pulverized coal at high temperatures conforming to requirements of ASTM C 618, Type ‘C” or “F” and following:

1. Minimum CaO content of 20 percent
2. Loss on ignition not to exceed 3 percent
3. Contain no lignite ash

D. Asphaltic Seal Cure: Conform to requirements of Section 02336 - Lime Stabilized Subgrade.

PART 3  E X E C U T I O N

3.01  INSTALLATION

A. Conform to Part 3 of Section 02336 - Lime Stabilized Subgrade with following exceptions:

1. Include fly ash in percentage amounts in lime or lime slurry as established from geotechnical evaluation for application, mixing, and compaction.

2. Apply lime/fly ash as single mix, single pass over lower PI soils.

3. Conduct operations to minimize elapsed time between mixing and compacting lime/fly ash stabilized subgrade in order to take advantage of rapid initial set characteristics. Complete compaction within 2 hours of commencing compaction and not more than 6 hours after adding and mixing last stabilizing agent.

3.02  QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Soil will be sampled to establish percent of fly ash and hydrated lime, quicklime, or lime slurry to be applied to subgrade material.

C. Testing will be in accordance with Part 3 of Section 2336-Lime-Stabilized Subgrade.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Foundation course of portland cement stabilized natural subgrade material.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for Portland cement stabilized subgrade is on a square yard basis compacted in place to proper density. Separate measurement will be made for each different required thickness of subgrade course.

a. Limits of measurement shall match actual pavement replaced, but no greater than maximum pavement replacement limits shown on Drawings. Limits for measurement will be extended to include installed portland cement stabilized subgrade material that extends 2 foot beyond outside edge of pavement to be replaced, except where proposed pavement section shares common longitudinal or transverse edge with existing pavement section. No payment will be made for portland cement stabilized subgrade in areas beyond these limits.

b. Limits of measurement and payment shall match pavement replacement limits shown on Drawings, except as noted in Paragraph 1.02.A.1.a, or as approved by Project Manager.

2. Payment for Portland cement is by ton of 2000 pounds dry-weight basis.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification that Portland cement complies with these specifications.

PART 2 PRODUCTS

2.01 WATER

A. Water: clean, clear and free from oil, acids, alkali, or organic matter.

2.02 PORTLAND CEMENT

A. ASTM C 150 Type I; bulk or sacked.

2.03 SOIL

A. Provide soil consisting of approved material free from vegetation or other objectionable matter encountered in existing roadbed.

2.04 TESTS

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Tests and analysis of soil materials will be performed in accordance with ASTM D 4318.

C. Soil will be evaluated to establish ratio of cement to soil to obtain desired stability. Normal range is 6 percent to 10 percent by weight.

D. The percentage of moisture in soil, at time of cement application, will be determined by ASTM D 558. Moisture will not be allowed to exceed quantity that will permit uniform, complete mixture of soil and cement during dry mixing operations nor specified optimum moisture content for soil cement mixture, as determined.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify subgrade lines and grades are correct.

3.02 EQUIPMENT

A. Apply Portland cement treatment with machine or combination of machines and auxiliary equipment to produce specified results. Mixing may be accomplished by multiple-pass traveling mixing plant or single-pass traveling mixing plant. Provide sufficient equipment to enable continuous prosecution of work.

3.03 PREPARATION

A. Backfill for utilities below future grade.

B. Verify subgrade is firm and able to support, without displacement, construction equipment at specified density. Correct soft or yielding subgrade and stabilize by scarifying and aerating or by adding cement and compacting to uniform stability.

C. Grade, shape, and compact, as required, to allow construction of Portland cement treatment for in-place materials to lines, grades, thickness, and typical cross section shown on Drawings. Remove unsuitable soil or material and replace with acceptable material.

D. Pulverize soil so that at completion of moist-mixing, 100 percent by dry weight passes 1-inch sieve, and minimum of 80 percent passes No. 4 sieve, exclusive of gravel or stone retained on these sieves. Pulverize existing bituminous wearing surfaces so that 100 percent will pass 2-inch sieve.

3.04 MIXING

A. Do not place and mix cement when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Spread cement uniformly on soil at rate specified by laboratory. When bulk cement spreader is used, position it by string lines or other approved method to ensure uniform distribution of cement. Apply cement only to area where operations can be continuous and completed in daylight, within 1 hour of application. Amount of moisture in soil at time of cement placement shall not exceed quantity that will permit uniform mixture of soil and cement during dry mixing operations. Do not exceed specified optimum moisture content for soil cement mixture.
C. Do not allow equipment other than that used in spreading and mixing, to pass over freshly 
spread cement until it is mixed with soil.

D. Dry mix cement with soil after cement application. Continue mixing until cement has been 
sufficiently blended with soil to prevent formation of cement balls when water is applied. 
Mixture of soil and cement that has not been compacted and finished shall not remain 
undisturbed for more than 30 minutes.

E. Immediately after dry mixing is complete, uniformly apply water as necessary and 
incorporate it into mixture. Pressurized equipment must provide adequate supply to ensure 
continuous application of required amount of water to sections being processed within 3 
hours of cement application. Ensure proper moisture distribution at all times. After last 
increment of water has been added, continue mixing until thorough and uniform mix has 
been obtained.

F. Ensure percentage of moisture in mixture, based on dry weights, is within 2 percentage 
points of specified optimum moisture content prior to compaction. When uncompacted soil 
cement mixture is wetted by rain indicating that average moisture content exceeds tolerance 
given at time of final compaction, reconstruct entire section in accordance with this Section 
at no additional cost to City.

3.05 COMPACTION

A. Prior to beginning compaction, ensure mixture is in loose condition for its full depth. 
Uniformly compact the loose mixture to specified density, lines, and grades.

B. After soil and cement mixture is compacted, apply water uniformly as needed and mix 
thoroughly. Then reshape surface to required lines, grades, and cross section and lightly 
scarify to loosen imprints left by compacting or shaping equipment.

C. Roll resulting surface with pneumatic-tired roller and "skin" surface with power grader. 
Thoroughly compact mixture with pneumatic roller, adding small increments of moisture, as 
needed. When aggregate larger than No. 4 sieve is present in mixture, make one complete 
coverage of section with flat-wheel roller immediately after skinning operation. When 
approved by Project Manager, surface finishing methods may be varied from this procedure, 
provided dense uniform surface, free of surface compaction planes, is produced. Maintain 
motisture content of surface material at its specified optimum during finishing operations. 
Compact and finish surface within period not to exceed 2 hours, to produce smooth, closely 
knit surface, free of cracks, ridges, or loose material, conforming to crown, grade, and line 
shown on Drawings within period not to exceed 2-hours.

3.06 CONSTRUCTION JOINTS

A. At end of each day's construction, form straight transverse construction joint by cutting back 
into total width of completed work to form true 2-inch depth vertical face free of loose and
shattered material. Construct cement treatment for large wide areas in series of parallel lanes of convenient length and width approved in advance by Project Manager.

3.07 CURING

A. Moist cure for minimum of 3 days before placing base or surface course, or opening to traffic. When open, restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep subgrade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base and surface within 14 days after final mixing and compaction, unless prior approval is obtained from Project Manager.

3.08 TOLERANCES

A. Completed surface: smooth and conforming to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16-foot length.

3.09 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. In-place density will be determined in accordance with ASTM D 2922 or ASTM D 698. Minimum of three tests will be taken for each 1000 feet per lane of roadway or 500 square yards of embankment.

3.10 PROTECTION

A. Maintain stabilized subgrade to lines and grades and in good condition until placement of base or surface course.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION
SECTION 02340

COMPACTED SAND FILL UNDER TANK FLOOR PLATE

PART 1 GENERAL

1.01 SECTION INCLUDES

Excavation, sand fill and compaction under structures within limits shown on plans.

1.02 MEASUREMENT AND PAYMENT

A. No separate measurement and payment for work performed under this Section except as indicated in section 1.02 B and 1.02 C. The Contractor shall include the cost for this work in the contract bid price for work of which this is a component part.

B. Extra excavation ordered by the Engineer for removing weak areas in the subgrade, as determined by proof rolling procedures, will be measured per cubic yard and paid at the unit price bid for "Extra Excavation".

C. Extra select fill ordered by the Engineer for replacing weak areas in the subgrade will be measured per cubic yard and paid at the unit price bid for "Extra Select Fill".

1.03 REFERENCES

A. AWWA D 100 – Standard for Welded Steel Tank for Water Storage


C. ASTM D 698 – Standard Test Methods for Laboratory Compaction

D. ASTM D 1557 - Standard Test Methods for Laboratory Compaction


1.04 SUBMITTALS

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

B. Submit proposed materials and sequence of operations for compacting sand. Describe proposed equipment.

C. Submit sand fill to Engineer for approval.
PART 2 PRODUCTS

2.01 MATERIALS

A. Clean sand or clean bank sand free from clay and clay lumps, shale, loam, organic matter, salt or chlorides, and other deleterious materials in accordance with ASTM C33 shall be used. Water soluble ionic (salt) contamination of the sand shall be determined and limited in accordance with AWWA D100, Section 12.6, Note 3. Maximum chloride level not to exceed 100 ppm, maximum sulfate level not to exceed 200 ppm.

B. Sand to have a maximum plasticity index of 7 in accordance with ASTM D-4318 and not more than 15% passing a No. 200 sieve, in accordance with ASTM C117.

C. Water, if used to obtain moisture content, to be clean and fresh.

D. Hydrated lime for soil stabilization shall comply with City of Houston Standard Specifications 02336 – Lime-Stabilized Subgrade.

E. Select fill shall be silty or sandy clay with liquid limit of less than 40 and plasticity index between 7 and 20.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Excavate or strip to depth as indicated on Plans or as directed by the Engineer to effectively remove all vegetation, topsoil and debris, if present.

Limit of excavation and stripping to be defined by a radius equal to the tank ring foundation wall outer radius plus 5 feet.

B. Existing trees are to be grubbed to a minimum depth of 3 feet to remove stumps.

C. Following stripping, the exposed subgrades are to be proof-rolled with a minimum 20 ton pneumatic roller to detect any soft or poorly compacted areas.

D. All weak areas in the subgrade are to be removed and replaced with select fill. Where indicated on the Drawings, scarify upper 6-inches of soil and stabilize with 5% hydrated lime and compact to 95% of maximum density as determined by ASTM D698.

E. Shape surface to receive sand fill as shown on Plans.

F. Fill for grade adjustments (below clean sand) is to be select soil, free of organic and deleterious material and have a plasticity index between 7 and 20.
Fill for grade adjustments is to be placed in lifts not exceeding 8 inches loose measure and compacted to at least 95% of the standard Proctor maximum dry density within \( \pm 2 \) percentage points of the optimum moisture content in accordance with ASTM D1557.

G. Place clean sand or clean bank sand base under floor plate in 4-inch maximum lifts, measured loose, and compact with pneumatic, vibratory or mechanical tamps. Compact to 95% standard Proctor maximum dry density with \( \pm 2 \) percentage points of the optimum moisture content in accordance with ASTM D698.

H. After compaction, shape surface area to grade indicated.

I. The Owner shall provide for density testing and will be performed on each lift of fill for grade adjustments and fill under tank floor as directed by the Engineer.

J. Contractor shall notify the Engineer at least twenty-four (24) hours prior to proof rolling and density testing.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ductile iron pipe and fittings for water lines, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for ductile iron pipe and fittings under this Section, with the exception of extra fittings in place. Include cost in unit prices for work as specified in the following Sections, as applicable:

   a. Section 02511 - Water lines
   b. Section 02531 - Gravity Sanitary Sewers
   c. Section 02532 - Sanitary Sewage Force Mains
   d. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Extra Ductile Iron Compact Fittings in Place shall be for additional fittings required to complete job. This is not to exclude extension of pipe across driveway or intersection for purpose of terminating line in more advantageous position. This determination shall be at discretion of Project Manager. This bid item includes additional fittings as may be necessary to complete job in conformance with intent of Drawings.

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

1.03 REFERENCES


G. ANSI A 21.51 (AWWA C 151) - Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids.

H. ANSI A 21.53 (AWWA C 153) - Standard for Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for Water Service.


L. ASTM F 477 - Elastomeric Seals (gaskets) for Joining Plastic Pipe.


N. AWWA C 105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

O. AWWA C 300 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and other Liquids.

P. AWWA C 600 - Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances.

Q. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.


S. American Association of State Highway Transportation Officials (AASHTO).
1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. For pipes 16 inches and greater submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing the following:

1. Manufacturer's pipe design calculations.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, restrained joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (*.PDF).


4. Class and length of joint.

C. Submit manufacturer's certifications that ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

D. Submit certifications that pipe joints have been tested and meet requirements of ANSI A 21.11.

E. Submit affidavit of compliance in accordance with ANSI A21.16 for fittings with fusion bonded epoxy coatings or linings.

PART 2 PRODUCTS

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: Shall conform to AWWA C115, C150 and C151 and bear mark of Underwriters’ Laboratories approval. Provide minimum thickness Class 52 for sanitary sewers. Unless otherwise shown on Drawings, use a minimum Pressure Class 250 for water lines less than or equal to 20-inch diameter. For 24-inch and larger, design for project specific hydraulics as per AWWA C150. Use minimum Pressure Class 350 for water lines in casing or trenchless construction and for flanged pipe.
B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

C. For 24-inch and larger water lines, furnish and install cathodic protection in accordance with Section 16640 - Cathodic Protection for Pipelines.

D. For sanitary sewer lines, modify pipe for cathodic protection in accordance with Section 16640 - Cathodic Protection for Pipelines. In lieu of furnishing ductile iron pipe with cathodic protection system, furnish ductile iron pipe with polyethylene encasement, provided the following criteria is met:

1. Provide minimum thickness class.

2. Provide polyethylene encasement material and installation in accordance with AWWA C105, and backfill as specified. Minimum of two complete wraps of 8-mil-thick polyethylene.

3. Use polyethylene encasement for open cut installations only. For augered sections or sections installed inside a casing, provide coating in accordance with paragraph 2.05 D.1.

4. Adhere to other requirements specified herein (e.g., insulation kits, etc.).

E. For use of pressure class pipe for water lines, design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading, AREMA E-80 loads and depths of bury as indicated on Drawings. Design pipes with Marston's earth loads for a transition width trench for zero to 16 feet of cover. Use Marston's earth loads for a trench width of O.D. (of pipe) + 4 feet for pipe greater than 16 feet of cover. Use Marston's equations for a trench condition in both open-cut and tunnel applications. Design for most critical groundwater level condition. Pipe design conditions:

1. Working pressure = 150 psi.

2. Hydrostatic field test pressure = 150 psi.

3. Maximum pressure due to surge = 225 psi.

4. Minimum Pressure due to surge = -10 psi.

5. Design tensile stress due to surge or hydrostatic test pressure: No greater than 50% minimum yield.

6. Design bending stress due to combined earth loads and surge or hydrostatic test
pressure: No greater than 48,000 psi.

7. Unit weight of fill $\geq 120$ pcf.

8. Deflection lag factor ($D_l$) = 1.2.

9. Bedding constant ($K$) = 0.1.

10. Moment coefficient = 0.16.

11. Fully saturated soil conditions $h_w = h = \text{depth of cover above top of pipe}$.

F. Hydrostatic Test of Pipe: AWWA C 151, Section 5.2.1, at point of manufacture. Hold test for a minimum 2 minutes for thorough inspection of pipe. Repair or reject pipe revealing leaks or cracks.

G. Pipe Manufacturer for large diameter water lines: Minimum of 5 years of successful pipe installations in continuous service. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

<table>
<thead>
<tr>
<th>Line Diameter</th>
<th>Required Bends*</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 and 24 inches</td>
<td>Four 45° bends per 5,000 LF of water line</td>
</tr>
<tr>
<td>&gt; 24 inches</td>
<td>Four 22.5° bends per 10,000 LF of water line</td>
</tr>
</tbody>
</table>

*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer's option (i.e. two 22.5° bends are equivalent to one 45° bend) and will be counted as one fitting.

Manufacturer or supplier must be capable of delivering bends to job site within 12 hours of notification. Use fittings at direction of Project Manager where unforeseen obstacles are encountered during construction. These fittings are in addition to any fittings called out in construction documents and must be available at all times.

H. Provide flange adapter with insulating kit as required when connecting new piping to existing piping and piping of different materials, unless otherwise approved by Project Manager.

I. Clearly mark pipe section to show location and thickness/pressure class color coded.

J. No welding will be permitted on Ductile Iron Pipe except at restrained joint spigots or fittings as per ANSI/AWS D11.2. No field welding is allowed.
2.02 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.16 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For sanitary sewer lines with bolted joints, conform to requirements of AWWA C111; provide minimum 304 stainless steel for restraint joints. For water lines with bolted joints, conform to requirements of AWWA C111; provide Denso or approved equal petrolatum based tape coating system for exposed portion of nuts and bolts.

B. Where required by Drawings, provide approved restrained joints for buried service. Refer to City’s List of Approval Products for approved joint restraint mechanisms.

C. Threaded or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 02515 - Hydrostatic Testing of Pipelines or Section 02532 - Sanitary Sewer Force Mains, as applicable. Provide restrained joints for test pressure or maximum surge pressure as specified, whichever is greater for water lines. Do not use passive resistance of soil in determining minimum restraint lengths.

E. Electrical Bond Wires: Bond Wires; use stranded, copper cable furnished with high molecular weight polyethylene insulation (HMWPE). Use wire gauge (AWG) as shown on Drawings.

F. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer for pipe joints or restraint joints. Submit details of other methods of providing curves and bends for consideration by Project Manager. When other methods are deemed satisfactory, install at no additional cost to City.

2.03 GASKETS

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material in accordance with ANSI A21.11 or ASTM F 477; for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. For pipes to be installed in potentially contaminated areas, see Specification Section 02105 - Sampling and Analysis in PPCA.

C. For Pipes to be installed in any other contaminated areas, use gaskets as recommended by the Pipe Manufacturer, Engineer of the Record and approved by City Engineer prior to installation.
2.04  FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they connect to.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11; pressure rated at 250 psi.

E. Ductile Iron Compact Fittings: Shall conform to AWWA C153 and shall be:
   1. Fusion bonded epoxy lined or
   2. Cement mortar lined.

F. For tangential flanged outlets shown on Drawings, substitute with a tee with an equivalent sized outlet unless otherwise approved by Project Manager.

2.05  COATINGS AND LININGS

A. Water line Interiors: ANSI A21.4, cement lined with seal coat; ANSI A 21.16 fusion bonded epoxy coating for interior; comply with NSF 61.

B. Sanitary Sewer and Force Main Interiors:
   1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.
   2. Liner thickness: Nominal 40 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6-inches back from end.
   4. Acceptable Lining Materials:
      a. Provide approved virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage; heat bonded to interior surface of pipe and fittings.
      b. Ceramic Epoxy – Protecto 401 or approved equal.
C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Exterior:

1. Encasement and coating requirement for water lines
   a. Open cut construction method:
      1) Provide double wrap polyethylene encasement applied in accordance with AWWA C105 or
      2) Provide Polyurethane coating in accordance with Section 02527 - Polyurethane Coatings on Steel and Ductile Iron Pipe.
   b. Auger or casing construction method:
      1) Provide Polyurethane coating in accordance with Section 02527 - Polyurethane Coatings on Steel and Ductile Iron Pipe or
      2) Provide minimum thickness Class 52 pipe, double wrap with polyethylene encasement. Place circumferential wraps of tape or plastic tie straps at two-foot intervals along the barrel of the pipe, and thoroughly seal each end of the polyethylene tube.
   c. Tunnel, Casing or Direct Bury: Conform to requirements of Paragraph 2.05E.


E. Polyethylene Wrap: For buried sanitary sewer pipes not cathodically protected, provide polyethylene wrap unless otherwise specified or shown. For water lines, provide polyethylene wrap unless otherwise specified or shown. Conform to requirements of Section 02528 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, sanitary sewer lines may use bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer for maximum resistance to the contaminants identified in the Phase II Environmental Site Assessment Report. If no alternative coating is specified for water lines, provide polyethylene wrap in potentially contaminated areas.
2.06 MANUFACTURERS

A. Use pre-approved manufacturers listed in City of Houston approved products.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to installation requirements of Sections 02511 - Water Lines, 02531 - Gravity Sanitary Sewers, 02532 - Sanitary Sewer Force Mains 02631 - Storm Sewers and 02553 - Point Repairs and Obstruction Removal, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install double wrap polyethylene encasement in conformance with requirement of AWWA C105 and Section 02528 – Polyethylene Wrap.

D. Holiday Testing.
   1. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.
   2. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

E. Provide electrical continuity bonding across buried mechanical and push-on joint assemblies, except where insulating flanges are required by Drawings.
   1. Provide minimum number of bond wires shown on Drawings. Remove one inch of HMWPE insulation from each of bond wire prior to attaching.
   2. Secure wire onto pipe using approved Thermite Welding procedures.
   3. Coat bare metal and weld metal after weld is secure. Use coal-tar compound or other compatible coating. For polyurethane coated pipe, use compatible polyurethane coating.
   4. Visually inspect Thermite Weld connections for electrical continuity, strength and suitable coating prior to backfilling or placing pipe in augered hole or casing.

3.02 FIELD REPAIR OF COATINGS

A. Polyurethane: Conform to requirements of Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.
B. Fusion Bonded Epoxy: Conform to requirements for new fittings in ANSI A 21.16.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Steel pipe and fittings for water lines for aerial crossings, aboveground piping, and encasement sleeves. Do not bury steel pipe, unless it is large diameter water line.

B. Specifications identify requirements for small-diameter less than or equal to 20 inches.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for steel pipe and fittings under this Section. Refer to Section 02511 - Water Lines for measurement and payment.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.


E. ASTM A 105 - Standard Specification for Carbon Steel Pipe Forgings for Piping Applications


H. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).


K. AWWA C 200 - Standard for Steel Water Pipe 6 in. and Larger.

L. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

M. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

N. AWWA C 210 - Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.


O. SSPC Good Painting Practice, Volume 1.

P. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.

Q. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.

R. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

S. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.

T. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures. For aerial crossings and above ground piping, include lay schedule of new pipe and fittings indicating alignment and grade, laying dimensions, lining and coating systems, proposed welding procedures, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings.

B. Submit manufacturer’s certifications that pipe and fittings are new and unused.
C. Submit manufacturer's certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200.

D. Submit manufacturer's affidavits that coatings and linings comply with applicable requirements of this Section and:

1. Polyurethane coatings were applied in strict accordance with manufacturer's recommendation and allowed to cure at temperature 5 degrees above dew point.

2. Linings were applied and allowed to cure at temperature above 32 F.

E. Submit certification from NACE Certified Coatings Inspector, having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected were properly repaired.

1.05 QUALITY CONTROL

A. Prior to start of work, provide proof of certification of qualification for welders employed for type of work, procedures and positions involved. Provide welder qualifications in accordance with AWWA C 206.

B. Shop-applied coatings and linings; provide services of an independent coating and lining inspection service or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector verifying compliance with same requirements specified in Paragraph 3.02.

C. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.

D. Final Inspection:

1. Before shipment, inspect each finished pipe, fitting, special and accessory for markings, metal thickness, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness.

2. Inspect for coating placement and defects. Test exterior coating for holidays.

   a. Inspect linings for thickness, pitting, scarring, and adhesion.

E. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.
PART 2 PRODUCTS

2.01 STEEL PIPE

A. Provide steel pipe and encasement sleeves designed and manufactured in conformance with AWWA C 200 and AWWA M 11 except as modified herein. Steel to be minimum of ASTM A106, ASTM A 36, ASTM A 1011 Grade 36, ASTM A 53 Grade B, ASTM A 135 Grade B, or ASTM A 139 Grade B.

B. Minimum Allowable Steel-Wall Thickness:

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4.50</td>
<td>0.250</td>
<td>11.35</td>
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<tr>
<td>6</td>
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<tr>
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<td>10</td>
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<tr>
<td>20</td>
<td>20.00</td>
<td>0.375</td>
<td>78.60</td>
</tr>
</tbody>
</table>

Notes for Carrier Pipe:

1. Review pipe and fitting design for conditions exceeding those specified herein.

2. Provide pipe with wall thickness of no less than listed in table above.
### Minimum Diameter Casing Pipe (Encasement Sleeves)

<table>
<thead>
<tr>
<th>Corresp. Casing Pipe Size (In.)</th>
<th>Min. Wall O.D. (In.)</th>
<th>Thick. (In.)</th>
<th>Approx. Wt. Per L. F. Uncoated (Lb.)</th>
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</thead>
<tbody>
<tr>
<td>8</td>
<td>8.625</td>
<td>0.219</td>
<td>19.64</td>
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<tr>
<td>10</td>
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<td>52.73</td>
</tr>
<tr>
<td>24</td>
<td>24.00</td>
<td>0.250</td>
<td>63.41</td>
</tr>
</tbody>
</table>

**Notes for Casing Pipe:**

1. Provide casing pipe with wall thickness of no less than listed in table above.
3. Verify casing diameter required with dimensions of casing spacer.

**C.** Provide pipe sections in lengths of no less than 16 feet except as required for special sections, and no greater than 40 feet.

**D.** Provide short sections of steel pipe no less than 4 feet in length unless indicated on Drawings or specifically permitted by Project Manager.

**E.** Fittings: Factory forged for sizes 4 inches through 20 inches; long radius bends; beveled ends for field butt welding; wall thickness equal to or greater than pipe to which fitting is to be welded unless otherwise shown on Drawings.

**F.** Joints:

2. Electrically isolate flanged joints between steel and cast iron by using flange isolation fittings as specified in paragraph 2.03 of Specification Section 15640 – Joint Bonding and Electrical Isolation. Use epoxy coated nuts and bolts to assemble the fittings.
3. Elbows to be standard weight seamless elbows per ASTM A106, Grade A or B.

G. Flanges: Refer to Specification Section 02511 – Water Lines.

2.02 INTERNAL LINING SYSTEMS FOR STEEL PIPE, ALL INSTALLATIONS

A. Supply steel pipe with epoxy lining, capable of conveying water at temperatures not greater than 140 degrees F. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61 and certification to be from organization accredited by ANSI. Unless otherwise noted, coat exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, etc., with epoxy lining, as specified.

B. Epoxy Lining AWWA C 210, White, or approved equal for shop and field applied, except as modified in this Section. Provide material from same manufacturer.

| Surface Preparation as recommended by manufacturer | SSPC-10  
| Near White Blast Clean |
| Finish Coat | AWWA C210. Provide Devoe Bar Rust 233H or approved equal. |

1. Provide dry film thickness in accordance with product manufacturer recommendations. Do not exceed maximum DFT as recommended by manufacturer.


2.03 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVEGROUND AND IN VAULTS (EXPOSED)

A. Provide approved epoxy/polyurethane coating system as designated below. Provide material from same manufacturer.

| Surface Preparation as recommended by manufacturer | SSPC SP 10  
| Near White Blast Clean |
| Intermediate Coat | Chemical Resistant Epoxy, or approved equal, AWWA C210 |
| Finish Coat | Polyurethane, or approved equal Blue Fed Std. No. 15102 color as approved by Project Manager |

B. Total Allowable Dry Film Thickness (DFT) for System: as recommended by manufacturer.
C. Factory and field testing: in accordance with AWWA C210.

D. Clean bare pipe free from mud, mill lacquer, oil, grease, or other contaminant. Inspect and clean surfaces according to SSPC-SP-1 to remove oil, grease, and loosely adhering deposits prior to blast cleaning. Remove visible oil and grease spots by solvent wiping. Use only approved safety solvents which do not leave residue. Use preheating to remove oil, grease, mill scale, water, and ice provided pipe is preheated in uniform manner to avoid distortion.

E. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges. Grind weld bead for proper coating application as recommended by coating manufacturer. Presence of metallic defects may be cause for rejection of pipe.

PART 3 EXECUTION

3.01 PIPING INSTALLATION

A. Conform to applicable provisions of Section 02511 - Water lines, except as modified in this Section.

B. Comply with the following:

1. Bedding and Backfilling: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

2. For pipes with coating: Do not roll or drag pipe on ground, move pipe in such a manner as not to damage pipe or coating. Carefully inspect pipe for abrasions and repair damaged coating before pipe is installed.

C. Static Electricity:

1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.

2. Electrically test where required after installation is complete.

3.02 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE GROUND AND IN VAULTS (EXPOSED) AND EPOXY INTERNAL LINING SYSTEM.

A. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.

B. Workmanship:

1. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.

C. Surface Preparation:

1. Prepare surfaces for painting by using abrasive blasting.

2. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.

3. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.

4. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by grinding to 1/4-inch minimum radius.

5. Abrasive Material:
   a. Blast only as much steel as can be coated same day of blasting.
   b. Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to job site in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.
   c. After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Tex Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Project Manager.
   d. Do not blast if metal surface may become wet before priming commences, or when metal surface is less than 5 degrees F above dew point.

6. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis 1.

7. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing ¾-inch by-4 inch piece of clear Scotch type tape on blasted surface, then removing and placing tape on 3x5 white index card. Reclean areas exhibiting dust or residue.

D. Coating and Lining Application:

1. Environmental Conditions: Do not apply coatings or linings when metal temperature is less than 50 degrees F; when ambient temperature is less than 5 degrees F above dew point; when expected weather conditions are such that ambient temperature will drop below 40 degrees F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper
humidity levels.

2. Application Procedures:
   
a. Apply in accordance with manufacturer's recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive over spray, or delaminations.

b. Thin materials only with manufacturers recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.

c. Discard catalyzed materials remaining at end of day.

3. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.

4. Cure a minimum of 24 hours at 77 degrees F before successive coats are applied. During curing process, provide force air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coatings are applied, provide forced air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

E. Testing of Coatings and Linings:

1. Inspect pipe for holidays and damage to coating:
   
a. If test indicates no holidays and coating is damaged, remove damaged layers of coating and repair in accordance with coating manufacturer’s recommendations.

2. Perform holiday test in accordance with NACE Standard Recommended Practice, RPO 188-90, Discontinuity (Holiday) Testing of Protective Coatings.

3. Begin testing of completed coating after coating has sufficiently cured, usually one to 5 days. Consult coating manufacturer for specific curing schedule.

4. Perform adhesion test on pipe in accordance with ASTM D 4541.
5. For coating thickness of 20 mils or less, test with wet sponge low-voltage holiday detector. For coating thickness in excess of 20 mils, test with high-voltage holiday detector. Perform electrical holiday test with 60-cycle current audio detector. Select test voltage as suggested in table below.

### MINIMUM VOLTAGES FOR HIGH VOLTAGE SPARK TESTING

<table>
<thead>
<tr>
<th>Total Dry Film Thickness (mils)</th>
<th>Suggested Inspection (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 40</td>
<td>3,000</td>
</tr>
<tr>
<td>41 to 55</td>
<td>4,000</td>
</tr>
<tr>
<td>56 to 80</td>
<td>6,000</td>
</tr>
</tbody>
</table>

3.03 JOINTS AND JOINTING

A. Welded Joints:

1. Conform to requirements of Section 02511 - Water Lines.

2. Field weld to be full penetration butt welded joints for steel pipe and encasement sleeves for entire circumference.

3. City will employ an independent certified testing laboratory to perform weld acceptance tests on welded joints. Testing Laboratory will test by X-ray methods for butt welds, for 100 percent of joint welds. Project Manager has final decision as to suitability of welds tested.

B. Flanged Joints: Conform to requirements of Section 02511 - Water Lines.

3.04 COATINGS AND LININGS INSPECTION RESPONSIBILITIES

A. Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. Project Manager is responsible for quality assurance and reserves the right to inspect or acquire services of an independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at all phases of coatings and linings work, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Project Manager provides such inspection.
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Copper tubing for water service lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for copper tubing under this Section. Include cost in unit price for water taps and service lines.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


B. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certified test results of ASTM B 88.

C. Submit manufacturer's testing certification that copper tubing conforms to requirements of ASTM B 88. Number of samples for testing of each size of tubing is modified as follows:

1. For each 7500 feet of tubing: 1 sample

2. For each set of tubing less than 7500 feet: 1 sample
PART 2  PRODUCTS

2.01  MATERIALS

A. Provide Type K annealed, seamless, copper tubing, 3/8 inch to 2 inch in diameter conforming to requirements of ASTM B 88.

B. Provide 3/8-inch and 1-inch tubing in coils of minimum 60 feet in length, and 1 1/2-inch and 2-inch tubing in coils 40 feet in length.

C. Provide tubing manufactured in United States of America. Tubing shall be inspected and tested by laboratory designated by Project Manager at point of manufacture or locally. Furnish tubing, at no additional cost to designated testing laboratory along with mill compliance certificates.

D. Provide flared or compression-type brass fittings for use with Type K annealed copper tubing in accordance with AWWA C 800.

PART 3  EXECUTION

3.01  INSTALLATION

A. Conform to installation requirements of Section 02512 - Water Tap and Service Line Installation, except as modified in this Section.

3.02  JOINTS

A. Minimum joint spacing for 3/4-inch and 1-inch tubing shall be 60 feet and for 1 1/2-inch and 2-inch tubing shall be 40 feet.

B. Cut copper tubing squarely by using cutting tools designed specifically for purpose and avoid procedures that cause pipe to bend or pipe walls to flatten.

C. After tubing has been cut, but before flaring, use reamer to remove inside rolled lip from tubing. Expand flared ends by use of flaring tool using care to avoid splitting, crimping, or over stressing metal. Provide at least 10 inches of straight pipe adjacent to fittings.

D. When compression fittings are used, cut copper tubing squarely prior to insertion into fitting. Assemble in accordance with manufacturer's recommended procedure.
3.03 BENDS

A. Bend tubing by using appropriate sized bending tool. No kinks, dents, flats, or crimps shall be permitted. Cut out and replace damaged section. Install no bends with radius smaller than radius of coil of tubing as packaged by manufacturer. Copper tubing shipped in straight lengths conforms to the following:

1. For 2-inch diameter: Maximum of one 45-degree bend per 4-foot section.

2. For 1 1/2-inch diameter: Maximum of one 45-degree bend per 3-foot section.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES
   A.  Fiberglass reinforced (FRP) pipe for sanitary sewers.

1.02  MEASUREMENT AND PAYMENT
   A.  Unit Prices.
      1.  No separate payment will be made for fiberglass pipe under this Section. Include cost in
          unit price for Work, as specified in Section 02531 - Gravity Sanitary Sewers, Section
          02532 - Sanitary Sewage Force Mains, or Section 02550 - Sliplining Sanitary Sewers.
      2.  Refer to Section 01270 - Measurement and Payment for unit price procedures.
   B.  Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in
       this Section is included in the total Stipulated Price.

1.03  REFERENCES
   A.  ASTM D 3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-
       Resin) Sewer Pipe.
   B.  ASTM D 3681 - Method for Determining Chemical Resistance of "Fiberglass" (Glass-Fiber-
       Reinforced Thermosetting-Resin Pipe in a Deflected Condition.
   C.  ASTM D 3754 - Standard Specification for "Fiberglass" (Glass-Fiber Reinforced Thermosetting-
       Resin) Sewer and Industrial Pressure Pipe.
   D.  ASTM D 4161 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-
       Resin) Pipe Joints Using Flexible Elastomeric Seals.

1.04  SUBMITTALS
   A.  Conform to requirements of Section 01330 - Submittal Procedures.
B. Provide sufficient data for the Project Manager to properly evaluate the pipe.

C. Product data submittals shall include the following, as a minimum:
   1. Details of the proposed pipe.
   2. Properties and strengths of the pipe.
   3. Details of pipe joint.
   4. Pipe design analysis.
   5. Instruction on storage, handling, transporting, and installation.

D. Test Reports: Provide test reports upon request, certifying that the pipe has been tested in accordance with and exceeds minimum requirements of ASTM D 3262 and ASTM D 3681.

PART 2 PRODUCTS

A. Provide fiberglass reinforced pipe per the City of Houston Approved Product List.

2.02 MATERIALS

A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been collected from applications of a composite material of similar construction and composition as the proposed product.

B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade glass filaments with binder and sizing compatible with impregnating resins.

C. Fillers: Silica sand or other suitable materials may be used.

D. Additives: Resin additives, such as pigments, dyes, and other coloring agents, if used, shall in no way be detrimental to the performance of the product nor shall they impair visual inspection of the finished products.

E. Rubber Gaskets: Supply from an approved gasket manufacturer in accordance with ASTM F 477, when no contaminant is identified and suitable for the service intended. Gaskets shall either be affixed to the pipe by means of a suitable adhesive or shall be installed in such a manner so as to prevent the gasket from rolling out of the pre-cut groove in the pipe or sleeve coupling. When pipe is to be installed in potentially contaminated areas, especially where free
product is found near the elevation of the proposed sewer, provide the following gasket materials for the noted contaminants.

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other Contaminants</td>
<td>As recommended by the pipe manufacturer, Engineer of the Record and approved by City Engineer prior to installation</td>
</tr>
</tbody>
</table>

1. If required gasket material is not available for use, pipe other than fiberglass pipe must be used in potentially contaminated areas in accordance with specification section 02105-Sampling and Analysis in PPCA.

F. 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. Pipe shall meet or exceed requirements of ASTM D 3681.

2.03 MANUFACTURE AND CONSTRUCTION

A. Pipes

1. Furnish pipes in the diameters specified and within the tolerances specified below.

2. Manufacture pipe by the centrifugal casting process or filament winding to result in a dense, nonporous, corrosion-resistant, consistent composite structure to meet the operating conditions as shown on the Drawings.

3. Do not use stiffening ribs or rings.

B. Couplings: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D 4161.

C. Fittings: Flanges, elbows, reducers, tees, and other fittings shall be capable of withstanding operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass fiber reinforced overlays.

D. Manhole Connections: Provide a water stop flange (wall pipe) for connection to manhole base or other structure in accordance with Section 02081 - Cast-in-Place Concrete Manholes, or Section 02082 - Precast Concrete Manholes.

E. Grout Ports: Provide grout ports in the wall of pipe when required. Provide plugs of 316 stainless steel or other corrosion-resistant material compatible with the pipe. Grout port plugs
shall be designed and installed to meet the test pressure of the pipe.

2.04 DIMENSIONS

A. Diameters: The actual outside diameter of the pipes shall be in accordance with Table 3 of ASTM D 3262 for gravity sewers, or ASTM D 3754 for force mains.

B. Lengths: The pipe standard length will be approximately 20 feet. A maximum of 10 percent of the lengths, excluding special order pipes, may be supplied in random lengths.

C. Wall Thickness: The minimum average wall thickness shall be the stated design thickness. The minimum single point thickness shall not be less than 90 percent of the stated design thickness.

D. End Squareness: Pipe ends shall be square to the pipe axis.

E. Tolerance of Fittings: The tolerance of the angle of an elbow and the angle between the main and leg of a wye or tee shall be plus or minus 2 degrees. The tolerance on the laying length of a fitting shall be plus or minus 2 inches.

2.05 STIFFNESS CLASSES

A. Stiffness class of FRP pipe shall satisfy design requirements, but shall not be less than 46 psi, when used in direct bury operation; 36 psi, when installed within a primary tunnel liner.

B. Stiffness class of FRP in a pipe jacking operation shall be governed either by the ring deflection limitations or by a pipe design providing longitudinal strength required by the jacking method and shall satisfy design requirements stated below. Submit design calculations as required in Paragraph 1.04, Submittals.

1. Pipe stress calculations based on jacking loads shall be performed to conform to Section 02441 - Microtunneling and Pipe Jacked Tunnels.

2. Ring deflection calculations shall conform to design requirements of 30 TAC Chapter 317.20 pertaining to flexible pipe used in gravity sewers. The pipe deflection calculations shall ensure that predicted deflection will be less than 5 percent under long-term loading conditions (soil prism load) for the highest density of soil overburden and surcharge loads. Deflection on calculations shall be prepared using long-term (drained) values for soil parameters contained in the geotechnical investigation report for the Project, or other site-specific data obtained by the Contractor as approved by the Engineer.

2.06 TESTING

A. Pipes shall be tested in accordance with ASTM D 3262 or ASTM D 3754, as applicable, except that the factory hydrostatic pressure testing is not required.

B. Joints: Coupling joints shall be qualified per the tests of Section 7 of ASTM D 4161.
2.07 INSPECTION

A. The Project Manager 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.

B. Manufacturer's Notification: Should the Project Manager wish to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Project Manager with adequate advance notice of when and where the production of those pipes will take place.

C. Failure to Inspect: Should the Project Manager elect not to inspect the manufacturing, testing, or finished pipes, it in no way implies approval of products or tests.

2.08 PACKAGING, HANDLING, AND SHIPPING

A. Packing, handling, and shipping should be done in accordance with the manufacturer's recommendations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install pipe and fittings in accordance with requirements of Section 02531 - Gravity Sanitary Sewers, 02532 - Sanitary Sewage Force Mains, or Section 02550 - Sliplining Sanitary Sewers.

B. The manufacturer must supply a suitable qualified field service representative to be present periodically during the installation of pipe.

C. Pipe Bedding: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

D. Pipe Handling: Use textile slings.

E. Jointing

1. Clean ends of pipe and coupling components.

2. Check pipe ends and couplings for damage. Correct any damage found.

3. Coupling grooves must be completely free of dirt.

4. Apply joint lubricant to pipe ends and rubber seals of coupling. Use only lubricants approved by the pipe manufacturer.

5. Use suitable auxiliary equipment, such as a wire rope puller, to pull joints together.
6. Do not exceed forces recommended by the manufacturer for coupling pipe. If excessive force is required, remove coupling, determine source of problem, and correct it.

7. In the process of jointing the pipe, do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

F. If pressure grouting of the pipe is conducted as part of a pipe-jacked tunnel installation, seal the grout holes with liner resin to a thickness equal to the pipe liner thickness or with a threaded plug for that purpose.

G. Tests: Conform to requirements of Section 02533 - Acceptance Testing for Sanitary Sewers.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. High density polyethylene (HDPE) pipe for gravity sanitary sewers and drains, including fittings.

B. High density polyethylene (HDPE) pipe for sanitary sewer force mains, including fittings.

C. High density polyethylene (HDPE) pipe for gravity storm sewers and drains, including fittings.

D. High density polyethylene (HDPE) pipe for storm sewers culverts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for HDPE pipe under this Section. Include cost in unit prices for work, as specified in following sections:

a. Section 02531 - Gravity Sanitary Sewers.

b. Section 02532 - Sanitary Sewer Force Mains.

c. Section 02550 - Sliplining Sanitary Sewers.

d. Section 02571 - Pipe Bursting/Crushing Sanitary Sewers.

e. Section 02631 - Storm Sewers.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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


B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

C. ASTM D 2321 - Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Pipe.


K. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.
B. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, pipe length, laying dimensions, fabrication, fittings, flanges, gasket material, and special details.

C. Submit detailed calculations for pipe design.

D. Submit details of Pipe Joints and jointing procedure for HDPE pipe.

1.05 QUALITY CONTROL

A. Provide manufacturer's certificate of conformance to Specifications.

B. Furnish pipe and fittings that are homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

C. Project Manager reserves right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve manufacturer of responsibilities to provide products that comply with applicable standards and these Specifications.

1. Manufacturer's Notification: Should Project Manager wish to witness manufacture of specific pipes, manufacturer shall provide Project Manager with minimum three weeks notice of when and where production of those specific pipes will take place.

2. Failure to Inspect. Approval of products or tests is not implied by Project Manager’s decision not to inspect manufacturing, testing, or finished pipes.

D. Pipe manufacturer to provide services of experienced, competent, and authorized representative to visit site to advise and consult Contractor during jointing and installation of pipe.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience of minimum 5 years of pipe installations that have been in successful, continuous service for same type of service as proposed Work.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide products manufactured by companies listed on the City of Houston Standard Product List.
B. Furnish solid wall pipe with plain end construction for heat joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce fused leak-free joint.

C. Furnish profile-wall gravity sanitary sewer pipe with bell-and-spigot end construction conforming to ASTM D 3212. Joining will be accomplished with elastomeric gasket in accordance with manufacturer's recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, elastomeric gasket, contained in machined groove on pipe spigot, is compressed radially in pipe bell to form positive seal. Design joint to avoid displacement of gasket when installed in accordance with manufacturer's recommendations.

D. Furnish solid wall pipe for sanitary sewer force mains with minimum working pressure rating of 150 psi, and with inside diameter equal to or greater than nominal pipe size indicated on Drawings.

E. Furnish corrugated profile-wall polyethylene (CPP) pipe for gravity storm sewer and storm sewer culvert pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line. Suitable joints are:

1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged.

2. Exterior Bell and Spigot. Bell shall be fully welded to exterior of pipe and overlap spigot end so that flow lines and ends match when fully engaged.

F. Jointing:

1. Gaskets:

   a. Meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.

   b. HDPE Pipes are Not allowed to be installed in potentially contaminated areas, unless approved by City Engineer.

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other Contaminants</td>
<td>As recommended by pipe manufacturer</td>
</tr>
</tbody>
</table>
2. Lubricant. Use lubricant for assembly of gasketed joints which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.02 MATERIALS FOR SANITARY SEWER

A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting requirements of cell classification 345434D or E, in accordance with ASTM D 3350, are also suitable for making pipe products under these specifications. Inner wall of pipe shall be of light color for television inspection purposes.

B. Other Pipe Materials: Materials other than those specified in Paragraph 2.02A, Pipe and Fittings, may be used as part of profile construction, e.g., as core tube to support shape of profile during processing, provided that these materials are compatible with base polyethylene material and are completely encapsulated in finished product and in no way compromise performance of pipe products in intended use. Examples of suitable material include polyethylene and polypropylene.

2.03 MATERIALS FOR GRAVITY STORM SEWERS AND STORM SEWER CULVERTS

A. Pipe and Fittings: High density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in ASTM D 3350. Manufacturing shall meet requirements of ASTM F 2306.

2.04 TEST METHODS FOR SANITARY SEWER

A. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Project Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.05A, in suitable press until internal diameter has been reduced to 40 percent of original inside diameter of pipe. Rate of loading shall be uniform and at 2 inches per minute. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles.

C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace shear load transfer bars and supports with 6-inch-wide support blocks that can be either flat or contoured to conform to pipe's outer contour.
D. Purpose of Tests. Flattening and joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

2.05 TEST METHODS FOR GRAVITY STORM SEWERS AND STORM SEWER CULVERTS

A. All testing and material requirements shall be in accordance with ASTM F 2306.

2.06 MARKING

A. Mark each standard and random length of pipe in compliance with these Specifications with following information:

1. Pipe size.
2. Pipe class.
3. Production code.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to requirements of following Sections:

1. Section 02550 - Sliplining Sanitary Sewers.
2. Section 02531 - Gravity Sanitary Sewers.
5. Section 02571 - Pipe Bursting/Crushing Sanitary Sewers.
6. Section 02631 - Storm Sewers

B. Install pipe in accordance with the manufacturers recommended installation procedures and ASTM D 2774.

C. HDPE pipe is not approved in applications requiring augering of pipe.

D. Bedding and backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.
E. Use only workmen trained in the installation of HDPE Pipe.

F. Do not store pipe uncovered direct in direct sunlight. Allow pipe temperature to approach ground temperature before each individual pipe section is terminally connected.

G. Joints: Join sections of HDPE pipe into continuous lengths above ground by thermal butt fusion method in accordance with AWWA C906 and pipe manufacturer’s recommendations for specified service. Fusion joints: meeting minimum requirements of manufacturer for cool down time and other fusing requirements. Socket fusion and extrusion welding or hot gas welding will not be accepted.

H. Cutting pipe: Comply with pipe manufacturer’s recommendations. After cutting, leave end pipe in accordance with manufacturer’s recommendations.

END OF SECTION
PART 1    G E N E R A L

1.01   SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 60 inches.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.02   MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for work included as specified in the following sections:

   a. Section 02511 - Water Lines
   b. Section 02531 - Gravity Sanitary Sewers

   A. Section 02532 - Sanitary Sewer Force Mains
   B. Section 02631 - Storm Sewers

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03   REFERENCES


I. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

J. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

C. Contractor to review and submit PVC pipe manufacturers recommended installation procedures.

D. Calculations and limits of thrust restraint shall be based on AWWA M23, latest edition.

1.05 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory.
located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Project Manager for review. Cost of testing paid by Contractor.

PART 2  PRODUCTS

2.01  MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454 virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.

1. Pipe Material:
   a. DR 18: For restrained joints where shown on Drawings.
   b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.

1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.

2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:

1. Gasket materials shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.

2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

G. Do not use PVC in potentially or known contaminated areas.

H. Do not use PVC in areas exposed to direct sunlight.

2.02 WATER SERVICE PIPE

A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 14 inch through 20 inch: AWWA C 905; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. Make curves and bends by offsetting (i.e., deflecting joints). Do not exceed maximum offset recommended by pipe manufacturer or the City, whichever is less.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer’s written certification.

2.03 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe shall be in accordance with provisions in following table:
### Wall Construction

<table>
<thead>
<tr>
<th>Wall Construction</th>
<th>ASTM Designation</th>
<th>SDR (Max.) / Stiffness (Min.)</th>
<th>Diameter Size Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D3034</td>
<td>SDR 26 / PS 115</td>
<td>6&quot; to 10&quot;</td>
</tr>
<tr>
<td></td>
<td>D3034</td>
<td>SDR 35 / PS 46</td>
<td>12&quot; &amp; 15&quot;</td>
</tr>
<tr>
<td></td>
<td>F679</td>
<td>SDR 35 / PS 46</td>
<td>18&quot; to 60&quot;</td>
</tr>
<tr>
<td></td>
<td>AWWA C900</td>
<td>DR 18 / N/A</td>
<td>4&quot; to 12&quot;</td>
</tr>
<tr>
<td></td>
<td>AWWA C909</td>
<td>DR 18 / N/A</td>
<td>4&quot; to 12&quot;</td>
</tr>
<tr>
<td></td>
<td>AWWA C905</td>
<td>DR 18 / N/A</td>
<td>14&quot; to 20&quot;</td>
</tr>
</tbody>
</table>

Note: Refer to City of Houston Approved Products List for list of manufacturers.

### PVC Storm Sewer Pipe

B. PVC storm sewer pipe shall be in accordance with provisions in following table:

<table>
<thead>
<tr>
<th>Wall Construction</th>
<th>Manufacturer</th>
<th>ASTM Designation</th>
<th>SDR (Max.) / Stiffness (Min.)</th>
<th>Diameter Size Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid</td>
<td>J-M Pipe</td>
<td>D3034</td>
<td>SDR 26 / PS 115</td>
<td>6&quot; to 10&quot;</td>
</tr>
<tr>
<td></td>
<td>CertainTeed</td>
<td>D3034</td>
<td>SDR 35 / PS 46</td>
<td>12&quot; &amp; 15&quot;</td>
</tr>
<tr>
<td></td>
<td>Diamond</td>
<td>D3034</td>
<td>SDR 35 / PS 46</td>
<td>18&quot; to 27&quot;</td>
</tr>
<tr>
<td></td>
<td>Uponor ETI</td>
<td>F679</td>
<td>SDR 35 / PS 46</td>
<td></td>
</tr>
<tr>
<td></td>
<td>North American</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWWA C900</td>
<td>DR 18 / N/A</td>
<td>4&quot; to 12&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWWA C909</td>
<td>DR 18 / N/A</td>
<td>4&quot; to 12&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWWA C905</td>
<td>DR 18 / N/A</td>
<td>14&quot; to 16&quot;</td>
<td></td>
</tr>
<tr>
<td>Truss (Gasketed)</td>
<td>Contech</td>
<td>D2680</td>
<td>N/A / 200 psi</td>
<td>8&quot; to 15&quot;</td>
</tr>
<tr>
<td>Profile</td>
<td>Contech A-2000</td>
<td>F949</td>
<td>N/A / 46 psi</td>
<td>12&quot; to 36&quot;</td>
</tr>
<tr>
<td></td>
<td>Contech A-2026</td>
<td>F949</td>
<td>N/A / 115 psi</td>
<td>8&quot; to 10&quot;</td>
</tr>
<tr>
<td></td>
<td>ETI, Ultra-Rib</td>
<td>F794</td>
<td>N/A / 46 psi</td>
<td>8&quot; to 30&quot;</td>
</tr>
<tr>
<td></td>
<td>ETI, Ultra-Corr</td>
<td>F794</td>
<td>N/A / 46 psi</td>
<td>24&quot; to 36&quot;</td>
</tr>
</tbody>
</table>
C. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe stiffness of 115 psi.

D. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

E. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded or otherwise held in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

F. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

1. Fittings for straight through and transition connections conform to requirements of Section 02534- Sanitary Sewer Service Stubs or Reconnections.

G. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Project Manager. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified. This is a brief summary of the test method, and the full current edition of the standard must be followed.

H. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length. This is a brief summary of the test method, and the full current edition of the standard must be followed.

I. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.03F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test. This is a brief summary of the test method, and the full current edition of the standard must be followed.
J. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe. This is a brief summary of the test method, and the full current edition of the standard must be followed.

K. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

L. Saddle for pipe with 0.5 inch width and greater: Connect side sewer by drilling proper size round hole in wall of the main sewer pipe, inserting an approved pipe compression saddle. The Saddle shall meet requirements of ASTM C-923. Saddles will accept 4”, 6”, and 8” pipe. The lateral pipe shall be held in place by one stainless steel compression band with stainless steel nut and bolt (any AISI Series 300) type tightening device and meeting requirements of ASTM A240. A stainless steel shear band shall wrap around the pipe a minimum of 380 degrees. Saddle may not protrude into mainline pipe.

2.04 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Section 02532 - Sanitary Sewage Force Mains.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Section 02501 - Ductile Iron Pipe and Fittings, Paragraph 2.04, except furnish fittings with one of following approved internal linings:

1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting

2. Nominal 40 mils (35 mils minimum) polyurethane

3. Nominal 40 mils (35 mils minimum) ceramic epoxy

4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Section 02528 - Polyethylene Wrap.
E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

2.05 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 EXECUTION

3.01 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer’s recommendations.

3.02 INSTALLATION

A. Conform to requirements of Section 02511 - Water Lines, Section 02531 - Gravity Sanitary Sewers, and Section 02532 - Sanitary Sewer Force Mains, as applicable.

B. Install PVC pipe in accordance with Section 02317 - Excavation and Backfill for Utilities, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines with minimum 6-inch separation, unless otherwise shown on Drawings:

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support. Ensure barrel is fully supported along entire length of pipe, prior to backfilling.

F. For PVC pipe installed by trenchless methods, provide integral restrained joints and pull pipe through hole or casing. For PVC pipe pushed through hole or casing, provide approved bell insertion protection system.

G. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.
H. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

I. Pipe Assembly Procedures

1. Do not remove gasket from pipe.

2. Lay pipe by inserting spigot end into bell flush with the insertion line or as recommended by pipe manufacturer.

3. Do not assemble joint by swinging or stabbing.

4. Do not assemble joint using machinery or equipment such as backhoe bucket.

5. At no time shall spigot go past insertion line or homing mark. Continuously observe and check each homing mark for proper length, and install pipe with homing mark visible.

3.03 PVC RESTRAINED MECHANISM

A. For low-profile coupling with spline-type joints:

1. Do not apply lubricant to spline or pipe or coupling spline grooves.

2. Do not use excessive force while inserting the spline through coupling.

3. Insert spline until it is fully seated around circumference of pipe.

B. Field Cutting of Pipe Ends:

1. Perform by workers certified by manufacturer.

2. Use a PVC pipe cutter and provide square ends.

3. Follow manufacturer’s recommendation to disassemble restrained joint after it has been locked in place.

4. For low-profile coupling with spline-type joints, use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION
PART 1    GENERAL

1.01 SECTION INCLUDES

A. Prestressed concrete cylinder pipe (PCCP) and fittings for buried water lines sizes 20 inches and larger.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. No separate payment will be made for PCCP under this Section. Include cost in price for water lines.

2. Maintain on site minimum of two 3-degree and two 5-degree grade angle adapters. Adapters are considered “extra unit price.” When used during construction, adapter will be paid at unit price.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.


H. ASTM C 497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.


Q. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

R. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

S. AWWA C 301 - Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids.

T. AWWA C 304 - Standard for Design of Prestressed Concrete Cylinder Pipe.

U. AWWA M 9 –Concrete Pressure Pipe.

V. NSF 61 - Drinking Water System Components - Health Effects.

W. SSPC SP 7 - Surface Preparation Specification No. 7 - Brush Off Blast Cleaning.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings and certification signed and sealed by Professional Engineer registered in State of Texas showing following:

1. Manufacturer's pipe design and thrust restraint calculations in accordance with AWWA M9, latest edition.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details,
with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (*.PDF).

3. Include hot tapping procedure.

4. Submit certification from manufacturer that design was performed for project in accordance with requirements of this section.

C. Within 30 calendar days following Notice to Proceed and before initiation of manufacture of prestressing wire, submit following:

1. Name and location of prestressing wire manufacturer.

2. General description of quality control procedures used by wire manufacturer. Include physical and chemical property tests utilized, testing frequency and test records; and description of methods employed to assure compliance with AWWA C301 regarding wire surface temperature, type of thermometer, location of temperature measurement, frequency of temperature tests and test records.

3. Approximate dates when wire will be manufactured for use in pipe.


D. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding. Submit standard repair procedures that describe in detail shop and field work to be performed.

E. Submit following within 45 days after manufacturing of pipe and fittings:

1. Prestressing wire records.
   a. ASTM A 648 for wire.
   b. Steel reports as required in AWWA C301, Section 5.2.5.
   c. Records of testing accomplished to measure wire surface temperature as required in ASTM A648.
   d. Results of other tests of steel reinforcement required in AWWA C301, Section 4.4.7, 4.4.8, and 4.4.9.
e. Wire tension records required in AWWA C301, Section 4.6.7.1. Indicate heat and coil of prestressing wire used.

2. Test results.
   a. Hydrostatic testing, acid etching, dye penetration, magnetic particle and x-ray weld test reports as required.
   b. Compressive strength (28 day) test results for each type of coating, lining and core mix design.

3. Pipe manufacturer's certification that PCCP:
   a. Cylinder assembly has been hydrostatically tested at factory for two (2) minutes minimum in accordance with Section 2.01 J and AWWA C301.
   b. Mortar coatings and linings were applied or allowed to cure at temperature above 32 degrees F.

F. Submit following for nonshrink grout for special applications:
   1. Manufacturer's technical literature including specifications for mixing, placing, and curing grout.
   2. Results of tests performed by certified independent testing laboratory showing conformance to ASTM C 1107, Nonshrink Grout and requirements of this specification.
   3. Certification product is suitable for use in contact with potable water.

G. Submit proof of certification for welders. Indicate certified procedures and position each welder is qualified to perform. Provide documentation of the most recent weld qualification test date and continuity of use in each process for which the welder or welding operator is required.

H. Submit certification showing calibration within last 12 months for equipment such as scales, measuring devices, and calibration tools used in manufacture of pipe. Each device used in manufacture of pipe is required to have tag recording date of last calibration. Devices are subject to inspection by Project Manager.

1.05 QUALITY CONTROL

A. Manufacturer to have permanent quality control department and laboratory facility capable of performing inspection and testing required. Inspection procedures and manufacturing process are subject to inspection by Project Manager. Perform
manufacturer tests and inspections required by AWWA C 301 as modified by these Specifications. Repair defects when as substandard welds, excessive radial offsets (misalignment), pitting, gouges, cracks, other nonconforming conditions.

1. Cylinder and Joint Ring Assembly:
   a. Review mill certifications for conformance to requirements of Specifications.
   b. Perform physical testing of each heat of steel for conformance to applicable ASTM standards.
   c. Inspect physical dimensions and overall condition of joint rings and cylinder/joint ring assembly to verify compliance with requirements of AWWA C 301.
   d. Test cylinder/joint ring weld for tensile strength. Test one specimen for each 500 cylinder/joint ring assemblies in addition to those tests required by AWWA C 301.
   e. Reject dented steel cylinders.

2. Prestressing Wire:
   a. Inspect wire spacing during wire placement on core.
   b. Test wire splices for each production run or a minimum of once a week, whichever is less, for conformance with minimum strength criteria.

3. Pipe Cores and Coating:
   a. Review mill certificates for each load of cement for conformance to ASTM C 150.
   b. Perform sieve analysis weekly for each source of coarse and fine aggregate for conformance to ASTM C 33.
   c. Inspect kiln recorder charts daily to confirm proper curing environment.
   d. Prior to prestressing, inspect each core for voids, chips, cracks, deleterious surfaces and foreign matter.
   e. Check mortar batch proportions, moisture content and slurry application rate. Check coating thickness over wire on each pipe.
f. Check physical integrity of cured mortar coating.

g. Reject pipe with cracks in mortar coating exceeding 0.01 inches wide.

4. Protective Coatings: Check daily application rate and resulting dry film thickness.

B. Gaskets: Randomly test rubber cord for diameter, tensile strength, elongation, compression set, hardness, and specific gravity after oven aging on one out of 100 gaskets.

C. Weld Testing:

1. Perform macroetching tests for complete penetration production welds on normal production weld tests. Complete joint penetration welds are defined in ANSI/AWS A3.0. Verify complete joint penetration by means of macroetch of joint weld cross section. Macroetch technique in accordance with ASTM E 340.

2. Perform ultrasonic or x-ray testing of manual butt welds for fittings and special pipes. Perform dye penetration testing of manual lap welds for fittings and special pipes and for joint ring weld onto cylinder.

3. Perform minimum of one set of weld test specimens in accordance with ANSI/AWS A3.0 on each size, grade and wall thickness at minimum of every 3,000 feet of pipe manufactured. Perform no less than one test per project by each welding machine and each operator.

D. Cast four standard test cylinders each day for each 50 cubic yards of core concrete or mortar coating or portion thereof for each mix placed in day. Perform compressive strength test at 28 days. No cylinder test result shall be less than 80 percent of specified strength.

E. Make available copy of Physical and Chemical testing reports for steel cylinders and provide reports at request of Project Manager.

F. Check physical dimensions of pipe and fittings: Physical dimensions to include pipe lengths, pipe LD., pipe O.D. and bend angles.

PART 2 PRODUCTS

2.01 PRESTRESSED CONCRETE CYLINDER PIPE

A. Furnish all concrete pressure pipe by same manufacturer.
B. Provide prestressed concrete cylinder pipe in conformance with AWWA C 301, AWWA C 304 and AWWA M 9 except as modified in this Section. Use of pipe from inventory is permitted only if specifications and certifications are met. Provide testing records for pipe.

C. Do not use prestressed concrete cylinder pipe in aerial crossings, exposed or other unburied areas.

D. Pipe Manufacturer:
   1. Must have minimum of 5 years of manufacturer's pipe installations that have been in successful and continuous service.
   2. Must maintain on site or in plant minimum of four 22.5-degree bends per 10,000 linear feet of water line. Additionally, for 102” pipe and larger, four bevel adaptors must be maintained on site or in the plant. Any combination of bends may be substituted at manufacturer's option (i.e. two 11.25-degree bends are equivalent to one 22.5-degree bend and will be counted as one fitting). Must be capable of delivering bends or bevel adaptors to job site within 12 hours of notification. These fittings are in addition to fittings called out on Drawing and must be available at all times.

E. Pipe Design Conditions:
   1. Working pressure: 150 psi.
   2. Hydrostatic field test pressure: 150 psi.
   3. Maximum pressure due to surge: 225 psi.
   4. Minimum pressure due to surge: -5 psi.
   5. Unit weight of soil: 120 pcf minimum, unless otherwise specified.
   7. Pipe and Fittings: Designed to withstand most critical simultaneous application of external loads including construction loads and internal pressures.
   8. Design: Based on minimum of AASHTO HS-20 loading, AREA Cooper E-80 loads when under railroads, and depths of bury as indicated. Design pipe with Marston's earth loads for transition width trench for all heights of cover.
      a. Calculate moments and thrusts in wall based on height of earth load, live load, water weight, and pipe weight.
b. For earth load heights up to 16 feet, use bedding sand as bedding material and use 90-degree Olander coefficients for earth load, live load, and water weight contained in pipe along with 15-degree Olander coefficients for pipe weight.

c. For earth load heights 16 feet and greater, use cement stabilized sand as bedding material below springline of pipe, and use 150-degree Olander coefficients for earth load, live load, and water weight contained in pipe along with a 15-degree Olander coefficient for pipe weight.

9. Groundwater Level: Assume below pipe for pipe design. Assume equal to natural ground surface for other conditions.

10. Design pipe for transmitting potable water, unless otherwise shown on Drawings.

11. Manufacture pipe for adverse environmental conditions in accordance with Section 7.5.5 of AWWA C304.

12. Design pipe for buried conditions and kept empty for up to 365 days.

13. Tunnel and Augered Sections: Provide constant outside diameter from bell to spigot end for pipe. Exclude structural benefits associated with primary liner. Design pipe and pipe joints to carry loads including but not limited to: overburden and lateral earth pressures, subsurface soil, grouting, other conditions of service, thrust of jacks, and stress anticipated during handling and installation.

F. Coatings and Linings:

1. Provide Portland cement; ASTM C 150, Type I or II. Provide one type of cement for entire project.

2. Water Absorption Test: ASTM C 497, Method A; perform on samples of cured mortar coating taken from each working shift. Cure mortar coating samples in same manner as pipe.

a. Test Value: Average minimum of 3 samples taken from same working shift, no greater than 9 percent for average value, 11 percent for individual value.

b. Test Frequency: Perform tests each working shift until conformance to absorption requirements has been established by 10 consecutive passing test results, at which time testing may be performed weekly. Resume testing for each working shift when absorption test results fail
until conformance to absorption requirements is reestablished by 10
consecutive passing test results.

3. Apply one coat of primer to exposed steel parts of steel bell and spigot rings. Prior to coating, blast clean in accordance with SSPC-SP7 (Brush Off Blast Cleaning). Apply primer in accordance with manufacturer's recommendations.

4. Coat and line access inlets, service outlets, test inlets and air release/vacuum relief riser pipe with same coating and lining of water line in accordance with AWWA C 301, Section 4, unless otherwise indicated on Drawings.

5. Do not exceed two hours between application of first and last course when cement mortar is applied in more than one course; otherwise, do not defer placing of coating of any portion of pipe length. Verify cement mortar coating thickness on each size of pipe by nondestructive method before removing pipe from coating machine.

6. Remove and replace disbonded lining or coating. Reject pipe requiring patches larger than 100 square inches or 12 inches in greatest dimension. Allow no more than one patch on either lining or coating of pipe. Provide WELD-CRETE Probond Epoxy Bonding Agent ET-150, parts A and B; Sikadur 32 Hi-Mod, or approved equal bonding agent for pipe patching.

G. Fittings and Specials:

1. Design fittings to same internal and external loads as straight pipe.

2. Manufacture in accordance with Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.

3. Provide fabricated bends or fittings with minimum radius of 2-1/2 times pipe diameter.

4. Design test plugs to withstand forces generated by hydrostatic test and test pressure from either side. Do not exceed 50 percent of minimum yield for design stresses due to hydrostatic pressure. Assume opposite side of plug does not contain water.

5. Provide no specials less than 4 feet in length unless indicated on Drawings or approved by Project Manager.

6. Butt Straps for Closure Piece: Provide at locations indicated on Drawings or authorized by Project Manager. Minimum 12-inch-wide split butt strap; minimum plate thickness equal to thinnest member being joined; fabricated
from material equal in chemical and physical properties to thinnest member being joined. Permit no angular deflection or joint offset at butt-strap joints.

7. Provide minimum 6-inch welded outlet for inspecting each closure section, unless access manway is within 40 feet of closure section.

8. Provide Denso petroleum based tape or approved equal for exposed portions of nuts and bolts.

H. Joints:

1. AWWA C 301 rubber-gasketed or welded bell-and-spigot type except where flanged joints are required for valves and fittings as shown on Drawings. Refer to Section 02511 - Water Lines for details on joints and jointing.

2. Rubber-Gasketed Joints: Single weld bell and spigot ring onto steel cylinder. In thrust areas, double weld bell-and-spigot onto steel cylinder. Bond as shown on Drawings to provide electrical continuity along entire pipeline.

3. Restrained Joints: Restrain joints by welding or harnessing joints.
   a. Design Pressure: 1.5 times working pressure.
   b. Harnessed Joints: AWWA M 9, clamp or snap ring type, except where prohibited. Limit maximum size of snap ring joints to 48-inch diameter pipe.
   c. Groundwater Level: Assumed to be equal to natural ground surface.
   d. Provide restrained joint pipe with adequate cylinder thickness to transmit full thrust generated by internal pressure across joints.

1) Calculate distance of restrained joints based on resistance along each leg of bend with thrust based on bend angle.

2) Calculate cylinder thickness not to be less than that defined in following table:

<table>
<thead>
<tr>
<th>Inside Diameter (inches)</th>
<th>Cylinder Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 120</td>
<td>0.25 inch</td>
</tr>
<tr>
<td>102 to 120</td>
<td>4 gauge</td>
</tr>
<tr>
<td>90 to 96</td>
<td>6 gauge</td>
</tr>
</tbody>
</table>
3) Allow cylinder thickness to reduce linearly from maximum calculated thickness or from minimum cylinder thickness (as determined in Paragraph 2.01 H.3.d.1, whichever controls, to minimum thickness required by design over required length (as determined in Paragraph 2.01 H.3.d.1) of restrained joints.

4. Use only fully circumferentially welded joints in areas considered potentially petroleum contaminated, within tunnels and under foreign pipelines. Perform welding in accordance with Section 02511 – Water Lines.

5. Pipe Flanges: AWWA C 207 for standard steel flanges of pressure class corresponding to pipe class.

I. Pipe Lengths: Provide pipe sections in standard lengths with minimum length of 16 feet and maximum length of 25 feet, and as indicated on approved shop Drawings or approved by Project Manager. Gasketed joints are allowed on standard lengths of pipe. Non-standard pipe lengths must be approved by Project Manager and joints must be welded as specified herein to achieve equal to or greater than standard pipe length before gasketed joints can be used. Internally and externally mark pipe section with durable marking to show location and pipe pressure.

J. Hydrostatic Test of Cylinder: AWWA C 301, Section 4.6.4.3, at point of manufacture. Hold test for minimum 2 minutes for thorough inspection of cylinder. Repair or reject cylinders revealing leaks or cracks.

K. Transport fittings 42 inches in diameter and larger with end caps and stulls. Remove end caps just prior to installation. Remove stulls after completion of backfill operation.

L. Provide radius of curve as indicated on Drawings unless approved by Project Manager. Make curves and bends by deflecting joints, by use of beveled joints, or by combination of two methods, unless otherwise indicated on Drawings. Do not exceed deflection or joint offset angle recommended by pipe manufacturer. Provide beveled pipe sections of standard length used in curved alignment, except when shorter sections are required to limit radius of curvature. In such case, provide sections throughout curve of substantially equal length.
M. When manufacturing straight pipe sections, manual welding is allowed for following:

1. Tack welding of coils and plates during continuous pipe making process.

2. Rewelding and repairing structural defects in plate and automatic machine welds.

3. Attaching new coil of steel to previous coil.

N. Prior to arrival on project site, identify pipe sections within limits of thrust restraint with permanent, brightly colored, and highly visible markings on outer pipe coating as approved by Project Manager.

2.02 PRESTRESSING WIRE

A. General:

1. Conform to requirement of ASTM A 648, AWWA C 301 and this specification.

2. Furnish test results from independent manufacturer (i.e., manufacturer with no legal or financial ties to pipe manufacturer). Tests must have been performed within 12 months prior to submittal or when supplier changes.

3. Test foreign manufactured wire by local independent laboratory.

4. Prestressing wire surface temperature: not more than 360 degrees at any point in drawing process. Audit surface temperature of wire throughout length of wire drawing process daily for each working shift producing ASTM A 648 wire.

5. Do not use wire with visible pitting or rust that cannot be wiped off.

6. Do not use wire that fails, for no observable mechanical reason other than tension force, during circumferential wrap. Do not splice, but reject this section of wire.

B. Perform mechanical tests per AWWA C301 - Steel Reinforcement except as modified below:

1. Retest coil for which failed torsion test sample has radial, spiral (that is, longitudinal) split visible to unaided eye or evidenced by abrupt offset in wire surface detectable with fingernail.
2. Test sample, for mechanical requirements, from 1 of each 10 consecutively produced coils or fraction thereof in each lot. Pipe manufacturer to establish procedures so samples are randomly selected from entire length of wire coils.

C. Perform hydrogen embrittlement sensitivity testing on samples of prestressing wire in accordance with ASTM A648 and A1032. Test one set of pre-qualified samples for each anticipated wire manufacturing source anticipated by pipe manufacturer for project. Perform tension, wrapping, and torsion on wire samples. Perform pre-qualification testing prior to pipe manufacturing and for each source of supply for wire. Do not use wire failing to conform to test requirements of specification. Acceptance criteria are according to ASTM A648, S1, and AWWA C301, 4.4.8.1. Utilize only wire that meets both of following:

1. Passed aforementioned test.

2. Manufactured from same source and manufacturing procedures.

2.03 GROUT FOR JOINTS AND SPECIAL APPLICATION

A. Joint Grout:

1. Cement Grout Mixture: One part cement to two parts of fine, sharp clean sand. Mix interior joint mortar with as little water as possible until very stiff but workable. Mix exterior joint mortar with water until it has consistency of thick cream.

2. Water: Potable water with total dissolved solids less than 1000 mg/1; ASTM D 512 chloride ions less than 100 mg/1 for slurry and mortar cure; ASTM D 1293 pH greater than 6.5. Use potable water with 250 ppm limit on chlorides and sulfates.

3. Portland Cement: ASTM C 150, Type I or II. Provide one type of cement for entire project.

4. Sand:
   b. Exterior joints: ASTM C 33 natural sand with 100 percent passing No. 16 sieve.

5. Mix cement grout to specific gravity of 19 lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of and at request of Project Manager. Add additional cement grout or water to mixed cement grout to bring mix to
proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

B. Provide approved Nonshrink Grout for Special Applications, Patches and Repairs.

1. Conform to requirements of ASTM C 1107, Nonshrink Grout.

2. Pre-blended factory-packaged material manufactured under rigid quality control.

3. Contain non-metallic natural aggregate, be non-staining and non-corrosive.

4. Meeting NSF 61 Standard suitable for use in contact with potable water supply.

5. Exterior: Highly flowable to fill joint wrapper without leaving voids or trapped air. Interior capable of being placed with plastic consistency.


7. Contain no chlorides or additives which may contribute to corrosion of prestressed concrete cylinder pipe.


9. Resist attack by oil or water.

10. Mix, place, and cure in accordance with manufacturer's recommendations. Upon 72 hours notice, provide services of qualified representative of nonshrink grout manufacturer to aid in use of product under job conditions.

11. Mix non-shrink grout to specific gravity of 17.7 lb/gallon or greater as measured by grout/slurry balance. Use grout/slurry balance manufactured by Baroid or approved equal. Perform test in presence of and at request of Project Manager. Add additional cement grout or water to bring mix to proper moisture content or specific gravity. Discard grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

12. Compressive strength: ASTM C 1107 2500 psi minimum 7-day unconfined; 5000 psi minimum 28-day unconfined.

C. Finished surface of lining and interior joint to be comparable to surface rubbed with No. 16 carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add
cement to form surface paste as necessary. Leave interior with clean, neat and uniform-appearing finish.

D. Joint Wrapper: Minimum width of 9 inches for 33-inch diameter and smaller; minimum width of 12 inches for diameters greater than 33 inch hemmed at edge to allow threading with minimum 5/8-inch-wide steel strap. Provide minimum 6-inch-wide wire Ethafoam strip sized, positioned, and sewn circumferential in center of wrapper.

2.04 CATHODIC PROTECTION

A. Connect each joint of pipe with bonding straps or approved devices to maintain continuity of current. Provide bonding straps free of foreign material.

B. Electrically isolate water line from other connections. Use insulating type joints or nonmetallic pipe unless otherwise indicated on Drawings.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Conform to requirements of Section 02511 - Water Lines. Do not install pipe without approved lay schedule.

B. Manufacturer will make available services of representative, throughout project duration when deemed necessary by Project Manager, to advise aspects of installation including but not limited to handling, storing, cleaning and inspecting, coatings and linings repairs, and general construction methods affecting pipe.

C. Bedding and Backfilling:

1. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

2. Align pipe at proper grade prior to joint connection and do not shift after jointing operation has been completed.

3. Do not move trench support system (trench safety system) once bedding material is compacted.

4. Excavate outside specified trench section for bell holes, and for spaces sufficient to permit removal of slings. Provide bell holes at proper locations for unrestricted access to joint. Form bell holes large enough to facilitate joint wrapping and to permit visual examination of process. Enlargement of bell holes as required or directed by Project Manager. Subsequent backfilling.
thereof will not be considered as authorized additional excavation and backfill. Backfill bell holes and spaces to satisfaction of Project Manager.

5. Remove blocking after placing sufficient backfill to hold pipe in position.

6. Use cement-stabilized sand in areas of trench excavation 16 feet and greater, as bedding material up to springline of pipe.

D. Follow nonshrink grout manufacturer's specifications for nonshrink grouting.

E. Install each pipe section in sequence identified on lay schedule. Deviations from lay schedule sequence shall be approved by Project Manager and denoted on final lay schedule.

F. Use adequate surveying methods, procedures and employ competent surveying personnel to ensure pipe sections are laid to line and grade and within stipulated tolerances. Measure and record, in form approved by Project Manager, in-place survey data for pipe laid each day and submit copy of data to Project Manager at end of that day. Survey data to include unique pipe number, deflection or joint offset angle at pipe joint and whether beveled ends were used, invert elevation at pipe joint, deviation of joint from project line, deviation of joint from project grade, inside pipe joint lap measured at top, bottom, and at springline (each side).

G. Static Electricity:

1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.

2. Electrically test where required after installation of pipeline is complete.

3.02 CLOSURES AND APPROVED PIPE MODIFICATIONS

A. No modifications of standard pipe for closures will be permitted in field. No field cutting of pipe or exposure of prestressed wire is permitted without written approval from Project Manager.

B. Pipe manufacturer's representative and Project Manager to entirely witness closures and approved pipe modification efforts.

C. Provide minimum lap of 4 inches between member being joined and edge of butt strap. Weld on both interior and exterior, unless otherwise approved by Project Manager.

D. Provide full circumferential welds on joints required to be welded. Employ independent certified testing laboratory, approved by Project Manager, to perform weld tests on field welds. Include cost of testing in contract unit price for water line.
Use magnetic particle test method for lap welds or X-ray methods for butt welds, for 100 percent of joint welds. Maintain records of tests. When defective weld is revealed, repair defective weld, and retest. Use wire and flux from same manufacturer throughout entire project.

E. Fill wrapper in field and allow excess grout water to seep out. Refill wrapper as necessary. When joint mortar level has stabilized and begun to mechanically stiffen, lap Ethafoam wrapper over top of joint, and secure in place.

F. Stretch test each gasket splice to twice its unstretched length and inspect for defects.

3.03 VISIBLE CRACKS

A. No visible cracks longer than 6 inches, measured to be within 15 degrees of line parallel to pipe longitudinal axis, are permitted except:

1. In surface laitance of centrifugally cast concrete,
2. In sections of pipe with steel reinforcing collars or wrappers, or
3. Within 12 inches of pipe ends.

B. Repair interior lining cracks that exceed 1/16-inch (0.0625 inches) wide.

C. Reject pipe with exterior coating cracks that exceed 0.01 inches wide.

D. Immediately remove pipe from site when pipe has cracks exceeding limitations and cracks are not repairable.

3.04 FIELD REPAIR PROCEDURES FOR COATING/LINING

A. Areas less than or equal to 6 inches in diameter: Patch honeycomb and minor defects in concrete surfaces with non-shrink grout conforming to section 2.03 B. Use only manual or small (low pressure) air chisels to chip away mortar coating or lining. Cut out unsatisfactory material and replace with nonshrink grout, securely bonded to existing coating or lining. Finish junctures between patches and existing concrete as inconspicuous as possible. Strike off nonshrink grout flush with surrounding surface after patch has stiffened sufficiently to allow for greatest portion of shrinkage. Finish surface in accordance with lining requirements.

B. Pipe with defective coating areas greater than 6 inches in diameter cannot be used. Immediately remove pipe from project.

C. Reject pipe when steel cylinder is dented while making field repair. Immediately remove pipe from project.

END OF SECTION
Section 02508
EXTRA STRENGTH CLAY PIPE

PART 1  GENERAL

1.01 SECTION INCLUDES

A. Extra strength vitrified clay pipe for direct burial.
B. Vitrified clay pipe for jacking and microtunneling.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. No separate payment will be made for extra strength vitrified clay pipe under this section. Include cost in unit price work, as specified in the following sections:
      a. Section 02441 - Microtunneling and Pipe Jacked Tunnels
      b. Section 02531 - Gravity Sanitary Sewers.
   2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

A. ASTM C 12 - Practice for Installing Vitrified Clay Pipe Lines.


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit complete product data for pipe, fittings, gaskets and couplings for approval. Indicate conformance to appropriate reference standards.

C. Submit certificates by a testing laboratory, hired and paid by the manufacturer, that clay pipes meet applicable standards when tested in accordance with ASTM C 301.

PART 2 PRODUCTS

2.01 VITRIFIED CLAY PIPE

A. Vitrified clay pipe for direct burial shall conform to ASTM C 700 requirements for extra strength clay pipe.

B. Approved manufacturers of extra strength clay pipe are Mission Clay Products Corporation and the Dickey Company.

2.02 JOINTS

A. Joints for extra strength vitrified clay shall conform to ASTM C 425.

1. For clay pipe 21 inches in diameter and larger, conform to requirements for compression joints for bell-and-spigot pipe.

2. For clay pipe 18 inches in diameter and smaller, conform to requirements for compression couplings for plain-end pipe.

B. Joints for jacking, sliplining, and microtunneling pipe shall conform to ASTM C 1208.
2.03 GASKETS

A. When no contaminant is identified, furnish rubber or polyurethane elastomer gasket material conforming to standards listed above.

B. Pipe to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket material for the noted contaminants:

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other contaminants</td>
<td>As recommended by the pipe manufacturer, Engineer of the Record and approved by City Engineer prior to installation</td>
</tr>
</tbody>
</table>

2.04 COMPRESSION COUPLINGS

A. The PVC collar material for compression couplings of plain-end pipe shall conform to requirements of ASTM D 1784, Class 12454-B.

B. Couplings for microtunneling and other pipe jacking methods shall be made with Type 316 stainless steel sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints shall have the same outside diameter as the pipe so when the pipes are assembled, the joints are flush with the pipe outside surface.

PART 3 EXECUTION

3.01 INSTALLATION

A. Conform to installation requirements of Section 02441 - Microtunneling and Pipe Jacked Tunnels and Section 02531 - Gravity Sanitary Sewers.

B. Install pipe in accordance with ASTM C 12, the NCPI Clay Pipe Engineering Manual, and manufacturer's recommendations.

3.02 ACCEPTANCE TESTING

A. Perform acceptance testing in accordance with Section 02533 - Acceptance Testing for Sanitary Sewer, and ASTM C 1091. Do not use procedures from ASTM C 828 unless authorized by Project Manager.
3.03 FIELD QUALITY ASSURANCE

A. The City may run tests on field samples following applicable ASTM standards at an independent laboratory to verify the required physical properties and characteristics of supplied materials. Provide product samples as requested by Project Manager.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber Reinforced Pipe for buried water lines up to 30 inches in diameter, unless otherwise approved by Project Manager.

B. Fiber Reinforced Pipe for buried sanitary sewer force mains up to 16 inches in diameter, unless otherwise approved by Project Manager.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for fiberglass pipe under this Section. Include cost in unit price for Work, as specified in Section 02511 – Water Lines and Section 02532 Sanitary Sewage Force Mains.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.3 REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.


C. ASTM D 2310 - Standard Classification for Machine-Made Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe


E. ASTM D 2992 - Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting) Resin Pipe and Fittings.


K. AWWA C 950 – Fiberglass Pressure Pipe

L. AWWA M 45 – Fiberglass Pipe Design

M. NSF Standard 61 - Drinking Water System Components - Health Effects.

1.4 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Provide sufficient data for the Project Manager to properly evaluate the pipe.

C. Product data submittals shall include the following, as a minimum:
   1. Details of the proposed pipe.
   2. Properties and strengths of the pipe.
   3. Details of pipe joint.
   5. Instruction on storage, handling, transporting, and installation.

D. Test Reports: Provide test reports upon request, certifying that the pipe has been tested in accordance with and exceeds minimum requirements of ASTM D 2412, ASTM D 2992 (if applicable), D 3262 and ASTM D 3681.

E. Certification from manufacturer that fiberglass pipe was hydrostatically tested at factory in accordance with AWWA C 950 and requirements of this section.
   a. Hydrostatic Test Pressure: 150 psi
b. Test Duration: Two (2) minutes

F. An affidavit of compliance stating that all delivered materials comply with the requirements of these specifications as well as compliance with AWWA C950.

G. For pressure mains 24-inches in diameter and larger, shop drawings signed and sealed by Professional Engineer registered in State of Texas showing:
   1. Manufacturer's pipe design calculations including thrust restraint design.
   2. Details of pictorial nature of critical features and specials indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and fully dimensioned details, with plan view detailing pipe invert elevations, bends, and other critical features. Indicate station numbers for fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe Portable Document Format (*.PDF).
   3. Certification from manufacturer that design was performed for project in accordance with requirements of this section. Certification to be signed and sealed by Professional Engineer registered in State of Texas.

1.5 QUALITY CONTROL

A. Manufacturer to provide permanent quality control department and laboratory facility capable of performing inspections and testing as required by Specifications. Material testing, inspection procedures, and manufacturing process are subject to inspection by Project Manager. Perform manufacturer's tests and inspections required by referenced standards and these Specifications.

B. Calibrate within last 12 months equipment such as scales, measuring devices, and other calibration tools used in manufacture of pipe. Affix tag recording date of last calibration on each device used in manufacture of pipe.

1.6 TESTING

A. Joints: Coupling joints shall be qualified per the tests of Section 7 of ASTM D 4161.

B. Provide pipes tested in accordance with AWWA C950 and ASTM D 3754 as applicable.

C. Hydrostatic Testing: AWWA C950, Section 5.1.2.1.1, at point of manufacture. Hold test for minimum 2 minutes for thorough inspection of pipe. Reject pipe revealing leaks or cracks.
PART 2 PRODUCTS

2.1 FIBERGLASS PIPE

A. Manufacture pipe by filament winding process to result in a dense, nonporous, corrosion-resistant, consistent composite structure to meet the operating conditions as shown on the Drawings.

1. Do not use stiffening ribs or rings.

2. The workmanship of the pipe shall be free of defects such as delaminations, indentations, pinholes, bubbles, cracks, pits, blisters, foreign inclusions, and resin-reduced areas. Reasons for these defect free workmanship is because of the serviceability and strength of the pipe could be compromised.

3. The pipe must be as uniform as commercially practicable in opacity, color, density as well as other physical properties.

4. Centrifugally cast fiberglass pipe may be used in lieu of filament-wound for pressure pipe with approval of Project Manager, however, this substitution will not be approved for water lines.

B. Furnish pipes in the diameters specified and within the tolerances specified below.

1. Tolerances:
   a. Sanitary Sewer Force Mains: Diameter tolerances in accordance with AWWA C950.
   b. Water Mains: Diameter tolerances in accordance with AWWA C950 for diameters up to 30 inches.

C. Lengths: Supply at least 90 percent of total footage of each size and class of pipe, excluding special order pipes in nominal lengths of 20 feet unless approved by Project Manager. No nominal lengths of less than four (4) feet may be used.

D. Wall Thickness: Provide minimum average wall thickness of stated design thickness. Provide minimum single point thickness not be less than 98 percent of stated design thickness for sanitary sewer applications and not less than 100 percent for water mains.

E. End Squareness: Provide pipe ends square to pipe axis with maximum tolerance of 1/8 inch.

F. Refer to list of Approved Products for acceptable manufacturers.

2.2 DESIGN CRITERIA

B. Sanitary Sewer Force Mains:

1. Provide minimum 150 psi Pressure Class. Stiffness class of FRP pipe shall satisfy design requirements, but shall not be less than 46 psi, when used in direct bury operation; 36 psi, when installed within a primary tunnel liner.

2. Pipe for Jacking: Govern stiffness class of FRP in a pipe jacking operation by either ring deflection or by a pipe design providing longitudinal strength required by the jacking method and shall satisfy design requirements stated below. Submit design calculations as required in Paragraph 1.04, Submittals.
   a. Perform pipe stress calculations based on jacking loads to conform to Section 02441 - Microtunneling and Pipe Jacked Tunnels.

3. Calculate pipe deflection to ensure that predicted deflection will be less than 5 percent under long-term loading conditions (soil prism load) for the highest density of soil overburden and surcharge loads. Prepare deflection on calculations using long-term (drained) values for soil parameters contained in the geotechnical investigation report for the Project, or other site-specific data.

4. Provide dual-angle, filament-wound fiberglass reinforced epoxy pipe with integral epoxy liner and exterior coating in sizes from 4-inch to 16-inch diameter. Conform to requirements of ASTM D 2310 or ASTM D 2996, depending on size and class of pipe required.

5. Hydrostatic design value shall be not less than 21,000 psi when tested in accordance with ASTM D 2992(B) and not less than 8000 psi when tested according to ASTM D 2992(A).

6. Burial depths for pipes with standard wall thickness shall be between 3 feet and 25 feet.

7. Joints: Heavy duty threaded coupling system with positive O-ring seals. For 4-inch through 6-inch diameters, provide mechanical joints with fast advance, acme-type threads. Male threaded portion of couplings shall lock the mechanical joints for couplings for pipe diameters of 8 inches through 16 inches. Axial movement of couplings shall allow up to 2 degrees of angular deflection without affecting O-ring seal integrity.

8. Pipes, fittings, and other components in this system shall be rated for service to 150 psig at 120 degrees F. Components shall be rated at or above design pressure of system.

C. Water Lines. At minimum, provide 150 psi Pressure Class and 46 psi Stiffness Class. Manufacturer to provide calculations in accordance with AWWA M 45 to determine the appropriate pressure class and stiffness class to withstand actual installation conditions, based on the following Design Criteria:
2. Hydrostatic Field Test Pressure: 150 psi.
3. Maximum Pressure Due to Surge: 225 psi.
4. Minimum Pressure Due to Surge: -10 psi
5. Unit Weight of Soil: 120 pcf.
6. Bedding constant (K) = 0.1.
7. Deflection lag factor (Dl) = 1.3
9. Maximum allowable long term deflection not to exceed 5 percent of original pipe diameter.
10. Design:
    a. Design to withstand most critical simultaneous application of external loads including construction loads and internal pressures.
    b. Base on minimum of AASHTO HS-20 loading, AREMA Cooper E-80 loads when under railroads, and depths of bury as indicated.
    c. Calculate earth loads and thrusts for restrained (tied) joints based on AWWA M45.
    d. Groundwater Level: Assume groundwater elevation at ground surface.
    e. Design pipe for buried conditions.

D. Tunnel and Augered Sections: Exclude structural benefits associated with primary liner. Design pipe and pipe joints to carry loads including but not limited to: Overburden and lateral earth pressures, subsurface soil, grouting, other conditions of service, thrust of jacks, and stress anticipated during handling and installation. Do not create grout holes with pipe.

2.3 MATERIALS

A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been collected from applications of a composite material of similar construction and composition as the proposed product.

B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade glass filaments with binder and sizing compatible with
impregnating resins.

C. Fillers: Silica sand or other suitable materials may be used.

D. Additives: Resin additives, such as pigments, dyes, curing agents, thixotropic agents, and other coloring agents, if used, shall in no way be detrimental to the performance of the product nor impair visual inspection of the finished products.

E. Internal Liner Resin:

1. Water Lines: Manufacture using materials meeting NSF 61. Any material used within the pipe must comply with requirements of the Safe Drinking Water Act and other federal requirements. If transporting potable water, fiberglass pipe must be evaluated and certified for this specific use. The mark or seal of the laboratory that is responsible for evaluating the pipe must be included on the pipe.

2. Sanitary Sewer Force Mains: Fiberglass pipe shall have resin-rich liner of following thickness:

   a. For nominal sizes 4 inches through 6 inches, conform to ASTM D 2310 RTRP 11CX and ASTM D 2996 RTRP 11CX 5430, with minimum liner thickness of 0.020 inch.

   b. For nominal sizes 8 inches through 16 inches, conform to ASTM D 2310 RTRP 11FX and ASTM D 2996 RTRP 11FX 3210, with minimum liner thickness of 0.025 inch.

   c. The coefficient of linear thermal expansion shall be \(8.5 \times 10^{-6}\) inch/inch/degrees F for 4-inch through 6-inch pipe and \(12.0 \times 10^{-6}\) inch/inch/degrees F for 8-inch through 16-inch pipe in accordance with ASTM D 696.

2.4 JOINTS

A. Gasketed Joints: Unless otherwise specified, field connect pipe with fiberglass sleeve couplings or confined o-ring bell-and-spigot joints that utilize elastomeric sealing gaskets as sole means to maintain joint water tightness. Joints shall meet performance requirements of ASTM D 4161.

1. Supply rubber gaskets from an approved gasket manufacturer in accordance with ASTM F 477, when no contaminant is identified and suitable for the service intended. Affix gaskets to pipe by means of a suitable adhesive, or install in such a manner so as to prevent the gasket from rolling out of the pre-cut groove in the pipe or sleeve coupling.

2. When pipe is to be installed in potentially contaminated areas, provide the following gasket materials for the noted contaminants.
<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber (for sanitary sewers)</td>
</tr>
<tr>
<td></td>
<td>Viton (FKM) (for water lines)</td>
</tr>
<tr>
<td>Other Contaminants</td>
<td>As recommended by the pipe manufacturer</td>
</tr>
</tbody>
</table>

3. If required gasket material is not available for use, pipe other than fiberglass pipe must be used in potentially contaminated areas.

B. Restrained Joints: Utilize locking or butt-and-wrap (laminated) joints capable of withstanding internal pressure and longitudinal tensile loads.

1. Design restrained joint pipe using the allowable stress for combined biaxial loading determined in accordance with the trapezoidal design envelope design procedure of ISO 14692, latest edition. Provide test results or other verification of joint and thrust pipe design for approval by Project Manager with submittal of pipeline layout drawings.

2. Provide butt-and-wrap joints where restrained joints are called out on 66-inch diameter and larger.

3. Butt-and-Wrap Joints: Provide fiberglass reinforced overlay build up of minimum dimensions of 4 inches by 6 inches around circumference joints located at thrust source and sections of pipe located within thrust restraint limits.

4. Biaxial Lockjoint: Joints shall consist of plastic bar(s) inserted into circumferential void(s) around rubber gasket joint. Circumferential void is formed by matching recessed grooves on bell and spigot. Bar(s) shall fill void, forming an interference fit with bell and spigot to prevent joint from separating. Joint water-tightness is provided by joint gasket.

5. If centrifugally cast fiberglass pipe is provided with approval from Project Manager, and approved restrained joints are not available, provide external thrust restraint system in accordance with Paragraph 3.02 – External Thrust Restraints.

2.5 FITTINGS

A. Provide fittings for water mains capable of withstanding specified test pressures.

1. Outlets and Tees. Provide fiberglass pipe, ductile iron, or steel pipe when branch is less than 20 percent of diameter of main pipe and less than or equal to 8 inch diameter. Attach by glass reinforced overlays as approved by Project Manager.

2. Provide ductile iron or steel pipe bends and outlets or tees greater than eight (8) inches in diameter or which are greater than 20 percent of diameter of main pipe.
a. Use same materials (ductile iron or steel) throughout entire project.

b. Conform to Section 02518 - Steel Pipe and Fittings for Large Diameter Water Mains or Section 02501 - Ductile Iron Pipe for other fittings and bends.

B. Provide fittings for force mains capable of withstanding specified test pressures.

1. Outlets and Tees. Provide fiberglass pipe or ductile iron pipe when branch is less than 20 percent of diameter of main pipe and less than or equal to 8 inch diameter. Attach by glass reinforced overlays as approved by Project Manager.

2. Provide ductile iron pipe bends and outlets or tees greater than eight (8) inches in diameter or which are greater than 20 percent of diameter of main pipe.

   a. Use same materials (ductile iron) throughout entire project.

   b. Conform to Section 02501 - Ductile Iron Pipe for other fittings and bends.

C. Fiberglass Pipe Fittings. Created by filament-winding or cut and miter process as described in AWWA M 45.

   1. Provide tolerance of angle of elbow and angle between main and leg of wye or tee to plus or minus 2 degrees. Provide tolerance on laying length of fitting to plus or minus 2 inches.

2.6 INSPECTION

A. The Project Manager 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.

B. Manufacturer’s Notification: Should the Project Manager wish to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Project Manager with adequate advance notice of when and where the production of those pipes will take place.

C. Failure to Inspect: Should the Project Manager elect not to inspect the manufacturing, testing, or finished pipes, it in no way implies approval of products or tests.

2.7 PACKAGING, HANDLING, AND SHIPPING

A. Packing, handling, and shipping should be done in accordance with the manufacturer’s recommendations.
PART 3 EXECUTION

3.1 INSTALLATION

A. Install pipe and fittings in accordance with requirements of Section 02511 – Water Lines or 02532 - Sanitary Sewage Force Mains.

B. The manufacturer must supply a suitable qualified field service representative to be present periodically during the installation of pipe.

C. Pipe Bedding: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.

D. Pipe Handling: Use textile slings.

E. Jointing:

1. Clean ends of pipe and coupling components.

2. Check pipe ends and couplings for damage. Correct any damage found.

3. Coupling grooves must be completely free of dirt.

4. Apply joint lubricant to pipe ends and rubber seals of coupling. Use only lubricants approved by the pipe manufacturer.

5. Use suitable auxiliary equipment, such as a wire rope puller, to pull joints together.

6. Do not exceed forces recommended by the manufacturer for coupling pipe. If excessive force is required, remove coupling, determine source of problem, and correct it.

7. In the process of jointing the pipe, do not allow the deflection angle to exceed the deflection permitted by the manufacturer.

F. If pressure grouting of the pipe is conducted as part of a pipe-jacked tunnel installation, seal the grout holes with liner resin to a thickness equal to the pipe liner thickness or with a threaded plug for that purpose.

G. Tests:


2. Sanitary Sewer Force Mains: Conform to requirements of Section 02532 – Sanitary Sewer Force Mains.
3.2 EXTERNAL THRUST RESTRAINT

A. In areas of thrust restraint not using an approved restrained joint, such as with centrifugally cast fiberglass pipe, use one of three methods below. Submit system for approval by Project Manager.

1. Encased Design: For areas with restrained joint length of less than 20 feet from thrust source.
   a. Provide thrust coupling as specified herein.
   b. Use reinforced concrete to encase bend and pipe within area of thrust restraint. Encasement shall be of enough strength to accept 125% of designed pipe thrust.
   c. Last four inches on both ends of encasement of fiberglass pipe shall be faced with minimum 1/4 inch thick rubber padding.
   d. Locate sleeve coupling outside encased area.

2. H-Pile Design: System design and construction to conform to Section 02465 - Drilled Shaft Foundation and to be signed and sealed by Professional Engineer in State of Texas.
   a. Provide thrust coupling as specified herein.
   b. Use concrete pipe support to support entire bend. Pipe supports shall have cradle with minimum 120 degree support arc. Support arcs shall be faced with minimum 1/4 inch thick rubber padding.
   c. Unless otherwise approved by Project Manager, install driven H-piles, with minimum of twelve (12) piles per individual support [three (3) piles on pipe cross-section axis by four (4) piles on pipe flow axis configuration] under concrete pipe support. Piles shall be of enough strength and depth to accept 125% of designed pipe thrust through shear resistance.
   d. Anchor bends to pipe support in manner to prevent over stressing fiberglass reinforced pipe.

3. Use ductile iron or steel for fittings and pipe in thrust area, in accordance with requirements in Section 02501 - Ductile Iron Pipe and Fittings, Section 02501 - Steel Pipe and Fittings, and Section 02511 - Water Mains. Join fiberglass reinforced pipe to steel or ductile iron pipe outside of thrust area using fiberglass pipe manufacturer recommendation.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Installation of water lines.

B. Specifications identify requirements for both small diameter water lines and large
diameter water lines. When specifications for large diameter water lines differ from
those for small diameter water lines, large diameter specifications will govern for large
diameter pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for water lines installed by open-cut, or trenchless construction or
aerial crossing, with or without restrained joint, with or without welded joints,
with or without thrust blocks, with or without casing, within limits of pipe
offset section or within limits of Potentially Petroleum Contaminated Area
(PPCA) or within limits of Fault Hazard Zone (FHZ) is on linear foot basis for
each size of pipe installed. Separate pay items are used for each type of
installation.

a. Mains: Measure along axis of pipe and include fittings and valves.

b. Branch Pipe: Measure from axis of water line to end of branch.

2. Payment for interconnection is on lump sum basis for each interconnection
identified on Drawings. Payment will include tapping sleeve and valves
piping, connections and other related work necessary for construction as shown
on Drawings or specified herein.

3. Payment for removal of existing internal elliptical or dished head plug is on
unit price basis for each internal elliptical or dished head plug removed.
Payment will include deletion of plug, drainage or dewatering of water lines,
repair of damaged linings, rechlorination and items incidental to operation.

4. Payment for plug and clamp is on a unit price basis for each size of pipe.
5. Payment for drainline connection with service manhole is on unit price basis for each drainline shown on drawings. Payment includes valve, access manhole and connection.

6. Payment for cylindrical corrosion barriers is on a unit price basis for each pipe fitting installed with one or more barriers.

7. When directed by Project Manager to install extra fittings as required to avoid unforeseen obstacles, payment will be based on the following:
   a. Each extra fitting requested by Project Manager and delivered to jobsite will be paid according to unit price for "Extra Fittings in Place."
   b. Payment will include and be full compensation for items necessary for installation and operation of water line.

8. No separate payment will be made for bell protection system for PVC pipe. Include cost in related unit price work.

9. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar.


M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Photographs: Submit photographs conforming to requirements of Section 01321 - Construction Photographs prior to commencement of construction.

D. Submit videotapes conforming to requirements of Section 01323 - Construction Videotapes, if applicable.

E. Submit Lone Star notification transmittal number prior to beginning excavation.

F. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:

1. Disinfection; not to exceed 4,000 linear feet per section.

2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.

3. Site restoration; not to exceed limits specified; sequence in order of disturbance.

G. For water lines to be field welded, submit proof of certification of field welders per AWWA C206. Indicate certified procedures and position each welder is qualified to perform. Provide documentation of the most recent weld qualification test date and continuity of use in each process for which the welder or welding operator is required.
PART 2  PRO D U C T S

2.01  PIPE MATERIALS
A. Install pipe materials which conform to following:
   1. Section 02501 - Ductile Iron Pipe and Fittings.
   2. Section 02502 - Steel Pipe and Fittings. Water line piping within plant site and aerial crossings to be welded joint steel pipe with flange or approved restraint joint connections, unless otherwise shown on Drawings.
   3. Section 02506 - Polyvinyl Chloride Pipe.
   4. Section 02507 - Prestressed Concrete Cylinder Pipe.
   5. Section 02509 – Fiberglass Reinforced Pipe for Pressure Mains
   6. Section 02518 - Steel Pipe and Fittings for Large Diameter Water Lines.
   7. Section 02613 - Bar-Wrapped Steel Cylinder Pipe.
B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.
C. Type of pipe materials used is Contractor's option unless specifically identified on Drawings.
D. Provide minimum of 3/8 inch inside joint recess between ends of pipe in straight pipe sections.

2.02  WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE
A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.
B. O-rings: Conform to National Sanitary Foundation requirements.

2.03  RESTRAINED JOINTS
B. PVC Pipe: See Section 02506 - Polyvinyl Chloride Pipe. Perform hydrostatic testing in accordance with ASTM F 1674.
C. Prestressed Concrete Cylinder Pipe, Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.06C).
D. Except for trenchless installation, restrained Joints where required on DIP and PVC pipe are allowed with the following requirements as an alternative to the pipe with an integral restrained joint system:

1. Restraint Devices: Manufacture of high-strength ductile iron, ASTM A 536. Working pressure rating twice that of design test pressure.

2. Bolts and Connecting Hardware: High-strength low-alloy material in accordance with ANSI A21.11/AWWA C111.

E. For ductile iron or PVC pipes in augered holes, provide restrained joints that are integral to both the bell and spigot ends, and do not extend beyond or increase the outside diameter of the bell.

F. For small diameter water lines crossing under sanitary sewer lines or laterals, provide ductile iron pipe with locking or bolted type restrained joints.

2.04 COUPLINGS AND APPURTEANCES FOR LARGE DIAMETER WATERLINE

A. Flexible (Dresser-type) Couplings:

1. Install where shown on Drawings or where allowed by Project Manager for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from neoprene or Buna-N.

2. For steel pipe, provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.

3. Provide approved flanged adapter couplings for steel pipe.

4. Use ASTM A193 Grade B7 high strength steel bolts and ASTM A194 heavy hex nuts where flexible couplings are installed underground. Provide cadmium plated hardware. Coat entire coupling with Denso or approved equal petrolatum-based tape.

B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on Drawings.


2. Seats: ASTM B 21-CA482 or ASTM B 301-CA145 bronze.

3. Resilient Seat:


2.05 COUPLINGS AND APPURtenances For LARGE DIAMETER WATERline

A. Install Flexible Expansion Joints at locations indicated on drawings, within limits of Fault Hazard Zone (FHZ), in accordance with the manufacturer’s recommendation.

PART 3  e x e c u t i o n

3.01  p R e p a r A T i o n

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.

C. Lay pipe to lines and grades shown on Drawings.

D. Confirm 9 feet minimum separation from gravity sanitary sewers and manholes or separation of 4 feet minimum from force mains as specified in this Section in all directions unless special design is provided on Drawings.

E. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from Project Manager before proceeding with construction.

F. Inform Project Manager if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Project Manager.

G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing two pipe installation crews shall be permitted, unless otherwise approved by Project Manager.

H. City of Houston Drinking Water Operations will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of blow-offs, chlorination and testing taps, and risers.


J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique
identifying mark minimum of 5 feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Project Manager.

3.02 HANDLING, CLEANING AND INSPECTION

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.

2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.

3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.

4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Slings shall be wide enough so as to not tear or wrinkle tape layers.

5. Use precautions to prevent injury to pipe, protective linings and coatings.

   a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.

   b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.

   c. Do not lift pipe using hooks at each end of pipe.

   d. Do not place debris, tools, clothing, or other materials on pipe.
e. Place pipe on timbers, tires or soil berms at the jobsite. Do not place pipe directly on ground.

6. Repair damage to pipe or protective lining and coating before final acceptance.

7. For cement mortar lined and coated steel pipe and PCCP, permit no visible cracks wider than 1/16”
   a. In surface laitance of centrifugally cast mortar.
   b. In sections of pipe with steel reinforcing collars or wrappers.
   c. Within 12 inches of pipe ends.

8. Repair pipe with visible cracks that exceed project specifications. If cracks cannot be repaired to specification remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation, and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged or unsound pipe and fittings and remove them from site.

3.03 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities.

3.04 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Project Manager. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.05 PIPING INSTALLATION

A. General Requirements:

1. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Project Manager. No additional payment will be made for higher class of pipe or improved bedding.
2. Lay pipe in subgrade free of water.

3. Properly form bedding to fully support bell without wedging or blocking up bell.

4. Open Cut Construction: Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.

5. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.

B. Install pipe continuously and uninterrupted. Obtain approval of Project Manager prior to skipping any portion of Work.

1. Before assembling couplings, lightly coat pipe ends and outside of gaskets with pipe lubricant, cup grease or liquid vegetable soap to facilitate installation.

2. Prior to proceeding with critical tie-ins, submit sequence of work based on findings from "critical location" effort.

3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Section 02317 - Excavation and Backfill for Utilities for additional requirements at critical locations.

E. Assessment of deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection or similar average measurements will not be deemed as meeting intent of standard. Refer to pipe material specifications for maximum allowable pipe deflection.

F. Perform following additional procedures when working on plant sites.
1. Seventy-two hours prior to each plant shutdown or connection, schedule coordination meeting with Project Manager and Water Production personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Project Manager agrees key personnel, equipment and materials are on hand to complete Work.

2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.

3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Project Manager and City's Utility Maintenance Division operator is present to observe.

4. Coordinate with City Drinking Water Operations to obtain reduction in operating pressures prior to performing connections to existing piping.

5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Project Manager.

6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Section 01110 - Summary of Work.

7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.

8. Submit to Project Manager Lone Star Notification transmittal number prior to beginning excavation.

9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.

10. Provide adequate notice to Project Manager and pipe manufacturer's representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.

11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Section 01330 - Submittal Procedures.
12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Project Manager by noon on Thursday of week. Contact person must be accessible during weekend, have Houston Metro Area phone number, and be authorized to make emergency decisions.

13. No night work or plant shutdown will be scheduled to begin two working days before or after designated City Holidays.

G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide City a minimum of two weeks notice prior to shutting down existing water line.

3.06 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:

1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.

2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.

4. After pipe sections are joined, check each gasket to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, and replace before remaking joint.

5. Provide means to prevent full engagement of spigot into bell in accordance with Paragraph 2.01 D. For PVC pipe, means may consist of an approved bell insertion protection system.

B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent over stressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
2. Use ring type or full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material in accordance with AWWA C207. Cut gaskets at factory to proper dimensions. In PPCA areas, provide gasket material in accordance with Section 02105 – Chemical Sampling and Analysis.

3. Provide ASTM A193 Grade B7 high strength steel stud bolts with ASTM A194 heavy hex nuts. Use cadmium-plated steel hardware underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Denso petrolatum-based tape or approved equal for all exposed portions of nuts, bolts and pipe hardware.

4. Isolation Joints:
   a. Provide full-face Type “E” gasket. For 30-inch diameter and greater, provide Pyrox G-10 material and EPDM sealing element. For 24-inch diameter and smaller, provide Phenolic material and EPDM sealing element. Provide full-length bolt isolating sleeves and washers. Provide matching steel washers on both sides of each insulating washer on every bolt. Furnish kits in accordance with Specification Section 15640 – Joint Bonding and Electrical Isolation.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.

2. Steel Pipe Joints: AWWA C 206. See Section 02502 – Steel Pipe and Fittings or Section 02518 – Steel Pipe and Fittings for Large Diameter Water Lines. Refer to Contract Drawings for joint details. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-inch and smaller.

3. Concrete Pipe Joints: See Section 02507 – Prestressed Concrete Cylinder Pipe or Section 02613 – Bar-Wrapped Steel Cylinder Pipe. Refer to Contract Drawings for joint details. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt-welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.
4. Welding Rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.

5. Deposit metal in successive layers to provide 1 to 3 passes or beads as required to complete the structural weld or control heat in the weld after backfill joint.

6. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.

7. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.

8. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.

9. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.

10. Welded Joints for Large Diameter Water Lines:

   a. Use exterior welds for 30-inch and smaller.

   b. Employ an independent certified testing laboratory, approved by Project Manager, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Project Manager for review. Project Manager has final decision as to suitability of welds tested.

   1) Weld acceptance criteria:


   b) Examine welded surfaces for the following defects:

      i. Cracking.

      ii. Lack of fusion/penetration.
iii. Slag which exceeds one-third \((t)\) where \((t)\) equals material thickness.

iv. Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width.

v. Relevant linear indications in which length of linear indication exceeds three times its width.

vi. Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge.

11. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.

12. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds must discontinue work and leave project site. Welder may return to project site only after recertification.

13. Scaffolding: Do not drag scaffolding or other items along interior of pipe.

14. Provide cylindrical corrosion barriers for polyurethane or epoxy-lined steel pipe 24-inch diameter and smaller, unless minimum wall thickness is 0.5 inch or greater.

   a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.

   b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience. All steel pipe is to have cutback 3/4 inch to no greater than 1 inch of internal diameter coating from weld bevel.

   c. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no
less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 222.

d. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Harnessed Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe or Steel Pipe):

1. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.

2. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum 1/2-inch joint recess. Use joint "diapers" minimum of 12 inches wide.

3. For field adjustments with deflections or joint offsets beyond manufacturer's recommendations:
   a. Field trim spigot.
   b. Do not engage ring.

4. Harnessed joints are not permitted in areas defined on Drawings as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.

5. Install harness type joints including snap rings at straight sections of pipe.

E. Restrained Joints:

1. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks unless otherwise shown on Drawings.

2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections or joint offsets indicated and on use of prestressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or joint offsets or use of other pipe material may result in reduction or increase of thrust lengths.

3. Pipe manufacturer or representative to perform thrust restraint calculations in accordance with latest revision of applicable standard for pipe material chosen. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Project Manager. Make adjustments in thrust restraint lengths at no additional cost to City.

4. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
5. Passive resistance of soil will not be permitted in calculation of thrust restraint for some pipe materials.

6. For 16-inch lines and larger use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.

7. Installation.
   a. Install restrained joints mechanism in accordance with manufacturer’s recommendations.
   b. Examine and clean mechanism; remove dirt, debris and other foreign material.
   c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.
   d. Verify gasket is evenly seated.
   e. Do not over stab pipe into mechanism.

8. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.

9. Place 2500 psi concrete conforming to Section 03315 - Concrete for Utility Construction, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

F. Joint Grout (Concrete Cylinder Pipe, Bar Wrapped Pipe, Mortar Coated Steel Pipe):

1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.

2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without retempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.
3. **Surface Preparation:** Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.

4. Follow established procedures for hot and cold weather concrete placement.

5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.

6. **Grouting Exterior Joint Space:** Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.

7. **Interior Joints for Pipe 24 Inches and Smaller:** Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Project Manager for 20-inch pipe and smaller.

8. Protect exposed interior surfaces of steel joint bands by pointing with grout. Remove and replace improperly cured or otherwise defective grout.

9. Strike off grout on interior joints and make smooth with inside diameter of pipe.

10. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.

11. **Interior Joints for Water Lines 30 Inches and Larger:** Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside.
surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Project Manager of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.

12. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately 1/2 inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to City.

H. Make curves and bends by deflecting or offsetting joints or other method as recommended by manufacturer and approved by Project Manager. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection or joint offset prior to installation.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.

2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.

3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.

4. Replace, repair, or reapply coatings and linings as required.

5. Assessment of deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.

6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect or offset to curved alignment.

I. Closures Sections and Approved Field Modifications to Steel, Concrete Cylinder Pipe, Bar Wrapped Pipe and Fittings:

1. For large diameter water lines, provide minimum overlap of 4 inches on each side for butt-strap closures.
2. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.

3. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.

4. Fill exposed interior and exterior surfaces with nonshrink grout.

3.07 CATHODIC PROTECTION APPURTEINANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap, wire or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Project Manager.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.08 SECURING, SUPPORTING AND ANCHORING

A. Support piping, as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begin upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.
POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

A. Conform to requirements of Section 02528 - Polyethylene Wrap.

CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews and, where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.

B. Unless otherwise approved by Project Manager, comply with the following:
   1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.
   2. No later than three days after completing disinfection preparatory work, submit to City appropriate request for disinfection.
   3. If City fails to perform initial disinfection of lines in accordance with Section 02514 - Disinfection of Water Lines, within seven days from submission of appropriate request, and if approved by Project Manager, pipe laying operations may continue beyond approved limits until the City responds.
   4. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
   5. Do not exceed a total of 50% of total project linear feet of disturbed right-of-way and easement until site is restored in accordance with Section 01740 - Site Restoration.
   6. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

C. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Section 01740 - Site Restoration. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000 linear feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. City must inspect water line for cleanliness prior to filling.
3.12 DISINFECTION OF WATER LINES
   A. Conform to requirements of Section 02514 - Disinfection of Water Lines.

3.13 FIELD HYDROSTATIC TESTS
   A. Conform to requirements of Section 02515 - Hydrostatic Testing of Pipelines.

END OF SECTION
Section 02512

WATER TAP AND SERVICE LINE INSTALLATION

PART 1  GENERAL

1.01  SECTION INCLUDES

A.  Tapping existing mains and furnishing and installing new service lines for water.
B.  Relocation of existing small water meters.
C.  Specifications identify requirements for both small-diameter (less than or equal to 20 inches) water lines and large-diameter (greater than 20 inches) water lines. When specifications for large-diameter water lines differ from those for small-diameter water lines, paragraphs for large-diameter water lines will govern for large-diameter pipe.

1.02  MEASUREMENT AND PAYMENT

A.  Unit Prices.

1.  Payment for water taps and copper service lines 3/4 inch through 1 inch is on unit price basis for each installation. Separate measurements will be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.04, Definitions.

2.  Payment for water taps and service lines 1 1/2 inch through 2 inch is on unit price basis for each installation. Separate measurements will be made for "short side", "long side" and "extra long side" connections as defined in Paragraph 1.04, Definitions.

3.  Payment for "short side, "long side" and "extra long side" includes locating water line, tap installation and connection to meter and restoring site.

4.  Payment for each small meter includes labor, materials, and equipment to relocate existing small meter.

5.  No additional payment will be made for bedding, backfill, compaction, push under pavement, etc.

6.  Refer to Section 01270 - Measurement and Payment for unit price procedures
B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

A. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.


1.04 DEFINITIONS

A. Short Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on same side of street.

B. Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance not to exceed 60 linear feet (at right angles to water line).

C. Extra Long Side Connection: Service line connecting proposed curb stop, located inside water meter box, to water line on opposite side of street or from center of streets where supply line is located in street center such as boulevards and streets with esplanades. Distance greater than 60 linear feet (at right angles to water line).

PART 2 PRODUCTS

2.01 MATERIALS

A. Copper Tubing: In accordance with Section 02503 - Copper Tubing. Polybutylene tubing is not permitted.

B. Corporation Stops: AWWA C 800 as modified in this Section:

1. Inlet End: AWWA standard thread.

2. Valve Body: Tapered plug type, O-ring seat ball type, or rubber seat ball type.

3. Outlet End: Flared-copper connection for use with Type K, soft copper or compression type fitting.
C. Provide taps for water line types and sizes in accordance with pipe tapping schedule located at end of this Section.

D. Dual Strap Saddles: Red brass body and straps; ductile-iron; vinyl-coated body and straps; or ductile-iron, vinyl-coated body and stainless-steel straps.

E. Taps for PVC Water Lines: Use dual-strap or single, wide-band strap saddles which provide full support around circumference of pipe and bearing area of sufficient width along axis of pipe, 2 inches minimum, ensuring that pipe will not be distorted when saddle is tightened. Provide approved stainless-steel tapping saddle with AWWA standard thread.

F. Taps for Steel Pipe: Not allowed, unless specifically approved by Project Manager. Use saddle only when tap is approved on steel pipe.

G. Curb Stops and Brass Fittings: AWWA C 800 as modified in this Section.

1. Inlet End: Flared copper connection or compression-type fitting

2. Valve Body: Straight-through or angled, meter-stop design equipped with following:
   a. O-ring seal straight plug type.
   b. Rubber seat ball type.

3. Outlet End: Female, iron-pipe thread or swivel-nut, meter-spud thread on 3/4-inch and 1-inch stops and 2-hole flange on 1 1/2 and 2-inch sizes.

4. Fittings: Provide approved fittings. Use same size open end wrenches and tapping machines as used with respective Mueller fittings.

5. Factory Testing of Brass Fittings:
   a. Submerge in water for 10 seconds at 85 psi with stop in both closed and open positions.
   b. Reject fitting that shows air leakage. Project Manager may confirm tests locally. Entire lot from which samples were taken will be rejected when random sampling discloses unsatisfactory fittings.

H. Angle Stops: In accordance with AWWA C 800; ground-key, stop type with bronze lock-wing head stop cap; inlet and outlet threads conform to application tables of AWWA C 800; and inlets flared connection or compression.

1. Outlet for 3/4-inch and 1-inch size: Meter swivel nut with saddle support.
2. Outlet for 1 1/2-inch through 2-inch size: O-ring sealed meter flange, iron pipe threads.

I. Fittings: In accordance with AWWA C 800 and following:
   1. Castings: Smooth, free from burrs, scales, blisters, sand holes, and defects which would make them unfit for intended use.
   2. Nuts: Smooth cast and has symmetrical hexagonal wrench flats.
   3. Flare-Joint Fittings: Smooth cast. Machine seating surfaces for metal-to-metal seal to proper taper or curve, free from pits or protrusions.
   4. Thread fittings, of all types, shall have N.P.T. or AWWA threads, and protect male threaded ends in shipment by plastic coating, or approved equal.
   5. Compression tube fittings shall have Buna-N beveled gasket.
   6. Stamp of manufacturer's name or trademark and of fitting size on body.

PART 3 EXECUTION

3.01 GENERAL

A. For service lines and lateral connections larger than those allowed in Pipe Tapping Schedule, branch connections and multiple taps may be used. Space corporation stops minimum of 2 feet apart.

B. Tapped collars of appropriate sizes: Approved in new construction only provided they are set at right angles to proposed meter location.

C. Use tapping machine manufactured for pressure tapping purposes for 2-inch and smaller service taps on pressurized water lines.

D. For new meter or when existing meter is in conflict with proposed pavement improvements, locate water meters one foot inside street right-of-way, or when this is not feasible, one foot on curb side of sidewalk. Contact Project Manager when major landscaping or trees conflict with service line and meter box location. No additional payment will be made for work on customer side of meter.

E. New location and installation of existing small meter shall conform to requirements of this Section.
F. Successfully perform hydrostatic and disinfection testing prior to installing service taps and lines.

3.02 SERVICE INSTALLATION

A. Set service taps at right angles to proposed meter location and locate taps in upper pipe segment within 45 degrees of pipe springline.

B. Install service lines in accordance with Section 02317 - Excavation and Backfill for Utilities.

C. Lay service lines with minimum of 30 inches of cover as measured from top of curb or, in absence of curbs, from centerline elevation of crowned streets or roads. Provide minimum of 18 inches of cover below flow line of ditches to service lines.

D. Service lines across existing street (push-unders): Pull service line through prepared hole under paving. Use only full lengths of tubing. Take care not to damage copper tubing when pulling it through hole. Compression-type union is only permitted when span underneath pavement cannot be accomplished with a full standard length of tubing. Use one compression-type union for each full length of tubing.

E. Maintain service lines free of dirt and foreign matter.

F. Install service lines so that top of meter will be 4 to 6 inches below finished grade.

G. Anticipate existing sanitary sewers to have cement stabilized sand backfill to bottom of pavement. Include cost of such crossings in unit price for services.

H. When copper line must be installed in cement stabilized sand use an 8 MIL polyethylene encasement tubing in accordance with AWWA C105.

3.03 CURB STOP INSTALLATION

A. Set curb stops or angle stops at outer end of service line inside of meter box. Secure opening in curb stop to prevent unwanted material from entering. In close quarters, make S-curve in field. Do not flatten tube. In 3/4-inch and 1-inch services, install meter coupling, swivel-nut, or curb stop ahead of meter. Install straight meter coupling on outlet end of meter.

3.04 GALVANIC CORROSION CONTROL

A. For 1 1/2” and 2” meters utilizing two bolt flanges, install 2.5 ounce sacrificial zinc anode caps meeting ASTM B418-88 requirements on the end of each bolt on both outlet and inlet side of the meter connection.

3.05 SEQUENCE OF OPERATIONS

A. Open trench for proposed service line in accordance with Section 02317 - Excavation and Backfill for Utilities.
B. Install curb stop on meter end of service line.

C. With curb stop open and prior to connecting service line to meter in slack position, open corporation stop and flush service line thoroughly. Close curb stop, leaving corporation stop in full-open position.

D. Check service line for apparent leaks. Repair leaks before proceeding.

E. Schedule inspection with Project Manager prior to backfilling. After inspection, backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

F. Install meter box centered over meter with top of lid flush with finished grade. Meter box: Refer to Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.
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DSS - DUAL STRAP SADDLES
WBSS - WIDE BAND STRAP SADDLES
DWBSS - DUAL WIDE BAND STRAP SADDLES

END OF SECTION
PART 1   G E N E R A L

1.01   SECTION INCLUDES

A. Wet connections for new water lines and service lines to existing water lines.

1.02   MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for wet connections shown on Drawings is on unit price basis for each wet connection. Separate payment will be made for each size of water line.

2. No compensation will be given for extra work or for damages occurring as result of incomplete shutoff.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03   REFERENCES

A. AWWA C 800 - Standard for Underground Service Line Valves and Fittings.

B. OSHA 29 CFR 1926.1101 - Asbestos.

1.04   DEFINITIONS

A. Wet connections consist of isolating sections of pipe to be connected with existing valves, draining isolated sections, and completing connections.

B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of 2-inch service line.
PART 2 PRODUCTS

2.01 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Sections 02501 through 02528 related to piping materials and to water distribution.

B. Corporation cocks and saddles shall conform to requirements of Section 02512 - Water Tap and Service Line Installation.

C. Valves shall conform to requirements of Section 02521 - Gate Valves.

D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 EXECUTION

3.01 CONNECTION OPERATIONS

A. Plan wet connections in manner and at hours with least inconvenience public. Notify Project Manager at least 72 hours in advance of making connections.

B. Do not operate valves on water lines in use by City. City of Houston Utility Operations Division will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Inspector is at job site. Connection work shall progress without interruption until complete once existing water lines have been cut or plugs have been removed for making connections.

3.02 2-INCH WET CONNECTIONS

A. Tap water line. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing water line. Use 2-inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

3.03 Protocol:

1. Mechanically excavate to no more than 6 in. of AC Pipe. Carefully uncover the remainder of pipe by hand or with shovel.

2. Keep pipe adequately wet before and during work.

3. Place 2 layers of 6 mil polyethylene sheeting under the asbestos pipe to prevent soil contamination.
4. Use hand tools to remove collars. Replace minimum 6 ft. section of pipe. Use of power tools is prohibited.

5. Do not crush AC pipe in place. Remove waste AC pipe.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Disinfection of potable water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for disinfection of water lines under this Section. Include cost in unit price of water lines being disinfected.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

B. Adjusting Payment for Retesting.

1. Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction will be charged to Contractor. Charges will be deducted from retainage amounts when construction estimates are processed for final payment.

2. Total charge will consist of base charge of $135.00 plus footage charge based on number of feet of specified diameter pipe in construction project. Footage charge is as follows:

<table>
<thead>
<tr>
<th>Size of Pipe</th>
<th>Charge per Linear Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch to 4 inch</td>
<td>$0.03</td>
</tr>
<tr>
<td>6 inch</td>
<td>$0.04</td>
</tr>
<tr>
<td>8 inch</td>
<td>$0.05</td>
</tr>
<tr>
<td>10 inch to 12 inch</td>
<td>$0.07</td>
</tr>
<tr>
<td>16 inch to 20 inch</td>
<td>$0.09</td>
</tr>
<tr>
<td>24 inch to 30 inch</td>
<td>$0.13</td>
</tr>
<tr>
<td>32 inch to 48 inch</td>
<td>$0.16</td>
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<tr>
<td>54 inch</td>
<td>$0.20</td>
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<tr>
<td>60 inch</td>
<td>$0.22</td>
</tr>
<tr>
<td>66 inch</td>
<td>$0.31</td>
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<tr>
<td>72 inch to 84 inch</td>
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<tr>
<td>90 inch to 96 inch</td>
<td>$0.58</td>
</tr>
<tr>
<td>108 inch</td>
<td>$0.75</td>
</tr>
<tr>
<td>120 inch or larger</td>
<td>$1.00</td>
</tr>
</tbody>
</table>

C. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in
1.03 REFERENCES

A. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.01 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to City water distribution system.

B. Water for disinfection and flushing will be furnished by City without charge.

C. Unless otherwise provided in Contract Documents, City will conduct disinfection operations assisted by Contractor.

D. Coordinate chlorination operations through Project Manager.

3.02 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to City water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines 8 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves as approved by Project Manager and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Project Manager. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

3.03 DISINFECTION BY CITY PERSONNEL
A. Correct problems that may prevent disinfection operations prior to advising Project Manager to perform disinfection work. When disinfection work cannot be performed due to covered up valves, missing valve stacks, inoperative fire hydrants or other nonconforming construction, charge will be levied against Contractor for each trip made by City personnel.

B. Notify and coordinate with Project Manager minimum of 72 hours before disinfection work is to be performed. Assist City personnel during disinfection operations.

3.04 DISINFECTION BY CONTRACTOR

A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:

1. Use not less than 100 parts of chlorine per million parts of water.

2. Introduce chlorinating material to water lines in accordance with AWWA C 651.

3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.

4. Open and close valves in lines being sterilized several times during contact period.

5. If chemical compound is used for sterilizing agent, place in pipes as directed by Project Manager.

3.03 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, bacteriological tests will be performed by City or testing laboratory in accordance with Section 01454 - Testing Laboratory Services. When test results indicate need for additional disinfection of water lines based upon Texas Department of Health requirements, assist City with additional disinfection operations.

3.06 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION
PART 1  G E N E R A L

1.01  SECTION INCLUDES
A. Field hydrostatic testing of newly installed water pipelines.

1.02  MEASUREMENT AND PAYMENT
A. Unit Prices.
   1. No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.
   2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

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

PART 3  E X E C U T I O N

3.01  PREPARATION
A. Disinfect water system pipelines prior to hydrostatic testing.
B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to City water distribution system.
C. Water for testing will be charged to Contractor in accordance with City Ordinances. Prior to hydrostatic testing, obtain a transient meter from the City. Deposit is required for transient meter.
D. Test pipelines with maximum lengths between valves, or plugs, according to the following criteria.
   1. 2,000 linear feet for small diameter pipelines (20-inches in diameters or smaller)
   2. 4,000 linear feet for large diameter pipelines (24-inches in diameters or larger)
E. Conduct hydrostatic tests in presence of Project Manager.

3.02 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For small diameter pipelines, expel air and apply minimum test pressure of 125 psi. For large diameter water lines, expel air and apply minimum test pressure of 150 psi.

D. Begin test by 9:00 a.m. unless otherwise approved by Project Manager. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.

E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.03 ALLOWABLE LEAKAGE FOR WATERLINES

A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

B. Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.

C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Project Manager for leakage during pressure test may be used to fulfill requirements of this section.

3.04 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Project Manager may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Section 02514 - Disinfection of Water Lines. Pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.
3.05 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Cut, plug and abandonment of water lines.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for cut, plug, and abandonment of water lines is on a unit price basis for each cut, plug, and abandonment performed. Separate payment will be made for each size of water line.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed plugs and clamps for approval.

PART 2  PRODUCTS

2.01 MATERIALS

A. Concrete for reaction blocks: Class B conforming to requirements of Section 03315 - Concrete for Utility Construction.

B. Plugs and clamps: Applicable for type of pipe to be plugged.
PART 3  EX E C U T I O N

3.01  APPLICATION

A. Do not begin cut, plug and abandonment operations until replacement water line has been constructed, disinfected, and tested, and service lines have been transferred to replacement water line.

B. Install plug, clamp, and concrete reaction block and make cut at location shown on Drawings.

C. Main to be abandoned shall not be valved off and shall not be cut or plugged other than at supply water line or as shown on Drawings.

D. After water line to be abandoned has been cut and plugged, check for other sources feeding abandoned water line. When sources are found, notify Project Manager immediately. Cut and plug abandoned water line at point of other feed as directed by Project Manager.

E. Plug or cap ends or openings in abandoned water line in manner approved by Project Manager.

F. Remove and dispose of surface identifications such as valve boxes and fire hydrants. Valve boxes in improved streets, other than shell, may be filled with concrete after removing cap.

G. Backfill excavations in accordance with Section 02317 - Excavation and Backfill for Utilities.

H. Repair street surfaces in accordance with Section 02951- Pavement Repair and Restoration.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Handling, transporting, and installing water line in primary liner tunnels, including invert cleanup and blocking and water line in casings that will be backfilled with concrete or grout.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment of water line installed by tunneling is by linear foot along center line of completed water line as designated on Drawings.

2. Payment for installation of water line in tunnel constructed according to Section 02425 - Tunnel Excavation and Primary Liner will be authorized by Project Manager in three parts. Pay estimates for partial payments will be made as measured above according to following schedule:

a. 60 percent of installation will be authorized when excavation and primary liner installation is complete.

b. 95 percent of installation will be authorized when water line installation and grouting is complete.

c. 100 percent of installation will be authorized when section successfully hydrostatically tested.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCE STANDARDS

A. ASME B 40.1 - Pressure Gauge and Gauge Attachments.

1.04  SUBMITTALS
A. Submit work plan including following information in accordance with Section 01330 - Submittals.

1. Method of transporting pipes into tunnel.

2. Method of hoisting and positioning pipe in tunnel.

3. Method of jointing and aligning pipe.

4. Method of supporting and blocking pipe.

5. Tunnel ventilation while setting pipe and completing joints, when applicable.

6. Material, equipment and procedures for grout placement and other information required by Section 02431 - Tunnel Grout.

B. Submit results of tunnel primary liner survey in accordance with Paragraph 3.02, Tunnel Survey.

C. Submit results of installed water line survey in accordance with Paragraph 3.10, As-built Survey and Installation Tolerances.

1.05 PROCEDURES

A. Joints: Prepare joints as recommended by pipe manufacturer and in accordance with Section 02511 - Water Lines.

B. Handling: Handle, store, and transport pipe in accordance with pipe manufacturer's recommendations and to prevent damage to pipe ends, pipe barrel, steel reinforcement, and pipe protective linings.

C. Grouting: Perform grouting of annular space between water line and tunnel liner to fill voids with grout, without dislocating or damaging pipe.

PART 2 PRODUCTS

2.01 ANNULAR GROUT

A. Specified in Section 02431 - Tunnel Grout
2.02 CONCRETE
A. Meeting requirement of Section 03315 - Concrete for Utility Construction, Class B concrete.

2.03 PIPE MATERIAL AND FITTINGS
A. Manufacture and deliver pipe material and fittings as described in Section 02511 - Water Lines.

2.04 SPACERS
A. Unless otherwise noted on Drawings, use casing spacers between water line and casing tunnel liner for water lines less than 36 inches in diameter. Refer to Paragraph 3.01 for exception. See Section 02447 - Augering Pipe for Water lines for spacer requirements and installation.

PART 3 EXECUTION

3.01 APPLICATION
A. Grout in place tunnels for water lines with diameters of 36 inches or greater. When tunnel liner plate is used, grout water line in place regardless of water line diameter.

3.02 TUNNEL SURVEY
A. Prior to installing water line in tunnel: Perform survey of tunnel in accordance with Paragraph 3.10B. Verify tunnel has been constructed within specified tolerances for line, grade, and roundness and water line to be placed in tunnel can be placed in conformance with tolerances specified. Should misalignment of tunnel preclude proper installation of water line, notify Project Manager of proposed correction method. Project Manager will make final decision on acceptability of correction.

3.03 PIPE TRANSPORT
A. Transport pipe in tunnel for final placement so that no damage occurs to pipe ends or pipe barrel and interior lining or exterior coating. Repair pipe damaged during transport or final placement in tunnel in manner acceptable to Project Manager prior to joining. Remove damaged pipe from tunnel and replace, when directed by Project Manager, at no additional cost to City.

3.04 TUNNEL CLEANUP
A. Remove temporary tunnel utilities, loose material, dirt, and debris prior to pipe placement. Broom clean concrete invert. Control seepage and remove standing water in invert.
B. Temporary construction tracks or pipe skids may be left in place when they do not interfere with alignment of water line, short circuit cathodic protection system, or interfere with final placement of annular grout.

3.05 INVERT PIPE SUPPORT

A. Construct invert pipe support of screeded concrete, steel beam, or other method, as approved, to final grade of outside of water line. Secure invert support to primary liner to prevent movement. Cure concrete support minimum of 48 hours prior to setting pipe. Maintain minimum of 4 inches clearance between outside of water line and steel beam or steel member.

3.06 JOINING PIPE IN TUNNELS

A. Lay pipe in accordance with pipe manufacturer's recommendations, and as specified in this Section. Join pipe segments so as to properly compress gaskets and allow for correct final positioning of pipe for line and grade. Closely align pipe and bring loosely together by means of hydraulic jacks, locomotives, pipe mobiles, or winches. Once pipes have been loosely joined, pull home by means of hydraulic tugger or other similar methods suitably protecting pipe and joints against damage. Impact joining, such as ramming with locomotives or other mechanical equipment, is not permitted.

3.07 SUPPORTING PIPE IN TUNNEL AND BULKHEADS

A. Develop and submit pipe supporting system that will prevent water line from floating and deforming beyond specified limits. Loads imposed on pipe, primary liner and surrounding soil during grouting shall be determined by Registered Professional Engineer in State of Texas. Show essential details in plan for supporting system. Position water line in tunnel to allow minimum of 4 inches of grout to be placed between water line and tunnel primary liner or casing.

B. Wooden support blocks are not allowed.

C. Prevent pipe from floating during backfill operations by properly installed supporting. Remove and replace segment of pipe which is distorted or moved from final line and grade.

D. Secure supporting in place so that it cannot be dislodged during adjacent pipe laying and during grouting operations.

E. Construct bulkheads of material, compatible with grout, to withstand imposed grout pressure without leakage. Provide bulkheads at frequency to allow completion of grouting in continuous operation and to permit timely removal of pipe and grout which may be needed as result of pipe distortion or movement. Modifications to bulkhead spacing will be reviewed by Project Manager. Provide adequate venting for bulkheads.
3.08 ANNULAR GROUT

A. Fill annular void between water line and tunnel primary liner or casing with grout, in accordance with Section 02431 - Tunnel Grout.

B. Test annular grout material, equipment, and procedures in accordance with approved submittal. Perform test on first 200 feet of water line to be backfilled. When grout does not totally fill annular space or other problems occur, correct defects in first test section and adjust method or mix and rerun test on next 200 feet. Repeat procedure as necessary.

C. Placement:

1. Placement Limits: Predetermine limits of each grout placement stage by size and capacity of batching equipment and initial set time of proposed grout. Under no circumstances shall placement at grout port continue longer than period of time for mix to take initial set. Locate grout hole spacing and locations according to number of stages necessary to backfill tunnel liner. Do not install another lift until proper set has been attained. Placement procedures shall be approved by admixture or additive manufacturers.

2. Equipment - Pumps: Pumping equipment must be of sufficient size and capacity to place grout to distances and volumes compatible with batching and mixing equipment. Maintain equipment and clean thoroughly each day. No hydrocarbons shall enter pumping chamber. Under no circumstances shall grout be pumped in excess of 1000 linear feet without prior approval by Project Manager. Pumping test and verification testing of resulting grout quality will be required for approval.

3. Slickline: Convey grout to point of placement in clean steel or rubber hoses designed to handle safely pump pressure and volumes during placement. Do not allow hardened grout or concrete to obstruct or coat steel pipe or hose internally.

4. Grout Connections: Grout connections shall be sized minimum of 2-inch inside diameter, consisting of grout hose attached immediately to pressure gauge. Gauged pumping pressure shall not exceed water line manufacturer's recommendations. Monitor grout pressure.

5. Gauges:

   a. Type: Instrument oil-filled and attached to saddle-type diaphragm seal (gauge saver) to prevent clogging with grout.

   b. Calibration: Certified and calibrated in accordance with ASME B 40.1.

   c. Range: Not more than 100 percent greater than design grout pressure.
d. Accuracy: No more than one-half percent error over full range of gauge.

e. Fitting: Attach gauge to valve immediately attached to grout port in tunnel liner. Provide T-fitting in injection line for sampling.

6. Limit pressure on annular space to prevent damage to pipe or liner. Define limiting and estimated required pressure range. Provide and monitor open ended, high point tap or equivalent vent at bulkhead opposite point of grouting.

7. Pump grout until grout within 5 percent of specified density discharges from end opposite injection point to ensure grout is not diluted by extraneous water in annulus.

8. Drilling of access holes from surface to facilitate grouting shall not be allowed.

9. Communication: There shall be constant communications via telephone between headerman at point of injection and pump, batch plant, and supervisor. Under no circumstance shall grouting continue without continuity of communications.

10. The headerman at point of placement shall advise batch plant of variations of density and make corrections as necessary. Record and submit to Project Manager for each days pour variations and corrections.

D. Delay grouting until all significant differential movement has stopped as determined by monitoring.

E. Remove bulkheads unless constructed of masonry.

F. Repair or replace damage or distortion to water line.

3.09 GROUTING JOINTS

A. Materials and procedures for filling interior joint recesses shall conform to Section 02511 - Water Lines.

3.10 AS-BUILT SURVEY AND INSTALLATION TOLERANCES

A. Perform as-built survey on installed water line. Determine horizontal and vertical location for invert of each pipe joint.

B. Acceptable tolerances: Within plus or minus 3 inches of horizontal alignment, within plus or minus 2 inches of vertical alignment.

C. Correct pipe section outside acceptable tolerances.
3.11 FINAL CLEANUP

A. Clean interior to pipe after interior work is completed. Remove loose material, dirt, and debris from completed pipeline. After completion of work inside pipe, prevent dirt, water, and other debris from entering until water line work is completed.

END OF SECTION
PART 1  G E N E R A L

1.01  SECTION INCLUDES

A. Large diameter (24 inches and greater) steel pipe and fittings for water lines and pumping facilities.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for steel pipe and fittings under this Section. Include cost in unit price for water lines, pumping facilities, and encasement sleeves.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES

A. AASHTO - Standard Specifications for Highway Bridges.


C. ASME Boiler & Pressure Vessel Code Section VIII – Rules for Construction of Pressure Vessels, Division 1


G. ASTM A 139 - Standard Specification for Electric-Fusion (ARC) - Welded Steel Pipe (NPS 4 and Over).


U. AWWA C 200 - Steel Water Pipe 6 in. and Larger.

V. AWWA C 205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe.

W. AWWA C 206 - Standard for Field Welding of Steel Water Pipe.

X. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

Y. AWWA C 208 - Dimensions for Fabricated Steel Water Pipe Fittings; Addendum C 208A.

Z. AWWA C 210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.


CC. AWWA C 602 - Cement-Mortar Lining of Water Pipelines - 4 in. (100 mm) and Larger - In Place

DD. AWWA C 604 – Installation of Buried Steel Water Pipe – 4 In. and Larger.


FF. SSPC Good Painting Practice, Volume 1.

GG. SSPC SP 1 - Surface Preparation Specification No. 1 Solvent Cleaning.

HH. SSPC SP 5 - Joint Surface Preparation Standard White Blast Cleaning.

II. SSPC SP 6 - Surface Preparation Specification No. 6 Commercial Blast Cleaning.

JJ. SSPC SP 10 - Surface Preparation Specification No. 10 Near-White Blast Cleaning.

KK. SSPC VIS 1 - Visual Standard for Abrasive Blast Cleaned Steel.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings signed and sealed by Professional Engineer registered in State of Texas showing following:

1. Manufacturer’s pipe design and thrust restraint calculations based on AWWA M11, latest edition.

2. Provide lay schedule of pictorial nature indicating alignment and grade, laying dimensions, welding procedures, fabrication, fitting, flange, and special details, with plan view of each pipe segment sketched, detailing pipe invert elevations, horizontal bends, welded joints, and other critical features. Indicate station numbers for pipe and fittings corresponding to Drawings. Do not start production of pipe and fittings prior to review and approval by Project Manager. Provide final approved lay schedule on CD-ROM in Adobe portable document format (*.PDF).

3. Include hot tapping procedure.

4. Submit certification from manufacturer that design was performed for project in accordance with requirements of this section. Certification to be signed and sealed by professional Engineer registered in State of Texas.
C. Submit manufacturer’s certifications that pipe and fittings have been hydrostatically tested at factory in accordance with AWWA C 200, Section 5.2.

D. Submit certification from NACE Certified Coatings Inspector, under supervision of inspector having Level III certification for coatings and linings, that steel pipe furnished on project was properly inspected and defective coatings detected properly repaired.

E. Submit inspection procedures to be used by manufacturer and for quality control and assurance for materials and welding. Submit, at least 30 days prior to repair work, procedures that describe in detail shop and field work to be performed. Repair defects such as substandard welds, excessive radial offsets (misalignment), pitting, gouges, cracks, etc.

F. Submit following for nonshrink grout for special applications:
   1. Manufacturer's technical literature including specifications for mixing, placing, and curing grout.
   2. Results of tests performed by certified independent testing laboratory showing conformance to ASTM C 1107, Nonshrink Grout and requirements of this specification.
   3. Certification product is suitable for use in contact with potable water.

G. Submit proof of certification for welders. Indicate certified procedures and position each welder is qualified to perform. Provide documentation of the most recent weld qualification test date and continuity of use in each process for which the welder or welding operator is required.

H. Within 45 calendar days after manufacturing of all pipe, submit affidavit of compliance that materials and work furnished comply with applicable requirements of referenced standards and these specifications. Make available copy of physical and chemical testing reports.

I. Within 45 days of manufacturing of all pipe, submit manufacturer’s affidavits that coatings and linings comply with applicable requirements of this Section and:
   1. Polyurethane coatings were applied in accordance with manufacturer’s recommendation applied and allowed to cure at temperature 5 degrees above dew point.
   2. Mortar coatings and linings were applied and allowed to cure at temperature above 32 degrees F.
3. **Test Results:**
   
a. Compressive strength (7 and 28 day) test results for mortar coating.

b. Hydrostatic testing, magnetic particle and non-destructive weld test reports as required.

**J.** Prior to start of field-applied cement mortar lining operation, submit comprehensive plan which identifies and describes as minimum:

1. Equipment used for batching, weighing, mixing, transporting and placing mortar.

2. Qualifications and specific experience of machine operators.

3. Source and type of cement, pozzolan, sand and admixtures used and certifications from suppliers that materials meet specifications.

4. Mix proportions to be used and slump limits (max. and min.).

5. A quality control plan which identifies quality control material tests and documented inspections necessary to ensure compliance with specified requirements.

**K.** Submit certification showing calibration within last 12 months for equipment such as scales, measuring devices, and calibration tools used in manufacture of pipe. Each device used in manufacture of pipe is required to have tag recording date of last calibration. Devices are subject to inspection by Project Manager.

**1.05 QUALITY CONTROL**

**A.** Provide pipe as the product from a single manufacturer who has had not less than fifty plate fittings within the past 5-year period and successfully produced one hundred thousand lineal feet of like diameter, thickness, and coated pipe. Pipe manufacturing operations (pipe, lining, and coating) shall be at one (1) location.

**B.** Manufacturer to provide permanent quality control department and laboratory facility capable of performing inspections and testing as required by specifications. Material testing, inspection procedures, and manufacturing process are subject to inspection by Project Engineer. Perform manufacturer’s tests and inspections required by referenced standards and these specifications, including the following. Correct nonconforming conditions.

1. **Steel Plate and Coils.** Review mill certifications for conformance to requirements of specifications; perform physical and chemical testing of each heat of steel for conformance to applicable ASTM standards.
2. Pipe:
   a. Inspect thickness, circumference, roundness, strength and size of seam welds (spiral or longitudinal), and squareness of pipe ends to verify compliance with AWWA C200.
      1) Pipe roundness to be within ± 1%.
      2) Frequency of production weld tests in accordance with AWWA C200 Section 4.10.4.6. Conduct weld tests at a maximum interval of once per 3,000 feet of weld.
      3) Provide certified test reports for factory welds on fittings from a certified welding inspector that may be in-house or third-party.
   b. Inspect physical dimensions and overall conditions of all joints for compliance with AWWA C200, approved submittals, and Specifications.
   c. Hydrostatically test finished pipe section to 75 percent of specified minimum yield strength of steel being used with zero leakage.
   d. Perform Charpy V-Notch (CVN) Test in accordance with AWWA C200.

3. Linings:
   a. Inspect unlined pipe for overall condition of inside barrel. Maintain inside barrel free of corrosive products, oil, grease, dirt, chemical, and deleterious material.
   b. Inspect lined pipe for physical dimensions and overall condition of lining, visible surface defects, thickness of lining, and adhesion to steel surface (for polyurethane or epoxy lining).
   c. Review certifications by manufacturers of lining components for conformance to AWWA standards and these Specifications.

4. Coatings: Measure temperature and dew point of ambient air before applying coatings. Inspect physical dimensions and overall condition of coatings. Inspect for visible surface defects, thickness, and adhesion of coating to surface and between layers.

5. Final Inspection:
a. Before shipment, inspect finished pipe, fittings, specials and accessories for markings, metal, coating thickness, lining thickness (if shop applied), joint dimensions, and roundness.

b. Inspect for coating placement and defects. Test exterior coating for holidays.

c. Inspect linings for thickness, pitting, scarring, and adhesion.

C. Shop-applied coatings and linings; provide services of qualified and certified coating and lining in house inspector, outside inspection service, or testing laboratory with qualified coating inspectors. Perform inspection by NACE trained inspectors under supervision of NACE Level III Certified Coatings Inspector.

D. Ensure workmen engaged in manufacturing are qualified and experienced in performance of their specific duties.

E. Cast four standard test cylinders each day for each 50 cubic yards of mortar coating or portion thereof for each coating and lining placed in a day. Perform compressive strength test at 28 days. No cylinder test result will be less than 80 percent of specified strength.

F. Dented steel cylinders may result in rejection of pipe if it cannot be repaired per C200 and to the satisfaction of the Project Manager.

G. Make available copy of physical and chemical testing reports for steel cylinders and provide reports at request of Project Manager.

H. Check physical dimensions of pipe and fittings. Physical dimensions to include at least pipe lengths, pipe I.D., pipe O.D. and bend angles.

1.06 INSPECTION

A. Project Manager may witness manufacture and fabrication of pipe and appurtenances. Independent testing laboratory under contract to Project Manager may perform tests at direction of Project Manager to verify compliance with these specifications. Provide assistance to accomplish such testing, including equipment and personnel, at no additional cost to City.

PART 2 PRODUCTS

2.01 STEEL PIPE

A. Furnish pipe, fittings, coating and linings all by one manufacturer and produced in one facility. Do not ship over salt water.
B. Furnish pipe smaller than 24-inch in accordance with Section 02502 - Steel Pipe and Fittings.

C. Fabricate and supply miscellaneous steel pipe and fittings in accordance with AWWA C200, C207, C208 and AWWA M11 except as modified herein. Steel to be minimum of ASTM A 36, ASTM 1018 Grade 36, ASTM A 53 Grade B, ASTM A 135 Grade B, ASTM A1011 or ASTM A 139 Grade B.

D. Provide pipe sections in lengths no greater than 50 feet and no less than 20 feet except as required for special fittings or closure sections.

E. Provide shop-coated and shop-lined steel pipe with minimum of one coat of shop-applied primer approved for use in potable water transmission on all exposed steel surfaces. Provide primer compatible with coating system and in accordance with coating manufacturer’s recommendations.

F. Provide closure sections and short sections of steel pipe not less than 4 feet in length unless indicated on Drawings or specifically permitted by Project Manager.

G. Square flanges with pipe with bolt holes straddling both horizontal and vertical axis. Provide 1/2-inch gap between pipe ends to be coupled with sleeve coupling unless otherwise indicated on Drawings.

1. Provide standard ring flanges, conforming to AWWA C207, Class D.

2. Apply Denso petroleum-based tape or approved equal to exposed portions of nuts and bolts.

H. Pipe Design Conditions:

1. Design: Design pipe and fittings to withstand most critical simultaneous application of external loads and internal pressures. Base design on minimum of AASHTO HS-20 loading or AREMA E-80 loads as appropriate and depths of bury as indicated on Drawings. Design pipes with Marston’s earth loads for transition width trench for all heights of cover.

2. Groundwater Level: Design for most critical ground water level condition.

3. Working pressure = 150 psi.

4. Hydrostatic field test pressure = 150 psi.

5. Maximum total pressure due to surge = 225 psi.

6. Minimum pressure due to surge = -5 psi.
7. Modulus of elasticity (E) = 30,000,000 psi.

8. Maximum deflection from specified diameter: Two (2) percent for mortar coating; three percent for flexible coatings and three percent for mortar lining.

9. Design stress due to working pressure to be no greater than 50 percent of minimum yield, and stress not to exceed 18,000 psi for mortar coated pipe.

10. Design stress due to maximum hydraulic surge pressure to be no greater than 75 percent of minimum yield, and stress not to exceed 27,000 psi for mortar coated pipe.

11. Modulus of soil reaction (E’) < 1500 psi. If E’ > 1000 psi, do not use silty sand (SM) for embedment.

12. Unit weight of fill (w) > 120 pcf.

13. Deflection lag factor (D1) = 1.2.

14. Bedding constant (K) = 0.1.

15. Fully saturated soil conditions: hw = h = depth of cover above top of pipe.

16. Do not allow diameter (D) over thickness (t) ratio to be greater than 230.

17. Provide minimum inside clear diameter for tunnel liners or casing in accordance with Section 02425LD- Tunnel Excavation and Primary Liner.

18. Exclude structural benefits associated with primary liner in design of pipe in tunnel installations.

   a. Design pipe and joints to carry loads including overburden and lateral earth pressures, subsurface soil and water loads, grouting, other conditions of service, thrust of jacks, and stresses anticipated during handling and construction loads during installation of pipe.

   b. Do not use internal removable stiffeners for pipe in tunnel, unless approved by Project Manager.

   c. External welded steel stiffeners will be permitted in design calculations for steel pipe, provided wall thickness is minimum of 1/2 inch. Minimum clearances specified between exterior pipe wall and tunnel liner applies to distance between outside diameter of external welded stiffener and tunnel liner.
19. Nominal Allowable Steel-wall Thickness for Water Lines: Provide in accordance with following table for HS-20 live loads and depths of cover of up to 16 feet. Net internal diameter (including inside linings) to be no less than net inside diameter listed. Contractor to review design for conditions more extreme than those indicated by this specification and design accordingly. If, in opinion of Project Manager, proposed pipe wall thicknesses appear inadequate for indicated loading conditions, submittal of design calculations will be required for review. Pipe wall not to be less than that defined in following table.

<table>
<thead>
<tr>
<th>Net Inside Diameter (Inches)</th>
<th>Minimum Wall Thickness (Inches)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Flexible Coating</td>
</tr>
<tr>
<td>108</td>
<td>0.500</td>
</tr>
<tr>
<td>102</td>
<td>0.500</td>
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<tr>
<td>96</td>
<td>0.484</td>
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<tr>
<td>90</td>
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<tr>
<td>36</td>
<td>0.178</td>
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<tr>
<td>30</td>
<td>0.149</td>
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<tr>
<td>24</td>
<td>0.149</td>
</tr>
</tbody>
</table>

I. Fittings for Water Lines: Fabricate in accordance with AWWA M11, , and AWWA C208.

1. Wall Thickness: Equal to or greater than pipe to which fitting is to be welded.

2. Elbows: 2-piece for 0 degrees to 22-1/2 degrees; 3-piece for 23 degrees to 45 degrees; 4-piece for 46 degrees to 67-1/2 degrees; and 5-piece for 68 degrees
to 90 degrees, unless otherwise shown on Drawings. Radius: Minimum radius of two and one-half times pipe diameter unless otherwise approved by Project Manager.

3. Outlets: Reinforced in accordance with AWWA M11, Chapter 9, AWWA C200, and AWWA C208. Provide interior lining and exterior coating in accordance with paragraphs on coating and lining and matching pipe to access inlets, service outlets, test inlets, and air-vacuum valve and other outlets, including riser pipes.

4. Butt Straps for Closure Piece: Minimum 12-inch-wide split butt strap; minimum plate thickness equal to thinnest member being joined; fabricated using material listed in Paragraph 2.01 C to thinnest member being joined. Provide minimum lap of 4 inches between member being joined and edge of butt strap, welded on both inside and outside, unless otherwise approved by Project Manager. Provide minimum 6-inch welded outlet for inspecting each closure section, unless access manway is within 40 feet of closure section.

5. Reducers: Provide in accordance with AWWA M11 and AWWA C208.

6. Dished Head Plugs: Design in accordance with ASME Boiler & Pressure Vessel Code, Section VIII, Division 1, latest edition. Design to withstand field hydrostatic test pressure from either side of plug. Design stress due to hydrostatic pressure to be no greater than 50 percent of minimum yield. Pipe on opposite side of hydrostatic test may or may not contain water.

J. Joints:

1. Standard field joint for steel pipe: AWWA M11 and C200. Rubber gasket Carnegie shape joint or rolled-groove rubber gasket and O-ring joint, in accordance with Contract Drawings, 66-inch maximum diameter. Joints may be lap-welded slip type in accordance with AWWA C200, except where flanged joints or butt strap joints are required.

2. Provide welded butt joints on above-ground piping, tee fitting supported on pier foundation, field welds for risers including vertical portion of crossover piping, and where noted on Drawings.

3. Pipe Manufacturer: Minimum of 5 years of successful service with proposed rubber gasket field joint and submit results from joint tests. Tests which may be required include tensile strength or yield tests of base material and spiral welded sections, flattening tests, chemical analysis, impact and hardness tests. Project Manager’s decision as to acceptability of joint is final.

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4. Pipe installed via tunnel to be capable of withstanding jacking forces.

5. Design restrained joints for test pressure or maximum surge pressure as specified, whichever is greater. Only minimum restrained joint lengths for prestressed concrete cylinder pipe are shown on Drawings.

6. Provide full circumferential welds at joints required to be welded.


8. Bells: Formed by either expansion of pipe end, which stretches steel past its elastic limit, or by attaching sized weld-on bell rings. Spigot ends: Sized prior to rolling gasket groove. Joints: Interchangeable and match up during installation, even if used out of sequence. Weld-on bell rings: AWWA M11; AWWA C200; attached with single or double, full thickness fillet welds (double weld in areas of thrust restraint).

9. Provide bells and spigots with dimensions and tolerances in accordance with AWWA C200, as modified herein. Difference in diameter between I.D. of bell and O.D. of spigot shoulder at point of full engagement with allowable deflection range of 0.00 inch to 0.04 inch as measured on circumference with diameter tape. Minimum thickness of completed bell ring is equal to thickness of pipe wall in barrel of pipe between joint ends.

   a. Furnish joint suitable for safe working pressure equal to class of pipe and will operate satisfactorily with deflection, tangent of which is not to exceed 0.75 inch/D where D is outside diameter of pipe in inches or with pull-out of 3/4 inch.

   b. Design clearance between bells and gasketed spigots so, when joint is assembled, it will be self-centered and gasket will be restrained or confined to annular space in such manner that movement of pipe or hydrostatic pressure cannot displace it. Compression of gasket when joint is completed will not be dependent upon water pressure in pipe and will provide watertight joints under operating conditions when properly installed.

   c. Use of an expanded bell with a Carnegie-style spigot is not allowed.
K. Manufacturer must maintain on site or in plant enough fittings to satisfy the following requirements:

<table>
<thead>
<tr>
<th>Line Diameter</th>
<th>Required Bends*</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 and 24 inches</td>
<td>Four 45-degree bends per 5,000 LF of water line</td>
</tr>
<tr>
<td>&gt; 24 inches</td>
<td>Four 22.5-degree bends per 10,000 LF of water line</td>
</tr>
</tbody>
</table>

*Based on total length of contract (minimum of four). Any combination of bends may be substituted at manufacturer’s option (i.e. two 22.5-degree bends are equivalent to one 45-degree bend) and will be counted as one fitting.

L. Manufacturer must be capable of delivering bends to job site within 48 hours of notification. Use fittings at direction of Project Manager where unforeseen obstacles are encountered during construction. These fittings are in addition to fittings called out on Drawings and must be available at all times. Use same product throughout entire project.

M. Perform x-ray, ultrasonic, magnetic particle, or dye penetrant testing per C200 of manual welds on special pipe and fittings.

N. Hydrostatic Test of Pipe:

1. AWWA C200, Section 5.2.1, at point of manufacture. Hold test pressure for minimum 2 minutes and conduct thorough inspection of entire weld length on pipe. Repair or reject pipe revealing leaks or cracks.

2. Calibrate pressure gauges within one year prior to testing as specified in Section 1.04 K.

O. Provide forged steel threaded outlets of approved design where required for use in passing hose or lead wires into pipe. Tap plugs with standard pipe threads and weld to pipe in approved manner and use solid forged steel plugs for closure.

P. Flanges:

1. Refer to Section 02511 – Water Lines.

Q. Make curves and bends by deflecting joints, or by using mitered joints, or by combination of two methods, unless otherwise indicated on Drawings or permitted by Project Manager. Do not exceed deflection or joint offset angle at joint as recommended by pipe manufacturer. Make penetration of spigot into bell at all points of circumference at least equal to minimum required penetration shown on Drawings. Mitered pipe sections used in curved alignment to be of standard length except when
shorter sections are required to limit radius of curvature, in which case all sections throughout curve are to be of equal length. Do not allow miter to exceed 5 degrees.

2.02 INTERNAL LINING SYSTEMS FOR STEEL PIPE, ALL INSTALLATIONS

A. Supply steel pipe with cement-mortar lining, capable of conveying water at temperatures not greater than 140 degrees F.

B. For all exposed (wetted) steel parts of flanges, blind flanges, bolts, access manhole covers, provide epoxy or polyurethane lining, as specified, unless otherwise noted or that may interfere with sealing surfaces.

C. Provide linings conforming to American National Standards Institute/National Sanitation Foundation (ANSI/NFS) Standard 61, and certification to be from organization accredited by ANSI.

D. Epoxy Lining:

1. AWWA C210, color White or Off-White, or approved equal otherwise approved by Project Manager. To be applied in factory. Perform field repairs in accordance with manufacturer’s recommendations. Submit field repair procedures to Project Manager for review. Provide materials from same manufacturer.
   a. Protect interior surface with liquid two-part chemically cured epoxy coating specified for interior surfaces.

<table>
<thead>
<tr>
<th>Surface Preparation</th>
<th>SSPC-SP10 Near White Blast Clean surface profile.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish Coat</td>
<td>AWWA C210. Provide Devoe Bar-Rust 233H or approved equal</td>
</tr>
</tbody>
</table>

2. Provide dry film thicknesses in accordance with product’s manufacturer recommendations. Do not exceed maximum DFT as recommended by manufacturer.


E. Shop-applied Cement-mortar Lining (for pipe ≤ 120 inches in diameter):

1. AWWA C205; except as specified herein: ¾-inch minimum thickness for pipe diameters 96-inches and larger, 1/2-inch minimum thickness for pipe diameters
42 inches to 84-inch; 3/8-inch minimum thickness for pipe diameters 36 inches and smaller. Cut back lining from joint ends no more than 2 inches to facilitate joining and welding of pipe.

2. Apply cement-mortar lining to inside of pipe by centrifugally spinning. For special sections (shape of which precludes application by spinning method) accomplish by mechanical placement or pneumatic placement and finish to produce smooth, dense surface comparable to centrifugally spinning.

3. Use galvanized wire mesh when shop-applied mortar is not applied by machine. Do not extend wire mesh across welded portion of mitered fittings. Crimp mesh to provide integral “chair” so wire does not fully rest against steel cylinder.

4. Make repairs of cement-mortar lining for widths exceeding 6 inches by bonding to steel and adjacent faces of lining with bonding agent conforming to ASTM C 881, Type II.

5. Restrict usage of sprinkler heads during moist curing to prevent over-spraying onto lining. No alternative curing methods are allowed.

6. Satisfy Project Manager that above requirements can be accomplished by manufacturer prior to shipment of pipe.

F. Field-applied Cement-mortar Lining (for pipe > 48 inches in diameter): Provide field-applied internal cement-mortar linings in accordance with AWWA C602, latest edition, except as modified in this Section.

1. Lining: Applied in one-course application of cement-mortar by machine that centrifugally places mortar against wall of pipe and mechanically trowel lining to smooth finish.

2. Steel pipe, fittings, receive cement-mortar lining.

3. Cement-mortar for Lining.

   a. Cement-mortar: Dense, smooth, and of uniform quality and consistency to assure efficient machine operation and uniform cement-mortar lining on pipe wall.

   b. Water-cement Ratio: Kept as low as possible; consistent with proper plasticity for application, allowing slight variations dependent upon temperature, length of haul for mortar, and moisture condition in pipe.
c. Mortar: Mixture of one part cement with not less than one or more than 1-1/2 parts of dry screened sand, by volume. After determining mixture, control materials to within plus or minus 2-1/2 percent by weight throughout entire work.

d. Comply with following materials for cement-mortar:

1) Provide Type II low-alkali Portland cement conforming to ASTM C 150, or Type IP (MS) Portland-Pozzolan cement conforming to ASTM C 595, unless otherwise specified. Conform to low alkali requirements of Table IA of ASTM C 150. Type IP (MS) cement to contain no more than 20 percent Pozzolan, to be inter-ground with clinker.

2) Use suitable facilities approved by Project Manager when available for handling and weighing bulk cement. Otherwise, deliver cement in original unopened sacks that have been filled by manufacturer. Plainly mark sacks with manufacturer’s name or brand, cement type lot number and weight. Discard unused cement. Use unopened bags of cement for each new batch.

3) Material Storage: Store cement to permit ready access for inspection and sampling. Protect cement and sand against contamination or moisture. Do not use and remove from site cement delivered with evidence of contamination or otherwise unsuitable. Store admixtures in accordance with manufacturer’s directions.

4) Use Portland cement of same brand and type unless otherwise approved by Project Manager.

5) Pozzolanic Material: AWWA C602, Paragraph 4.3.3.

6) Sand: AWWA C205, Section 4.2.3, except gradation of sand to yield fineness modulus of approximately 1.7; having no material coarser than that passing No. 16 sieve. Submit certification for compliance of sand with these specifications at least 10 calendar days before start of lining placement.

7) Water: Clean; free of deleterious amounts of acids, alkalis or organic materials; total dissolved solids less than 1000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5.
2.03 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE-GROUND AND IN VAULTS (EXPOSED)

A. Provide approved epoxy/polyurethane coating system as designated below. Provide materials from same manufacturer.

| Surface Preparation | SSPC SP 10  
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Near White Blast Clean</td>
</tr>
<tr>
<td></td>
<td>surface profile as recommended by</td>
</tr>
<tr>
<td></td>
<td>manufacturer</td>
</tr>
</tbody>
</table>

| Intermediate Coat   | Chemical Resistant Epoxy, or     |
|---------------------| approved equal                   |
|                     | DFT as recommended by            |
|                     | manufacturer                      |

| Finish Coat         | Polyurethane, or approved equal  |
|---------------------| DFT as recommended by            |
|                     | manufacturer                      |

B. Total Allowable Dry Film Thickness for System: as recommended by manufacturer.
C. Factory testing: In accordance with AWWA C210.

2.04 EXTERNAL COATING SYSTEMS FOR BURIED STEEL PIPE

A. Supply pipe with one of the following coatings specified.

1. Tape Coating: Conform to requirements of Specification Section 09902 – Tape Coatings on Steel Pipe.

2. Cement-mortar Coating: For 84-inch diameter and smaller unless otherwise shown on Contract Drawings. AWWA C205; shop-applied, cement-mortar coating except as modified in this Section; 1-inch minimum thickness; cut back coating from joint ends no more than 2 inches to facilitate joining and welding of pipe.

3. Polyurethane Coating: See Section 02527 - Polyurethane Coatings on Steel or Ductile Iron Pipe for requirements for use of polyurethane coating system.
B. Heat Shrink Joint Sleeves for Tape and Polyurethane Coating: AWWA C216. Provide Canusa Aqua-shield, or approved equal. For repairs to heat shrink joint sleeves, use Canusa Aqua-shield Repair Patch Kit or approved equal.

2.05 Provide shop-applied primer on coating holdback areas at joint in accordance with Paragraph 2.03 above.

EXTERNAL COATING SYSTEM FOR STEEL PIPE IN TUNNEL, CASING

A. Provide exterior coating system of pipe in tunnel, without annular grout, a minimum of 50 mils of polyurethane coating in accordance with Specification Section 02527 - Polyurethane Coatings for Steel or Ductile Iron Pipe.

B. For water lines in tunnel where annular grout will be used, shop coat external surfaces of steel pipe with epoxy in accordance with Paragraph 2.03 of this Section, or polyurethane in accordance with Specification Section 02527 – Polyurethane Coatings for Steel or Ductile Iron Pipe.

2.06 GROUT FOR JOINTS AND SPECIAL APPLICATIONS

A. Cement Grout Mixture: One part cement to two parts of fine, sharp, clean sand. Mix interior joint mortar with as little water as possible until very stiff but workable. Mix exterior joint mortar with water until it has consistency of thick cream. Mix cement grout to specific gravity of 19 lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of and at request of Project Manager. Add additional cement grout or water to mixed cement grout to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

1. Portland Cement: ASTM C 150, Type II. Provide one type of cement for entire project.

2. Sand:
   b. Exterior Joints: ASTM C 33; natural sand with 100 percent passing No. 16 sieve.

3. Water: Potable water with total dissolved solids less than 1000 mg/l; ASTM D 512 chloride ions less than 100 mg/l for slurry and mortar cure; ASTM D 1293 pH greater than 6.5. Use potable water with 250 ppm limit on chlorides and sulfates.

B. Provide approved Nonshrink Grout for Special Applications, Patches and Repairs.
1. Conform to requirements of ASTM C 1107, Nonshrink Grout.

2. Pre-blended factory-packaged material manufactured under rigid quality control, suitable for use in joints of prestressed concrete cylinder pipe.

3. Contain non-metallic natural aggregate and be nonstaining and noncorrosive.

4. Meeting NSF 61 Standard suitable for use in contact with potable water supply.

5. Compressive Strength: ASTM C 1107 2500 psi minimum 7-day unconfined; 5000 psi minimum 28-day unconfined.


7. Contain no chlorides or additives which may contribute to corrosion of steel pipe.


9. Resist attack by oil or water.

10. Mix, place, and cure in accordance with manufacturer’s instructions and recommendations. Upon 72 hours’ notice, provide services of qualified representative of nonshrink grout manufacturer to aid in assuring proper use of product under job conditions. Representative to be on site when product is first used.

11. Mix cement grout to specific gravity of 17.7 lb/gallon or greater as measured by grout/slurry balance. Use balance manufactured grout/slurry by Baroid or approved equal. Perform test in presence of and at request of Project Manager. Add additional cement grout to mixed cement grout or water to bring mix to proper moisture content or specific gravity. Discard cement grout that has been mixed more than 20 minutes and is not at proper specific gravity or moisture content.

12. Compressive Strength: ASTM C 1107 2500 psi minimum 7-day unconfined; 5000 psi minimum 28-day unconfined.

C. Finished surface of lining and interior joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat and uniform-appearing finish.
D. Joint Wrapper: Minimum width of 9 inches for 33-inch diameter and smaller; minimum width of 12 inches for diameters greater than 33-inch hemmed at edge to allow threading with minimum 5/8-inch-wide steel strap. Provide minimum 6-inch-wide Ethafoam strip sized, positioned, and sewn such that two circumferential edges of Ethafoam are 1-1/2-inches from outer edge of wrapper.

PART 3   E X E C U T I O N

3.01 PIPING INSTALLATION

A. Conform to applicable provisions of Section 02511 - Water Lines, except as modified in this Section

B. Comply with following:

1. Make available services of manufacturer’s representative when deemed necessary by Project Manager. Representative to advise in aspects of installation, including but not limited to handling and storing, cleaning and inspecting, coating and lining repair, and general construction methods as applicable to pipe.

2. Handling and Storage: Install padded struts or stulls prior to shipping, horizontally and vertically, as proposed by manufacturer and approved by Project Manager. Spiders: Installed in joint ends of fittings. Stulls to remain in place, horizontally and vertically positioned under following conditions:
   a. During storage and shipping.
   b. Until welding is complete.

3. Install stulls prior to placement of pipe, bends, and fittings to prevent deflection during installation. Provide stulls consisting of timber struts with end blocks shaped to fit curvature of interior surface of pipe or other appropriate configuration and material. Firmly edge and secure stulls to blocks so that they will remain intact position during handling and installation. Provide stulls adequate to resist handling loads encountered without structural failure to stull members or damage to pipe. Repair and or reject and remove from site pipe that arrives at site with defects in lining, including sand pockets, voids, and oversanded areas. Repairs must be made to the satisfaction of the Project Manager to be accepted

4. Store pipe at job site with securely fastened plastic endcaps to maintain moist pipe interior. Promptly replace damaged endcaps to avoid shrinkage or cracking of cement-mortar lining.
5. Immediately replace damaged plastic end caps. Do not leave uncapped for more than 4 hours.

6. Bedding and Backfilling:
   a. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities.
   b. Align pipe at proper grade prior to joint connection and do not shift after jointing operation has been completed.
   c. Take necessary precautions during bedding and backfilling operations to prevent deformation or deflection of cylindrical shape of pipe by more than allowable pipe deflection. Do not move trench support system (trench safety system) once bedding material is compacted.
   d. Excavate outside specified trench section for bell holes, and for spaces sufficient to permit removal of slings. Provide bell holes at proper locations for unrestricted access to joint. Form bell holes large enough to facilitate joint wrapping and to permit visual examination of process. Enlargement of bell holes as required or directed by Project Manager. Subsequent backfilling thereof will not be considered as authorized additional excavation and backfill. Backfill bell holes and spaces to satisfaction of Project Manager.
   e. Blocking may be removed 24 hours after placing backfill to top of pavement or natural ground level.

7. Pipe Deflection: After backfill is complete, test pipe for excessive deflection by measuring actual inside vertical diameter. For maximum deflection allowable, see Section 2.01.
   a. Deflection may be measured by Project Manager at location along pipe. Arithmetical averages of deflection are not acceptable.
   b. If deflection exceeds that specified, do one of the following:
      1) Remove backfill and side support. Reround the pipe and properly replace compacted backfill and side support. Review cement mortar lining to assure that no harmful damage has occurred.
      2) Remove entire portion of deflected pipe section and install new pipe as directed by Project Manager at no additional cost to City.
8. Move pipe in such manner not to damage pipe or coating. Do not roll pipe nor drag on ground. Use a minimum of two wide non-abrasive slings or belts to lift and lower pipe. Handle pipe using a spreader bar. Provide adequate spacing of pipe supports to prevent cracking or damage to lining or coating. Inspect and repair coating abrasions before pipe is lowered into trench.

9. Use of dogs, clips, lugs, or equivalent devices welded to steel pipe for purpose of forcing it into position will not be permitted unless approved by Project Manager. Remove foreign matter and protective material from surfaces that are to be in contact at joints. Leave surfaces of joint areas thoroughly clean for metal-to-metal contact of field joints.

C. Static Electricity:

1. Properly ground steel pipeline during construction as necessary to prevent build-up of static electricity.

2. Electrically test where required after installation of pipeline is complete.

D. Use adequate surveying methods, procedures and employ competent surveying personnel to ensure pipe sections are laid to line and grade and within stipulated tolerances. Measure and record, in form approved by Project Manager, and submit copy of data to Project Manager at end of that day. Survey data to include unique pipe number, deflection or offset angle at pipe joint and whether beveled ends were used, invert elevation at pipe joint, deviation of joint from project line, deviation of joint from project grade, inside pipe joint lap measured at top, bottom, and at springline (each side).

E. Any time that laying of additional pipe is stopped for more than eight hours, plug ends of installed pipe and take proper precautions against flotation of pipe segments.

3.02 EXTERNAL COATING SYSTEM FOR STEEL PIPE INSTALLED ABOVE GROUND AND IN VAULTS (EXPOSED) AND EPOXY INTERNAL LINING SYSTEM

A. Safety: Paints, coatings, and linings specified in this Section are hazardous materials. Vapors may be toxic or explosive. Protective equipment, approved by appropriate regulatory agency, is mandatory for personnel involved in painting, coating, and lining operations.

B. Workmanship:

1. Application: By qualified and experienced workers who are knowledgeable in surface preparation and application of high-performance industrial coatings.

C. Surface Preparation:

1. Use abrasive blasting to prepare surfaces.

2. Schedule cleaning and painting so that detrimental amounts of dust or other contaminants do not fall on wet, newly-painted surfaces. Protect surfaces not intended to be painted from effects of cleaning and painting operations.

3. Prior to blasting, clean surfaces to be coated or lined of grease, oil and dirt by steaming or detergent cleaning in accordance with SSPC SP 1.

4. Metal and Weld Preparation: Remove surface defects such as gouges, pits, welding and torch-cut slag, welding flux and spatter by grinding to 1/4-inch minimum radius.

5. Abrasive Material:
   a. Blast only as much steel as can be coated within same day of blasting.
   b. Use sharp, angular, properly graded abrasive capable of producing depth of profile specified herein. Transport abrasive to jobsite in moisture-proof bags or airtight bulk containers. Copper slag abrasives are not acceptable.
   c. After abrasive blast cleaning, verify surface profile with replica tape such as Tes-Tex Coarse or Extra Coarse Press-O-Film Tape, or approved equal. Furnish tapes to Project Manager.
   d. Do not blast if metal surface may become wet before priming commences, or when metal surface is less than 5 degrees F above dew point.

6. Evaluate degree of cleanliness for surface preparation with use of SSPC Pictorial Surface Preparation Standards for Painting Steel Surfaces, SSPC-Vis 1.

7. Remove dust and abrasive residue from freshly blasted surfaces by brushing or blowing with clean, dry air. Test cleanliness by placing 3/4-inch by 4-inch piece of clear Scotch-type tape on blasted surface, then removing and placing tape on 3x5 white index card. Reclean areas exhibiting dust or residue.

D. Coating and Lining Application:
1. Environmental Conditions: Do not apply when metal temperature is less than 50 degrees F; when ambient temperature is less than 5 degrees F above dew point; when expected weather conditions are such that ambient temperature will drop below 40 degrees F within 6 hours after application; or when relative humidity is above 85 percent. Measure relative humidity and dew point by use of sling psychrometer or similar in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. Provide dehumidifiers for field-applied coatings and linings to maintain proper humidity levels.

2. Application Procedures:
   a. Apply in accordance with manufacturer’s recommendations and requirements of this Section. Provide finish free of runs, sags, curtains, pinholes, orange peel, fish eyes, excessive overspray, or delaminations.
   b. Thin materials only with manufacturer’s recommended thinners. Thin only amount required to adjust viscosity for temperature variations, proper atomization and flow-out. Mix material components using mechanical mixers.
   c. Discard catalyzed materials remaining at end of day.

3. Thoroughly dry pipe before primer is applied. Apply primer immediately after cleaning surface. Apply succeeding coats before contamination of undersurface occurs.

4. Cure minimum of 24 hours at 77 degrees F before successive coats are applied. During curing process, provide forced-air ventilation in volume sufficient to maintain solvent vapor levels below published threshold limit value. Apply successive coats within recoat threshold time as recommended by coating or lining manufacturer on printed technical data sheets or through written communications. Brush blast joints of pipe which have been shop primed and are to receive intermediate and finish coats in field prior to application of additional coats. After interior coats are applied, provide forced-air ventilation in sufficient volume and for sufficient length of time to ensure proper curing before filling pipe with water.

3.03 EXTERNAL COATING SYSTEM FOR BURIED STEEL PIPE

A. Polyurethane Coating System:

1. Conform to requirements of Specification Section 02527 – Polyurethane Coatings for Steel or Ductile Iron Pipe.

B. Tape Coating System:
1. Conform to requirements of Specification Section 09902 – Tape Coatings on Steel Pipe.

2. Heat Shrink Joint Sleeves:
   a. Provide field-applied shrink-wrap coating system for coating field joints, tie-ins and other field welded joints. Apply heat-shrink sleeves prior to internal welding of pipe using approved procedure compatible with coating system. Install heat-shrink joint sleeves in accordance with manufacturer’s recommendations. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to advise Contractor and Project Manager regarding installation, repairs, and general construction methods.

3. Do not expose tape coatings or heat-shrink joint sleeves to harmful ultraviolet light for longer than recommended by the coating manufacturer.

4. At option of Project Manager, coating system and application may be tested and inspected.

3.04 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints:
   1. Use O-ring gasket with sufficient volume to approximately fill area of groove and gasket material in accordance with AWWA C200. Check each splice in gasket by stretching gasket to at least twice original length of gasket. Visually check stretched splice by rotating 360 degrees. Reject splices showing visible separation or cracks.

   2. Equalize rubber gasket cross section after rubber gasket is placed in spigot groove of pipe by inserting tool or bar such as large screwdriver under rubber gasket and moving it around periphery of pipe spigot. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined. Fit pipes together in manner to avoid twisting or otherwise displacing or damaging rubber gasket. Check gaskets after pipe sections are joined with feeler gauge to ensure that no displacement of gasket has occurred at point around circumference after joining. If displacement has occurred, remove pipe section and remake joint as if for new pipe. Remove old gasket and replace before remaking joint.

B. Welded Joints:
1. For welded lap joints, conform to requirements of Section 02511 - Water Lines.

2. Butt joints to be complete penetration for entire circumference.

C. Flanged Joints: Conform to requirements of Section 02511 - Water Lines.

D. Joint Grouting and Testing: Conform to requirements of Section 02511 - Water Lines.

E. Do not allow steel plugs for threaded outlets to project beyond inner surface of pipe shell and seal weld by at least two passes. Apply weld around outside of plug after it has been inserted in final position. Coat outlets and plugs inside and outside as required at field joints on pipe.

3.05 FIELD-APPLIED CEMENT-MORTAR LINING

A. Entrances Into Pipeline:

1. Establish means to permit entry and exit of labor, materials and equipment necessary for progress of work, as approved by Project Manager.

2. Provide dikes and channeling for diversion of flood and drainage waters away from these openings in pipeline. Use temporary airtight covers over openings to provide proper curing conditions in completed sections of lined pipe. Where operation of equipment requires that end of pipe be left open, install temporary bulkhead inside pipe to eliminate direct draft through pipe over completed sections.

3. Brace closure sections of pipeline left out to facilitate field lining above ground to conform as nearly as possible to shape of pipe in ground and then place cement-mortar lining by machine or hand trowel to same thickness as in adjoining machine-lined sections. Bulkhead sections immediately after being lined to maintain proper curing conditions for period of not less than 48 hours before sections are installed in pipeline. Install these sections of steel pipe.

4. Coat exterior surface of buttstraps and uncoated exterior surface area of steel pipe within excavations in accordance with specifications. Place cement-mortar lining inside areas of joints in accordance with specifications.

B. Mixing of Cement-mortar: Mix ingredients for cement-mortar for not less than 1-1/2 and not more than 6 minutes; use mortar promptly after mixing for lining pipe. Do not use mortar that has attained its initial set for lining. Do not retemper mortar. Add water to mix last.

C. Placing Cement-mortar Lining:
1. Complete joint work, backfill and welding before cement-mortar lining begins. After cement-mortar lining has cured, hydrostatic testing of pipe can begin.

2. Provide provisions necessary for Project Manager to conduct inspections of work in safe and thorough manner during and after initial application of mortar and after necessary repairs made. Include, as minimum, space on application machine, and adequate lighting to inspect gross surface areas.

3. Comply with ASTM C 494 and with manufacturer’s recommendations when using chemical admixtures, bonding agents, accelerators, and other additives.

4. Remove dirt, debris, oil, grease and loose mill scale and rust from interior surfaces of pipe, and scrape or brush surface with stiff bristle brush and/or water blast as may be necessary, and approved by Project Manager, to ensure clean surfaces for successful application of cement-mortar lining. Interior surfaces to be approved by Project Manager prior to placing lining.

5. Provide cement-mortar lining uniform in thickness along entire length of pipe. Provide cement-mortar no less than 1/2 inch over all surfaces with tolerance of plus 1/8 inch, and no allowance for minus tolerance.

6. Mechanically control travel of machine and rates of discharge of mortar to produce uniform thickness of lining without segregation around perimeter and along length of pipe.

7. Check finished surface by placing 12-inch straightedge parallel to axis of pipe along surface of straight section of lining. At no point will space between lined surface and straightedge be greater than 1/16 inch.

8. Provide smooth finished surface, within tolerances specified. Repair or replace surface irregularities including corrugations, ripples, or pits in any direction, to satisfaction of Project Manager. Remove defective lining material, including sand pockets, voids, oversanded areas, blisters, delaminations, or unbounded areas, cracked areas, irregular surfaces, and unsatisfactory thin spots. Remove to pipe wall and area repaired to full thickness of mortar lining.

9. Repair cracks 1/16 inch and larger to satisfaction of Project Manager.

10. Place cement-mortar lining by machine having following features:

   a. An applicator head which can be centered within pipe and which will centrifugally project mortar against wall of pipe at high velocity producing dense, uniformly distributed mortar on wall of pipe.
b. Equipped with mechanically driven, rotating steel trowels that immediately follow applicator, providing smooth, hard surface without spiral shoulders. Compensate for torque so that machine will sit true in pipe and trowel faces will not vary in angle with mortar face during complete 360-degree cycle. Clean trowels at frequent intervals to prevent accumulated mortar from obtaining initial set resulting in sanded or unglazed finish. Continuously operate trowels during application of cement-mortar and forward progress of lining machine.

c. Design applicator so that nothing will come in contact with troweled surface until it has attained final set, and so that forward progress of machine and mechanical placing of mortar can be controlled to assure uniform thickness of lining.

11. Immediately prior to application of cement-mortar lining, sweep and clean off slime, dirt, loose rust, loose mill scale, and other foreign materials. Free interior surface of pipe after cleaning of accumulated water on pipe wall or at joints.

12. Cement-mortar Lining: Adhere to steel at all points; provide consistent thickness except that lining of bell end of pipe where lining is to be thicker in order to fill depression and make smooth surface.

13. After receiving its finish troweling, do not roughen lining by rebound material or by mortar direct from machine.

14. Temporarily close outlets in pipeline with easily removable stoppers to prevent spun mortar from being thrown into such openings. After lining is applied, remove stoppers from outlets and repair lining damaged by removal of stoppers. Point outlet openings up to provide smooth flow.

D. Hand Finishing:

1. Repair defective areas in machine-applied lining and unlined joints by hand patching to yield lining equal to that required for machine-applied troweled lining.

2. Provide nonshrink grout for patching or lining joints as specified in this Section.

3. Clean defective areas of loose foreign material and moisten with water just prior to application of hand-applied mortar.

4. Use steel finishing trowels for hand application of cement-mortar.
5. Complete hand finishing required in given pipe section not later than day following machine application of mortar lining to that particular pipe section, whether normal working day or otherwise. Slow down or stop machine application of mortar lining to allow time for hand patching.

E. Curing of Lining: Begin curing operations immediately after completing any portion of mortar lining. Close pipe by airtight bulkheads, and maintain moist atmosphere in completed section of pipe to keep lining damp and to prevent evaporation of entrained water from mortar lining. Humidify air introduced into pipe for ventilating or curing purposes and maintain moist atmosphere inside pipe until Project Manager accepts Work.

3.06 COATINGS AND LININGS INSPECTION RESPONSIBILITIES

A. Contractor is responsible for quality control of coatings and linings applications and testing and inspection stipulated in this Section. Project Manager is responsible for quality assurance and reserves right to inspect or acquire services of independent third-party inspector who is fully knowledgeable and qualified to inspect surface preparation and application of high-performance coatings at phases of coatings and linings, field- or shop-applied. Contractor is responsible for proper application and performance of coatings and linings whether or not Project Manager provides such inspection.

B. Cement Mortar Lining and Joint Finish: Finished surface of lining and joint to be comparable to surface rubbed with No. 16 Carborundum stone. Rub joint mortar sufficiently to bring paste to surface, to remove depressions and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Leave interior with clean, neat and uniform-appearing finish.

3.07 FIELD REPAIR PROCEDURES AND SPECIAL FITTINGS APPLICATION FOR CEMENT MORTAR LINING

A. Areas less than or equal to 6 inches in diameter: Patch honeycomb and minor defects in concrete surfaces with nonshrink grout. Repair defects by cutting out unsatisfactory material and replacing with nonshrink grout, securely bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off grout flush with surrounding surface.

B. Areas greater than 6 inches in diameter:

1. Remove defective lining down to bare steel by chipping, making sure care is taken to prevent further lining damage. Ends of lining where defective lining is removed are to be left square and uniform, not feathered.
2. Clean bare steel with wire brush to remove loose or other foreign matter.

3. Remove existing wire reinforcement and replace. Overlap new reinforcement to existing reinforcement by 1/2 inch. Secure reinforcement, against wall of pipe, at frequent intervals, by tack welding to pipe.

4. Prepare cement mortar mixture. Mixture to compose of Portland Type II cement, sand, and water. Proportions of sand to cement not to exceed 3 parts sand to 1 part cement, by weight. Use only enough water to obtain proper placement characteristics. Set-up time before mixture is to be discarded is to be no longer than 1/2 hour. Nonshrink grout may also be used. Do not use combination of cement mortar and nonshrink grout within same repair.

5. Apply WELD-CRETE, or approved equal, concrete bonding agent to bare steel and interface of existing lining. After bonding agent is applied to steel and lining, new mix must be applied within 10 minutes.

6. Apply cement mortar to repair area 1/2 inch thick, then hand trowel to achieve smooth dense finish, making sure wire is not left exposed. To ensure proper thickness while placing new mortar, check thickness with 1/2-inch-long wire gauge.

7. Curing: Place plastic sheeting over repair area; use tape to adhere plastic to area surrounding repair area. Let cure for 4 days, then remove plastic sheeting.

END OF SECTION
Section 02520

FIRE HYDRANTS

PART I   GENERAL

1.01   SECTION INCLUDES

A. Fire hydrants.

B. Adjustment of fire hydrants and gate valves.

1.02   MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on a unit price basis for each fire hydrant assembly, including 6-inch gate valve and box, installed regardless of barrel depth.

2. Payment for fire hydrant branches (leads) is on linear foot basis for each branch installed. Separate pay items are used for open-cut and augured branches.

3. Payment for salvaged fire hydrants is on unit price basis for each fire hydrant removed and returned to City's Maintenance Quadrant Stock yard.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03   REFERENCES


B. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

C. SSPC SP2 - Hand Tool Cleaning

D. SSPC SP3 - Power Tool Cleaning

E. SSPC SP10 - Near-White Blast Cleaning

F. SSPC SP11 - Power Tool Cleaning to Bare Metal
G. SSPC 42 – Epoxy Polyamide/Polyamidoamine Primer, performance based

H. SSPC 36 – Two-Component Weatherable Aliphatic Polyurethane Topcoat, performance based

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

PART 2 PRODUCTS

2.01 HYDRANTS

A. Provide fire hydrants in conformance with AWWA C 502, Standard for Dry Barrel Fire Hydrants (Latest Edition). Hydrants are approved by the City for issuance of a Certificate of Responsibility. Only hydrants with current Certification of Responsibility will be allowed in City of Houston projects. Approved fire hydrants are listed under City’s Approved Water Product List.

B. The Project Manager may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at City expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty degree (360) rotation of upper barrel.

2.02 LEADS

A. Branches (Leads): Conform to requirements of Section 02501 - Ductile Iron Pipe and Fittings, Section 02502 - Steel Pipe and Fittings, and Section 02506 - Polyvinyl Chloride Pipe.

2.03 HYDRANT PAINTING

A. New hydrants and refurbished hydrants shall be shop coated as specified herein.
B. Exterior Above Traffic Flange (Including Bolts & Nuts). Bolts and nuts (both above and below ground) shall conform to AWWA C-502 Section 4.11 and shall be stainless steel, cadmium plated, or zinc coated.

1. Surface preparation to be in accordance with SSPC-SP 10 (NACE 2) near white blast cleaned surface.

2. Coat with a liquid or powder epoxy primer and two part polyurethane or TGIC polyester top coat system with total dry film thickness (DFT) of not to exceed 20 mils as follows:
   a. Prime Coat - Liquid or powder epoxy primer with a total dry film thickness (DFT) of 4-6 mils, OR cathodic epoxy electro-coat (e-coat) with a (DFT) of 0.5-1.0 mils.
   c. Finish Coat - Two part polyurethane enamel to be in general conformance with SSPC Paint Specification No. 36 or TGIC polyester system, with a total dry film thickness (DFT) 1.5-3.0 mils. Install color coded finish coating of bonnet in field.
   d. Bonnet Paint - Field apply finish coat of Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Dry film thickness of 2 - 3 mils. Bonnet colors are to be as specified in Paragraph 3.01 to designate the appropriate size of water supply line.

3. Colors - Primer: Manufacturer’s standard color. Finish coat of hydrant body: Federal Standard Color #15187 (Blue) or equivalent. Bonnet and Connection caps: Finished coated white. Paint white band of finish coat two (2) inches in width on hydrant body approximately six inches (6") above and parallel to traffic flange.

C. Field Maintenance Painting (Exterior Above Traffic Flange)

1. Surface Preparation to be in accordance with SSPC - SP2, Hand Tool Cleaning, or SSPC - SP3, Power Tool Cleaning, depending on condition of existing paint and extent of corrosion. It is not necessary to remove tightly adhered mill scale, rust, and paint. Mill scale, rust and paint are considered tightly adherent when they cannot be removed with dull putty knife. In some severe cases where it is necessary to remove majority of existing paint, surface should be cleaned in accordance with SSPC -SP11, Power Tool Cleaning to Bare Metal.

2. When surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.03.B.2 as for new
hydrants. When surface is cleaned to SSPC - SP2 or SSPC - SP3, coat hydrant with Silicone Alkyd Resin Enamel in general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3-6 mils.

Field coating should be conducted in accordance to the individual coatings manufacturer’s recommendations.

D. Exterior Below Traffic Flange (including lower barrel extensions).
   1. Surface preparation in accordance with SSPC- SP10 (NACE 2) Near White Blast Cleaned Surface.
   2. Primer: One or two coats of modified or equal polyamide epoxy primer, to be in general conformance with SSPC Paint Specification No. 42 or approved equal with a total dry film thickness (DFT) of 20 mils. Exterior below traffic flange should be the same color as the above traffic flange, i.e., blue. (Federal Standard Color #15187 (Blue) or equivalent.)

E. Interior Surfaces Above and Below Water Line Valve (including lower barrel extensions)
   1. Material used for internal coating of hydrant interior ferrous surfaces must be NSF certified as suitable for contact with potable water as required by Chapter 290, Rules and Regulations for Public Water Systems, Texas Commission on Environmental Quality.
   2. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied in two or three coats, according to manufacturer's recommendations, for total dry film thickness not to exceed 20 mils.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.

B. Locate nozzle center line minimum 18 inches above finish grade.

C. Place 12-inch by 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Project Manager) on pumper nozzles of new or relocated fire hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by Project Manager.

D. Do not cover drain ports when placing concrete thrust block.
E. Obtain Project Manager's approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.

F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to nearest Utility Maintenance Quadrant Facility.

G. Install branches (leads) in accordance with Section 02511 - Water Lines.

H. Coating Requirements:
   1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
   2. Furnish affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.

I. Use following color code for field coating of hydrant bonnet to indicate size of water line supplying hydrant:

<table>
<thead>
<tr>
<th>Supply Water Line Diameter (inches)</th>
<th>Bonnet Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Yellow</td>
</tr>
<tr>
<td>8</td>
<td>White</td>
</tr>
<tr>
<td>12-20</td>
<td>Green</td>
</tr>
<tr>
<td>24 and larger</td>
<td>Orange</td>
</tr>
</tbody>
</table>

J. Remove and dispose of unsuitable materials and debris in accordance with requirements of Section 01576 - Waste Material Disposal.

END OF SECTION
Section 02521

GATE VALVES

PART 1    GENERAL

1.01    SECTION INCLUDES

A. Gate valves.

1.02    MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for gate valves 20 inches in diameter and smaller under this Section. Include payment in unit price for water lines.

2. Payment for gate valves 24 inches to 36 inches in diameter is on a unit price basis. Unit price includes cost of required box for gate valves.

3. Payment for 2-inch blow-off valve with box is on a unit price basis for each installation.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03    REFERENCES


B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.


E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.

G. AWWA C 515- Standard for Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.
H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.
B. Submit manufacturer's product data for proposed valves for approval.
C. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.05 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.
B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed.
C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends
D. Coatings for Gate Valves 2 inches and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.
E. Gate Valves 2 inches in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.
F. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves.
Provide approved double disc valves. Comply with following requirements unless otherwise specified in Drawings:

1. **Design:** Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.

2. **Body:** Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.

3. **Bronze:** Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.

4. **Stems:** ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.

5. **O-rings:** For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.

6. **Stem Seals** Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

7. **Stem Nut:** Independent or integrally cast of ASTM B 62 bronze.

8. **Resilient Wedge:** Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

9. **Bolts:** AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

**G.** Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:

1. **Body:** Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.

2. **O rings:** For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.

3. **Stems:** ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
4. **Stem Nut**: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.

5. **Stem Seals**: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

6. **Bolts**: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

7. **Discs**: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.

8. **Wedging Device**: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.

9. **Provide bypass for double-disc valves (AWWA C500).**

10. **Bronze Mounting**: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.

11. **Gear Cases**: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.

12. ** Stuffing Boxes**: Located on top of bonnet and outside gear case.

H. **Gate valves 14 inches to 48 inches**: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.

1. **Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.**

2. **Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.**

3. **Ensure wedge is symmetrical and seals equally well with flow in either direction.**

4. **Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.**

5. **Bolts**: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.

6. **Provide high strength bronze stem and nut.**
7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.

8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.

9. Provide thrust washers to the thrust collar for easy valve operation.

I. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

J. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

K. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.

L. Provide flanged joints when valve is connected to steel or PCCP.

M. Key valve stem into the operator nut.

N. Do not exceed 600 ft-lbs of torque on operator nut on gate valve.

PART 3 EXECUTION

3.01 INSTALLATION

A. Earthwork. Conform to applicable provisions of Section 02317 - Excavation and Backfilling for Utilities.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.02 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.
C. For pipe section of each riser, use only 6 inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve. Assemble and brace box in vertical position as indicated on Drawings.

3.03 DISINFECTION AND TESTING

A. Assist Project Manager with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 - Hydrostatic Testing of Pipelines.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

3.04 PAINTING OF VALVES

A. Paint valves in vaults, stations, and above ground with approved paint.

END OF SECTION
Section 02522

BUTTERFLY VALVES

PART 1  G E N E R A L

1.01  SECTION INCLUDES

A. Butterfly valves.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1.  Payment for butterfly valves with operator manhole or valve box is on a unit price basis for each. Payment includes actuator, valve box or manhole (where shown), foundation and appurtenances necessary for complete installation of valve.

2.  For butterfly valves with vault, valve and vault will be paid separately. Butterfly Valve will be paid on a unit price basis for each and includes hardware, actuator, testing and installation. Vault will be paid on a lump sum basis, and includes all materials, equipment, and appurtenances necessary for complete vault structure, foundation and supports as shown on Drawings.

3.  Refer to Section 01270 – Measurement and Payment for unit price procedures.

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

1.03  REFERENCES

E. AWWA C 504 - Standard for Rubber-Seated Butterfly Valves.
F. AWWA C 516 – Large-Diameter Rubber-Seated Butterfly Valves, Sizes 78 in. (2,000 mm) and Larger.


H. AWWA C 550 - Standard for Protective Interior Coatings for Valves and Hydrants.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer’s product data for proposed valves and actuators for approval.

C. Submit Proof-of-Design and hydrostatic testing procedures in accordance with AWWA C504 or C516.

D. As part of initial review, submit manufacturer’s affidavits certifying the following:
   1. Compliance with specifications for valves and actuators.
   2. Butterfly valves were manufactured in the United States.
   3. Butterfly valves conform to applicable requirements of AWWA C504 or C516.

E. Butterfly valves have been satisfactorily tested in the United States in accordance with AWWA C504 or AWWA C516 using test pressure of 150 psi in both directions.

F. At time of delivery, submit manufacturer’s affidavits certifying the following:
   2. Valves were manufactured in accordance with AWWA C504 or C516.

G. At time of delivery, furnish certified drawings and material test records by manufacturer. Furnish certified copies of test reports for review.

H. Submit data indicating maximum torque required to open valve, maximum torsional strength of shaft and torque output of actuator.

I. Provide submittal information on CD-ROM in Adobe portable document format (*.PDF).

J. Include number of turns to operate valves to fully open/closed.
K. For 30-inch and larger diameters, submit procedures for complete seat replacement in the field.

1.05 QUALITY CONTROL

A. Perform valve leakage tests in both directions at 150 psi in factory and field. Hydrostatic field tests of 150 psi shall be made against dished head plug or similar arrangement.

B. When proof of design tests are performed on valve delivered to job site, replace disc, bushing, shaft and seals with new unused items, and test and certify as described above.

C. Hydrostatic Testing by Manufacturer:

1. Hydrostatic testing to be witnessed by Project Manager prior to shipment of valves. Provide minimum 4 weeks notice to Project Manager to schedule witness testing. When possible, maximize number of valves to be tested during a plant visit; no more than two visits will be allowed per project to witness test valves, unless otherwise approved by Project Manager. City will pay expenses for each visit up to total of two visits incurred by Project Manager to witness testing of each grouping of valve(s) per project. Expenses for subsequent or extended visits by Project Manager for defective valves, improper scheduling or valve failures are to be paid by Contractor. Witness of hydrostatic testing by Project Manager will only be in regard to compliance with this specification and will not constitute approval by Project Manager nor relieve Contractor of obligations to comply with contract documents.

2. Document serial number on valve at time of testing and reflect in certified test records furnished to Project Manager. Identification plate must be permanently affixed to valve and actuator prior to hydrostatic testing.

3. Hydrostatic testing to conform to AWWA C504 or C516 except as modified below:

a. Install actuator prior to hydrostatic testing. Test actuator to verify actual number of turns match manufacturer’s published number of turns. Verify valve stops are in correct positions.

b. Fully open and close valve prior to performing shell test and prior to each leakage test.

c. Perform shell test first.

d. When tested with water, adequately dry seat and disc.
e. When tested with air, fill top of valve with water to aid in viewing possible leakage.

f. Pressure Gauges: Calibrated within past 12 months; 0-500 psi range in increments of 5 psi; present calibration certificates prior to hydrostatic testing.

g. If seat adjustment is required during hydrostatic testing, perform valve leakage test again in both directions. Once seat adjustment is made, fully open and fully close valve three (3) times, and repeat leakage test.

4. Field Testing:

a. When valve arrives at the job site, Contractor is to operate valve fully open and closed twice in presence of Project Manager. Document number of turns to open and close each time.

b. Install operator nut plum.

c. After valve is installed, repeat the operation test and document number of turns in presence of Project Manager.

d. Manufacturer’s representative must be present to witness the operation test again at the substantial walk thru. Verify valve operate fully open/closed twice at the appropriate number of turns.

PART 2 PRODUCTS

2.01 VALVES AND ACTUATORS

A. Butterfly Valves and Actuators: Provide approved butterfly valves and actuators. Conform to AWWA C504 for 72-inch and smaller diameters. Conform to AWWA C516 for 78-inch and larger diameters. Compliance with NSF 61 is required for all parts in contact with finished water.

B. If type of valve is not indicated on Drawings, use butterfly valves for line valve sizes 24-inch and larger. When type of valve is specified on Drawings, no substitute will be allowed, unless otherwise approved by Project Manager.

C. Butterfly valves shall be short-body, flanged design and installed at locations as shown on Drawings.

D. Direct-bury valves and valves in subsurface vaults shall open clockwise. Above-ground and plant valves shall open counterclockwise.
E. Provide flanged joints when valve is connected to steel or PCCP. Provide ASTM A193 Grade B7 high strength steel stud bolts with ASTM A194 heavy hex nuts. Refer to flange bolting requirements in Section 02511 – Water Lines.

F. Butterfly Valves and Actuators (Additional Requirements for Large Diameter Water Lines):

1. Provide valves from approved manufacturer\(^{(1)}\). Provide all valves for single project, from same manufacturer. \(^{(1)}\)as modified for seat replacement in field for City of Houston

2. Provide manual actuators for single project from same manufacturer.

3. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension to be fully enclosed and watertight.

2.02 VALVE CONSTRUCTION

A. Valves:


2. 78-inches and larger diameters: AWWA C516, Class 150B. Body: ASTM A536 Grade 65-45-12. Flanges: ASME B16.1, Class 125 for up to 96-inch, AWWA C207, Class D with bolt holes \(\frac{1}{4}\)-inch larger than nominal bolt diameter for larger than 96-inch diameters.

B. Discs: ASTM A536 Grade 65-45-12 Ductile Iron.

C. Seats: Buna-N or neoprene, and may be applied to the disc or body. Mechanically secure seat to disc or body using stainless steel retainer ring and bolts. Do not rely solely on adhesive properties of epoxy or similar bonding agent to attach seat to body. When seat is on disc, retain seat in position by shoulders located on both disc and stainless steel retaining ring. Mating surfaces for seats: Type 304 or 316 stainless steel, and secured to disc by mechanical means. Sprayed-on or plated mating surfaces not allowed. Seat must be adjustable and replaceable in field with no special tools for valves greater than 30-inches in diameter.

D. Coat interior wetted ferrous surfaces of valve, including disc, with epoxy or fusion bonded epoxy suitable for potable water conditions. Epoxy, surface preparation, and epoxy application: In accordance with AWWA C550 and coating manufacturer’s recommendations. Provide minimum dry film thickness of 8 mils for epoxy coating or
minimum DFT of 16 mils for fusion bonded epoxy. Coatings shall be holiday tested and measured for thickness.

E. Valve shaft and keys: 24-inches in diameter and greater require a minimum of two (2) taper pins used for attaching valve shaft to valve disc. Use of torque plug for purposes of attaching valve shaft is not permitted. Shaft bearings: stainless steel, bronze, nylon or Teflon (supported by fiberglass mat or backing material with proven record of preventing Teflon flow under load) in accordance with AWWA C504 or C516. Sinter stainless steel bearing material. Design valve shaft to withstand 3 times the amount of torque necessary to open valve. Shaft Material:

1. 72-inches and smaller: Type 304 stainless steel for treated (potable) water applications. Type 316 stainless steel for raw water applications.

2. 78-inches and larger: ASTM A564, Type 630 (17-4 PH), Stainless Steel, Condition 1150.

3. Design valve shaft to withstand 3 times the amount of torque necessary to open valve.

F. Taper pins: Stainless Steel. Valves 24-inches in diameter and greater require a minimum of two (2) taper pins used for attaching valve shaft to valve disc, use of torque plug for purposes of attaching valve shaft is not permitted. Shaft Bearings: sintered stainless steel, sintered bronze, nylon or Teflon (supported by fiberglass mat or backing material with proven record of preventing Teflon flow under load) in accordance with AWWA C504 or C516.

G. Packing: Self adjusting and wear compensating, full or split ring V-type, and replaceable without removing actuator assembly.

H. Retaining Hardware for Seats: Type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitation effects.

I. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow, except where shown otherwise on Drawings.

J. For valves utilizing retaining rings, tighten bolts to a uniform torque. Measure torque prior to testing valve.

2.03 VALVE ACTUATOR CONSTRUCTION
A. Provide actuators for valves with size based on line velocity of 16 feet per second and uni-directional service, and unless otherwise shown on Drawings, equip with geared manual actuators. Provide fully enclosed and traveling-nut type, rack-and-pinion type, or worm-gear type for valves 24-inches and smaller. For 30-inches and larger, provide worm-gear or traveling-nut type.

B. Provide actuator designed for installation with valve shaft horizontal unless otherwise indicated on Drawings.

C. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements.

D. Provide oil-tight and watertight actuator housings for valves, specifically designed for submerged service, and factory packed with suitable grease.

E. Install valve position indicator on each actuator housing located above ground or in valve vaults. Valves shall be equipped with 2-inch actuator nut only.

F. Indicate direction of opening of valve on exposed visible part of assembly and cast direction of open on 2-inch nut on top of valve operator extension. Paint 2-inch actuator nut and extension shaft black when counterclockwise open and red when clockwise to open.

G. Design worm-gear or traveling-nut actuators to be self-locking and designed to transmit twice the required actuator torque without damage to faces of gear teeth or contact faces of screw or nut.

H. Actuators shall be capable of withstanding minimum 450 foot-pounds of torque against the stops without damage to any parts of the actuator or valve.

2.04 VALVE BOXES

A. Provide Standard Type "A" valve boxes conforming to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

2.05 VALVE SERVICE MANHOLES

A. For large diameter water lines, provide manholes to dimensions shown on Drawings conforming to requirements of Section 02082 - Precast Concrete Manholes.

PART 3 EXECUTION

3.01 EARTHWORK
A. Conform to applicable provisions of Section 02317 - Excavation and Backfill for Utilities.

3.02 SETTING VALVES AND VALVE BOXES

A. Prior to hydrostatic testing of water line and valve:
   1. Test valve by opening and closing valve a minimum of two times to verify valve seats properly.
   2. Verify number of turns from fully open to fully closed position is same as identified in manufacturer’s submittal.
   3. Adjust valve as required if number of turns do not match.
   4. Remove foreign matter from within valves.

B. Install valves in accordance with manufacturer’s recommendations. Install valves where shown on Drawings or as located by Project Manager.

C. Use valve boxes for 16-inch and 24-inch valves unless otherwise shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet.

D. Avoid disturbing or overstressing valve body when installing valves. Perform field adjustment of valves under pressure to ensure shutoff occurs in number of rotations as described in valves operation and maintenance manual.

E. Submit certification that large diameter valve was installed, adjusted, and exercised in accordance with manufacturer’s instructions. Manufacturer’s certification shall state that all performance characteristics of large diameter valves, as installed, have been met. Adjustments made to valve, for any reason, must be made by manufacturer’s representative.

3.03 DISINFECTION AND TESTING

A. Assist City with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 - Hydrostatic Testing of Pipelines. Do not use valves for throttling without prior approval of manufacturer.
3.04 COATING OF PIPING

A. Coat valves located in vaults, stations, and above ground using approved paint. Coating shall be 6-12 mils thick, but no more than 12 mils. Apply coating in accordance with manufacturer’s recommendations.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Pressure reducing valves (PRV).

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pressure reducing valves is on unit price basis for each valve installed.

2. Payment includes vault, piping, manhole, fittings, and appurtenances necessary for complete installation of valve.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES


1.04  SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

C. Submit design calculations and shop drawings for valve vaults and manholes, sealed by Engineer registered in the State of Texas.

1.05  QUALITY CONTROL

A. Submit manufacturer's affidavit that pressure reducing valves purchased for Work, were manufactured and tested in the United States, and conform to requirements of this Section.
PART 2  PRODUCTS

2.01  MATERIALS

A.  Provide approved PRV with basket strainer in location and arrangement as shown on Drawings.

1.  Valve body:  Ductile iron with ASME B16.1, Class 125, flanges.

2.  Valve cover:  ASTM A 48 cast iron.

3.  Valve internals:
   a.  Provide top and bottom single moving disc and diaphragm assembly.
   c.  Provide valve internal trim (seat ring, disc guide, and cover bearing) made of stainless steel.
   d.  Provide heat fusion bonded epoxy coating to internal and external surfaces of valve body including disc retainer and diaphragm washer. Holiday test coating applied to valve body.
   e.  Treat stem and seat with penetrative salt nitride process.
   f.  Use Xylan coated seat.
   g.  Do not use leather parts.

B.  Control Tubing:  Contain shutoff cocks with Y-strainer.

C.  PRV:  Equip with visual valve position indicator. Fit valve position indicator with air-bleed petcock. Initially set in field by authorized manufacturer's representative with 60 psi downstream pressure.

D.  Provide basket strainer upstream of PRV as shown on Drawings.


2.  Basket:  Type 304, stainless steel.
3. Model: Provide basket compatible with the manufacturer of the pressure reducing valve. Hayward Model 90, or approved equal, for PRV 4 inches through 24 inches. Provide Hayward Model 510, or approved equal, for PRV 14 inches or greater when space limitations dictate use of smaller strainer housing.

E. Provide pressure reducing pilot that has adjustable range of 20 - 175 psi. Provide and install pilot system components according to manufacturer’s recommendations unless otherwise approved by Project Manager.

F. Valve Vaults: Provide as shown on Drawings and conforming to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

PART 3  E X E C U T I O N

3.01 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfill for Utilities.

3.02 SETTING VALVES

A. Provide services of technical representative of valve manufacturer on site during installation of valves and to serve as adviser on aspects of installation. Take necessary precautions to protect pilot system during PRV installation.

B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

3.03 DISINFECTION AND TESTING

A. Disinfect valves and appurtenances as required by Section 02514 - Disinfection of Water Lines and test as required by Section 02515 - Hydrostatic Testing of Pipelines.

3.04 PAINTING OF PIPING AND VALVES

A. Paint piping and valves located in vaults, stations, and above ground using ACRO Paint No. 2215, or approved equal.

END OF SECTION
ARTICLE 02524
AIR RELEASE AND VACUUM RELIEF VALVES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air release and vacuum relief valves.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for air release and vacuum relief valves is on unit price basis for each valve installed.

2. Payment includes manhole or vault (when required), fittings, vent piping and bollard(s) and appurtenances necessary for complete installation of valve.

3. Payment for valve assembly on aerial crossing includes fittings, anti-vandalism protection, freeze protection, vent piping and appurtenances necessary for complete installation of valve.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's product data for proposed valves for approval.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. Provide combination air valves designed to fulfill functions of air release (permit escape of air accumulated in line at high point of elevation while line is under pressure) and vacuum relief.

B. Provide inlet and outlet connections, and orifice as shown on Drawings.

1. Valve exterior: Painted with shop-applied primer suitable for contact with potable water.

2.02 MATERIALS

A. Air Release Valves: Provide approved air release valves ASTM A 48, Class 30, cast iron; float and leverage mechanism with body and cover, ASTM A 240 or ASTM A 276 stainless steel; orifice and seat, stainless steel against Buna-N or Viton mechanically retained with hex head nut and bolt. Other valve internals shall be stainless steel or bronze.

B. Air Release and Vacuum Relief Valves: Provide single-body, standard combination valves or duplex-body custom combination valves as indicated on Drawings.

1. For 2 inch and 3 inch, single-body valves, provide inlet and outlet size as shown on Drawings and orifice sized for 100 psi working pressure.

   a. Valve materials: body, cover, and baffle, ASTM A 48, Class 35, or ASTM A 126, Grade B cast iron; plug or poppet, ASTM A 276 stainless steel; float, ASTM A 240 stainless steel; seat, Buna-N; other valve internals, stainless steel.

2. For 3 inch and larger duplex body valves as shown on Drawings, provide approved air release valve.

   a. Air and vacuum valve materials: body and cover, ASTM A 126, Class B, cast iron; float, ASTM A 240 stainless steel; seat, Type 304, stainless steel and Buna-N, for sanitary sewer, Garlock #3000 (non-asbestos), for water lines; other valve internals, stainless steel or bronze (for sanitary sewer).
b. Air release valve: Constructed as specified in paragraph above on Air Release Valves.

C. Vacuum Relief Valves: Provide approved air inlet vacuum relief valves with flanged inlet and outlet connections as shown on Drawings. Provide air release valves in combination with inlet and outlet, and orifice as shown on Drawings. Valve shall open under pressure differential not to exceed 0.25 psi.

1. Materials for vacuum relief valves: valve body, ASTM A 48, Class 35, cast iron; seat and plug, ASTM B 584 bronze, copper alloy 836; spring, ASTM A 313, Type 304, stainless steel; bushing, ASTM B 584 bronze, copper alloy 932; retaining screws, ASTM A 276, Type 304, stainless steel.

D. Additional Requirements for Wastewater Applications:

1. Air Release/Vacuum Relief Valves shall have a minimum seating pressure of 0 psi through a maximum operating pressure of 250 psi

2. Valve bodies shall be constructed of 316Ti stainless steel.

3. The valves shall have an internal debris shield and debris screen or an alternative mechanism to prevent clogging of the orifice.

4. Rubber components used shall be suitable for wastewater application

D. Manholes: As shown on Drawings conforming to requirements of Section 02082 - Precast Concrete Manholes.

PART 3  E X E C U T I O N

3.01 EARTHWORK

A. Conform to applicable provisions of Section 02317 - Excavation and Backfill for Utilities.

3.02 SETTING VALVES IN MANHOLES AND VAULTS

A. If required by Project Manager, provide services of technical representative of valve manufacturer available on site during installation of valves.

B. Prior to installing valves, remove foreign matter from within valves. Inspect valves in open and closed position to verify that parts are in satisfactory working condition.

C. Install valves and valve manholes and vaults where indicated on Drawings or as located by Project Manager. Set manholes and vaults plumb and as detailed. Center manholes on valves. Compact cement-stabilized sand around each manhole and vault for minimum radius
of 4 feet, or to undisturbed trench face when less than 4 feet. Provide above-ground vents for manholes and vaults as indicated on Drawings.

3.03 DISINFECTION AND TESTING

A. Assist City with disinfection of valves and appurtenances as required by Section 02514 - Disinfection of Waterlines and test as required by Section 02515 - Hydrostatic Testing of Pipelines.

3.04 PAINTING OF PIPING AND VALVES

A. Paint piping and valves located in manholes, stations, and above ground using approved paint.

END OF SECTION
Section 02525

TAPPING SLEEVES AND VALVES

PART 1   GENERAL

1.01 SECTION INCLUDES

A. Tapping sleeves and valves for connections to existing water system.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on unit price basis for each tap installed.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

3. For water lines 4-inches and greater, no payment will be made until coupon (cut out portion of pipe tapped) is delivered to City.

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


C. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service


E. AWWA C 200 - Standard for Steel Water Pipe - 6 in. and Larger.


G. AWWA C 500 - Standard for Metal Seated Gate Valves, for Water Supply Service.
H. AWWA C 223 - Fabricated Steel and Stainless Steel Tapping Sleeves.

I. OSHA 29 CFR 1926.1101 – Asbestos.

1.04 SUBMITTALS
A. Conform to requirements of Section 01330 - Submittal Procedures.
B. Submit results of tapping sleeves NPT test opening.
C. Submit manufacturer's affidavit as required in Section 02521 - Gate Valves.
D. For tapping fiberglass reinforced pipe (FRP), submit tapping procedures in accordance with FRP manufacturer’s recommendations.

1.05 DELIVERY, STORAGE AND HANDLING
A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

PART 2 PRODUCTS
2.01 MATERIALS
A. Tapping Sleeves:
   1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
   2. Branch Outlet of Tapping Sleeve:
      a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.
      b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
   3. Use cast iron split sleeve where fire service from 6-inch water line is approved.
   4. For tapping Fiberglass Reinforced Pipe (FRP), provide stainless steel tapping sleeves. Do not use cast iron or ductile iron tapping sleeves. Comply with FRP pipe manufacturer’s recommendations for tapping procedures.
B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:
1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.

2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.

3. Steel sleeves are restricted to use on pipe sizes 6 inches and larger.

4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.

5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.

6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12 mil thickness.

7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.

8. Provide approved steel tapping sleeves.


10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

11. Comply with AWWA C 223 - Fabricated Steel and Stainless Steel Tapping Sleeves.

C. Stainless Steel tapping-sleeve bodies and flange may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.

2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.

3. Stainless Steel sleeves are restricted to use on pipe sizes 4 inches and larger.


5. Bolts: ASTM A193 Stainless Steel, Type 304.


8. Provide approved stainless steel tapping sleeves.
9. Do not use stainless steel sleeves for taps greater than 75 percent of pipe diameter.

10. Comply with AWWA C 223 - Fabricated Steel and Stainless Steel Tapping Sleeves.

D. Tapping Valves: Meet requirements of Section 02521 - Gate Valves with following exceptions:

1. Inlet Flanges:
   a. AWWA C 110; Class 125.
   b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.

2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.

3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

E. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

PART 3 EXECUTION

3.01 APPLICATION

A. Install tapping sleeves and valves at locations and of sizes shown on Drawings, maintain 5 feet spacing from edge of tapping sleeve from any other tap or fitting. Install sleeve so valve is in horizontally level position unless otherwise indicated on Drawings.

B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.

C. Hydrostatically test installed tapping sleeve to 150 psig for minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.

D. When tapping concrete pressure pipe, size on size, use shell cutter one standard sizesaller than water line being tapped.

E. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

3.02 INSTALLATION

A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.

B. Verify clearance of 5 feet to maintain spacing.
C. Tighten bolts in proper sequence so that undue stress is not placed on pipe. For installation of tapping sleeves on FRP, comply with pipe manufacturer's recommendations for bolt torque values.

D. Align tapping valve properly and attach to tapping sleeve. Insert insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.

E. Make tap with sharp, shell cutter:
   1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.
   2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.
   3. For tapping FRP pipe, comply with pipe manufacturer's recommendations for forward feed rate.

F. Withdraw coupon and flush cuttings from newly-made tap.

G. Wrap:
   1. For 12-inch and smaller tap, wrap completed tapping sleeve and valve in accordance with Section 02528 - Polyethylene Wrap.
   2. For 16-inch and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of 16 mils.

H. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).

I. Request inspection of installation prior to backfilling.

J. Backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

3.03 ADDITIONAL REQUIREMENTS FOR TAPPING ASBESTOS-CEMENT (AC) PIPE

A. Notify Project Manager when AC pipe is encountered.

B. Refer to Section 02221 – Removing Existing Pavements and Structures for crew training, safety precautions, and AC pipe removal requirements.

C. Protocol:
   1. Mechanically excavate to no more than 6 in. of AC pipe. Carefully uncover the remainder of pipe by hand or with shovel.
   2. Keep pipe adequately wet before and during work.
3. Locate tap a minimum of 5 ft. away from existing AC collar.

4. Use of power tools is prohibited.

5. Remove waste AC pipe coupon.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

   A.  Water meters, submeters, and fire service meters.

1.02  MEASUREMENT AND PAYMENT

   A.  Unit Prices

      1.  Measurement for water meters is on unit price basis for installation of each meter type and size.

      2.  Payment includes vault, piping and appurtenances necessary for complete installation of meter.

      3.  Measurement for relocating and reinstalling meter with new box is on unit price basis for each meter relocated and reinstalled.

      4.  No separate payment for adjustment of meter or meter box unless otherwise shown in Drawings.

      5.  Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES


   B.  AWWA C 510 - Standard for Double Check Valve Backflow - Prevention Assembly.

   C.  AWWA C 700 - Standard for Cold-Water Meters - Displacement Type.

   D.  AWWA C 701 - Standard for Cold-Water Meters - Turbine Type for Customer Service.

   E.  AWWA C 702 - Standard for Cold-Water Meters - Compound Type.

   F.  AWWA C 703 - Standard for Cold-Water Meters - Fire Service Type.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit written certification of calibration and test results.

C. Submit manufacturer's certification that meters meet applicable requirements of this Specification Section.

D. Submit accuracy registration test certification from manufacturer for each 3-inch through 10-inch diameter meter.

1.05 QUALITY CONTROL

A. Submit manufacturer's warranty against defects in materials and workmanship for one year from date of Substantial Completion.

B. Provide vendor's unconditional guarantee that performance of each meter meets applicable AWWA standards and AWWA Manual M6 as follows:

1. Displacement type: 10 years from installation or register registration shown below, whichever comes first.

<table>
<thead>
<tr>
<th>Size (inch)</th>
<th>Registration (million gallons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8, 3/4</td>
<td>1.5</td>
</tr>
<tr>
<td>1</td>
<td>2.5</td>
</tr>
<tr>
<td>1-1/2</td>
<td>5.0</td>
</tr>
<tr>
<td>2</td>
<td>10.5</td>
</tr>
</tbody>
</table>

2. Turbine type: 1 year from date of installation.

3. Compound type: 1 year from date of installation.

4. Fire service type: 1 year from date of installation.

Operations of hermetically sealed register, 5/8-inch to 2-inch diameter, shall be unconditionally guaranteed for 15 years.

C. Provide manufacturer's unconditional guarantee for each sealed register against leakage, fogging, discoloration and stoppage for 15 years from date of installation.

D. Vendor may replace meters that become defective within guarantee period with meters that comply with this Specification. City will return defective meters to vendor at expense.
repaired or replaced under this guarantee must meet accuracy limits for new meters upon receipt and accuracy limits for remaining period of initial guarantee.

1.06 EASEMENT REQUIREMENTS

A. Install 2-inch and smaller water meters and shut-off valves (stop boxes) in right-of-way when possible. Otherwise, install in a minimum 5 foot by 5 foot separate water meter easement contiguous with public right-of-way.

B. Install 3-inch to 6-inch water meters in a minimum of 10 foot by 20 foot separate water meter easement contiguous with public right-of-way.

C. Install 8-inch and larger water meters in a minimum of 10-foot by 25-foot separate water meter easement contiguous with public right-of-way.

D. Locate water meter easements contiguous with public right-of-way unless approved by Project Manager. Provide minimum fifteen foot wide access easement when not contiguous with public right-of-way.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide meters of type and size as indicated on Drawings, unless otherwise indicated.

B. Provide bolted split casings. Main casings of meters and external fasteners: Copper alloy with minimum 75 percent copper for 5/8 inch to 2 inches, bronze or cast iron, hot-dipped galvanized or epoxy coating for 3 inches and larger.

C. Straightening Vanes: Non-corrosive material compatible with case material.

D. Intermediate gear train shall not come into contact with water and shall operate in suitable lubricant.

E. Registers: Automatic Meter Reading (AMR) type that provides pulse, contact closure, piezo switch or encoder generated output signal, compatible with City's radio and telephone AMR systems. Provide minimum 12-foot wire when permanently connected to register. Lens: impact resistant. Register box: tamper resistant by means of tamper screw or plug: Register: permanently sealed, straight-reading, center-sweep test hand, magnetic driven, U.S. gallons. Digits: 6, black in color, with lowest registering 3 digits (below 1,000-gallon registration) having contrasting digit and background color. Register capacity of meters: 9.99 million gallons for 5/8 inch to 2 inches and 999,999 million gallons for 3 inches and larger.

F. Connections: 5/8 inch to 1 inch: threads at each end; 1-1/2 to 2 inches: 2-bolt oval flanges each end; 3 inches and larger: flange at each end.
G. Stamp manufacturer's meter serial number on outer case. Stamp manufacturer's meter serial number on outside of register lid when provided. Manufacturer's serial numbers shall be individual and not duplicated.

H. Meters: Provide approved meters equip with AMR type register to connect to City of Houston's AMR system.

I. Manufacturing Quality Control shall permit successful interchangeability from one meter to another of same size including registers, measuring chambers and units, discs or pistons as units, change gears, bolts, nuts, and washers without affecting accuracy of new meter.

J. For water meter vaults provide:

1. 1/4-inch steel or aluminum with stainless steel hinge pins. Door shall open to 90 degrees and automatically lock in that position.

2. Provide approved meter vault covers.

2.02 METER APPLICATIONS

A. Meter type requirements to usage application

1. All meters must be compatible with the City of Houston automated meter reading (AMR) System and/or automated metering infrastructure (AMI) system.

2. Sizes 5/8-inch to 2-inch Meters: Displacement type excluding application exceptions notes in paragraph 2.02 A.3

3. Exceptions

   a. Meter types for sizes 1-inch to 2-inch NFPA 13-D, 13-R applications require prior approval by the City of Houston. (Displacement meters are not allowed for these applications).

   b. Applications where constant flow is required a 2-inch turbine type meter may be substituted.

B. Sizes 3-inch and above Meters:

1. Turbines:

   Processing plants
   Manufacturing facilities
   Lawn sprinkler systems
   Effluent water in treatment plants
Booster (pump) stations
Level controlled tank filling operations
Fire hydrants (transients)
Inter-systems sale or transfer
Sewer credit/sub-meter

2. Compounds:
Multi-family dwellings
Motels and hotels
Hospitals
Schools
Restaurants
Office buildings
Dormitories, nursing homes, department stores, shopping malls, and other commercial establishments

3. Fire Rated Turbines:
Open systems feeding directly from a tank

4. Fire Rated Compounds:
Combination domestic and fire services
Open system not feeding directly from a tank

5. Electromagnetic Meters:
Inter-system sale or transfer
Raw water
Basement or inside structure installations
Contract water
Above ground applications in potential hazardous chemical environs Meters larger than 10-inch.

C. Meter size requirements to flow considerations

Meter flow range is dependent on amount of pressure and slightly varies with manufacture.

<table>
<thead>
<tr>
<th>Flow Range</th>
<th>Max. Continuous Flow</th>
<th>Meter Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼ - 25 GPM</td>
<td>15 GPM</td>
<td>5/8” Positive Displacement</td>
</tr>
<tr>
<td>¾ - 70 GPM</td>
<td>50 GPM</td>
<td>1” Positive Displacement</td>
</tr>
<tr>
<td>1 ¼ - 120 GPM</td>
<td>80 GPM</td>
<td>1 ½” Positive Displacement</td>
</tr>
<tr>
<td>1 ½ - 170 GPM</td>
<td>100 GPM</td>
<td>2” Positive Displacement</td>
</tr>
</tbody>
</table>
Flow Range   Max. Continuous Flow   Meter Size
5 – 550 GPM   450 GPM          3” Turbine
15 – 1250 GPM 1000 GPM        4” Turbine
20 – 2500 GPM 2000 GPM        6” Turbine
30 – 4500 GPM 3500 GPM        8” Turbine
50 – 7000 GPM 5500 GPM        10” Turbine

Flow Range   Max. Continuous Flow   Meter Size
½ - 450 GPM   350 GPM          3” Domestic Compound
¾ - 1250 GPM 1000 GPM        4” Domestic Compound
1 – 2000 GPM 1400 GPM        6” Domestic Compound

¾/4 - 1200 GPM 1200 GPM        4” Fire Compound
1 ½ - 2500 GPM 2500 GPM        6” Fire Compound
2 – 4000 GPM 4000 GPM        8” Fire Compound
2 – 6500 GPM 6500 GPM        10” Fire Compound

D. Meter location preference hierarchy for 3” and Larger applications
Outline by order of preference for Meter Easement location. Any installation other than “D1.” requires approval from the Office of the City Engineer (OCE).

1. Adjacent to Public ROW
2. Not adjacent to Public ROW with water line easement.
3. Parking garage
4. Mechanical room area of basement
5. Public ROW
6. Above ground meter installations are required on potential hazardous chemical environs, and meters larger than 10”.

Note: Per chapter 7 of the City Of Houston Design Manual, Install separate tap and service lead for each domestic meter. Irrigation meters are to be branched off the domestic service.

Eligibility Requirements for Meter Easement Locations
Acronym Definition:
P.A.E.- Permanent Access Easement.
A.D.A.- American’s with Disabilities Act.
ROW- Right Of Way.
<table>
<thead>
<tr>
<th>Meter Location</th>
<th>Meter Easement</th>
<th>Water line Easement</th>
<th>P.A.E.</th>
<th>A.D.A. Requirements</th>
<th>Electric and Phone service</th>
<th>Encroachment permit</th>
<th>Min. Utility Spacing</th>
<th>Special Meter Vault, or Meter Setup Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade Level Easement Adjacent to ROW</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Grade Level Easement Not Adjacent to ROW</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Parking Garage</td>
<td>YES</td>
<td><strong>NO</strong></td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>NO*</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Mechanical Room in Basement</td>
<td>YES</td>
<td><strong>NO</strong></td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>NO*</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Public ROW</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Above Ground Installations</td>
<td>YES</td>
<td><strong>NO</strong></td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

* Provided structure does not encroach ROW

** Provided meter is set adjacent to ROW

2.03 MATERIALS

A. Cold-Water Meters:

1. Displacement Type: AWWA C 700; sizes 5/8 inch up to and including 2 inches; oscillating disc or piston of magnetic drive type; bolted split-case design, with either being removable.

2. Turbine Type: AWWA C 701; Class II; sizes 1 1/2 inches through 10 inches; flanged; straight-through measuring chamber; rotor construction: polypropylene or similar non-rubber material with specific gravity of approximately 1.0, equipped with near frictionless replaceable bearings in turbine working against rotor shaft positioned thrust bearing. Transient/Fire Hydrant Meter Inlet: Female fitting for attachment to hose nozzle with National Standard Fire hose thread. Outlet: 2-inch nipple with
National Pipe Thread. Include restriction plate to limit flow through meter to 400 gpm at 65 psi. 1 1/2 inches through 8 inches are to be furnished with test plugs in the outlet port of the meter for field testing.

3. Compound Type: AWWA C 702; sizes 2 inches through 6 inches. Measuring chambers: For use in continuous operation; separate units of copper alloy (minimum 84 percent copper) or approved polymer material, inert in corrosive potable water; with centering device for proper positioning. Measuring pistons: Non-pilot type with division plates of rubber covering vulcanized to stainless steel or other approved material of sufficient thickness to provide minimum piston oscillation noise. Measuring discs: Flat or conical type, one piece, mounted on monel or 316 stainless steel spindle. Measuring chamber strainer screen area: Twice area of main case inlet.

4. Fire-Service Type: sizes 4 inches through 10 inches; turbine-type, compound type, proportional type; AWWA C 703, with separate check valve conforming to AWWA C 510. Determine size of fire meter by adding fire flow and domestic flow.

2.04 STRAINERS

A. Displacement Potable Water Meters 5/8 inch through 2 inches: Self-straining by means of annular space between measuring chamber and external case or with strainer screens installed in meter. Provide rigid screens which fit snugly, are easy to remove, with effective straining area at least double that of main case inlet.

B. Potable Water Meters 2-inch diameter and larger: Equip with separate external strainer with bronze body for diameters less than 8 inches. 8-inch diameter and larger may be cast iron, hot-dipped galvanized or epoxy coating. Strainers: Bolted to inlet side of meter, detachable from meter, easily removable lid. Strainer screen: Made of rounded cast bronze, stainless steel wire, having nominal screen size of 3-1/2 mesh-per-inch (U.S. Series) not less than 45 percent clear area.

C. Provide separate approved external strainers (when required by meter manufacturer) approved for use in fire service metered connections by Underwriters Laboratories. Bodies: Cast iron or copper alloy. Ends: Flanged in accordance with ASME B 16.1, Class 125. Provide stainless steel basket. Strainers shall be detachable from meter.

2.05 CONNECTIONS AND FITTINGS

A. Provide pipe for connections in accordance with Section 02501 - Ductile Iron Pipe and Fittings and Section 02506 - Polyvinyl Chloride Pipe. Use restrained joints and flanged joints only.

B. Fittings:

1. For meters 2 inches and smaller: Same type of fittings as Outlet End fittings for Curb Stop in accordance with Section 02512 - Water Tap and Service Line Installation.
2. For meters 3 inches and larger: Restrained ductile iron; push-on bell joints or mechanical joint fittings between water line and meter vault; Class 125 flanged inside meter vaults; cement mortar lined and sealed.

2.06 LAYING LENGTHS

A. Minimum laying lengths for meter and standard strainer shall be as shown on Drawings.

PART 3 EXECUTION

3.01 TAPPING AND METER SERVICE INSTALLATION

A. Refer to Section 02525 - Tapping Sleeves and Valves for tapping requirements.

B. Meter Service Line:

1. Use pipe and fittings conforming to requirements of Section 02501 - Ductile Iron Pipe and Fittings, or Section 02506 - Polyvinyl Chloride Pipe.

2. Limit pulling and deflecting of joints to limits recommended by manufacturer.

3. Make vertical adjustments with offset bends where room will permit. Minimize number of bends as shown on detail drawings.

4. Provide minimum of ten pipe diameters of straight pipe length upstream and downstream of meter vault.

3.02 METER FITTING HOOKUP

A. Support meter piping and meter, level and plumb, during installation. Support meters 3 inches and larger with concrete at minimum of two locations.

B. Use round flanged fittings inside meter box or vault except for mechanical joint to flange adapter. Provide full-face 1/8-inch black neoprene or red rubber gasket material on flanged joints. Provide bolts and nuts made from approved corrosion-resistant material.

C. Tighten bolts in proper sequence and to correct torque.

D. Visually check for leaks under normal operating pressure following installation. Repair or replace leaking components.

3.03 METER BOX AND VAULT INSTALLATION

A. Conform to requirements of Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.
B. Perform adjustment to existing meter in accordance with Section 02085 - Valve Boxes, Meter Boxes, and Meter Vaults.

3.04 BASEMENT INSTALLATIONS FOR METERS

A. All piping within meter easement inside the building in basement must be welded steel to conform to section 02502 or restrained Ductile Iron to conform to section 02501. All transitions from PVC to Steel or Ductile iron must be made on the exterior side of the basement wall. All materials must be on the City approved list of materials.

1. The meter piping must conform to the City of Houston detail drawings for typical meter piping arrangement.

2. All pipes must be installed straight into the building.

B. 3” and larger meter installations for basements must be the Utility Customer Service approved for billing electromagnetic meter from the City Of Houston approved products list.

C. The customer must provide a NEMA type 4 enclosure 20”H x 16”W x 10”D for the mounting and containment of the meter electronics. The 120AC receptacle and phone jack must be installed in the enclosure.

D. The customer must provide and maintain 120AC power and phone line within five feet of the meter location.

1. The 120AC power must terminate with a GFI protected receptacle and be connected to the structures emergency back up power.

E. The customer must provide a phone line which can be a shared phone line.

1. Phone line must terminate with a phone jack inside the service rack enclosure.

F. The customer will be required to give the City of Houston the appropriate size meter easement to conform to the City of Houston Design Manual, with a minimum 8 feet clearance between floor and ceiling.

1. Meters installed in an interior room must be fitted with double doors for easy equipment access. A floor drain must be installed within the meter easement for water drainage.

2. The meter must be placed on the same floor level that the service line enters the structure. The service line must enter through the wall of the building. Use link seal method for pipe penetration thru wall as shown in City of Houston Detail Drawing.
3. The customer or property owner shall keep the space occupied by the meter free from rubbish or obstruction of any kind, and provide access in accordance to City of Houston Ordinance Chapter 47.

G. No signal from the meter will be shared, duplicated, or split for the customers use. Once the meter is installed and accepted by the City of Houston the meter, instruments, and all attachments becomes the sole property of the City of Houston.

3.05 CONTRACT METER INSTALLATIONS

A. All contract potable water and raw water accounts are required to install the Utility Customer Service approved for billing electromagnetic meter from the City Of Houston approved product list.

1. With exception of Emergency Backup System meters EBS which will be the approved mechanical type meter for the application.

B. All meter vaults must be designed to the City Of Houston standard detail drawings.

1. Meter installations larger than 10” that cannot be installed within the standard City vault, or meter installations in potential hazardous chemical environs must be installed above ground.

2. The City Of Houston Engineer’s office and the Meter Shop must approve an above ground meter installation.

3. All above ground meter installations must be painted to City of Houston specifications section 02527 and have freeze protection.

4. Above ground meter installations must have an 8’ tall perimeter fence with a gate when it is not inside a water plant facility.

C. All meter installations require meter easements and require a water line easement when meter easement is not adjacent to the City of Houston Right of Way.

1. All meters that are not located adjacent to the Public Right of Way must have an all weather hard surface road to the meter location.

D. All contract account customers must supply 120 AC voltage with a GFI receptacle and phone service with phone jack to be terminated in a NEMA type 4 enclosure 20”H x 16”W x 10”D at the meter location.

1. Electrical service to the City Of Houston meter station must be connected to the back up generator when installed within the districts plant facility.
2. 1” PVC electrical conduit must be installed from the enclosure to the meter for the meter electronics.

*Note: No customer will be allowed to share, split, duplicate, or disrupt any signal generated from the City Of Houston meter.*

3.06 TESTING

A. Accuracy registration tests will be conducted in accordance with latest revision of AWWA standard for type and size of meter.

1. Tests will be run by City of Houston on meters prior to installation at City's meter repair shop. Meters 2 inches and smaller will be tested at random at City's discretion. All 3 inches and larger meters will be tested.

2. Accuracy of displacement meters during guarantee period shall be as follows:

   a. Initial period: of 18 months from date of shipment or 12 months from date of installation: 98.5% to 101.5% at standard and minimum flow rates; 98% to 101% at low flow rates.

   b. Second period: AWWA new meter accuracy as tested below.

   c. Third period: AWWA new meter accuracy for standard flow rates and AWWA repair meter accuracy for minimum flow rate as tested below.

<table>
<thead>
<tr>
<th>Meter Size (inches)</th>
<th>GUARANTEE PERIOD</th>
<th>TEST FLOW RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age of Meter</td>
<td>Minimum Rate</td>
</tr>
<tr>
<td></td>
<td>Years Or Million*</td>
<td>(gpm)</td>
</tr>
<tr>
<td>5/8</td>
<td>&gt;1 to &lt;5</td>
<td>0.5</td>
</tr>
<tr>
<td>1</td>
<td>&gt;1 to &lt;5</td>
<td>1.0</td>
</tr>
<tr>
<td>1-1/2</td>
<td>&gt;1 to &lt;5</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>&gt;1 to &lt;5</td>
<td>5.5</td>
</tr>
</tbody>
</table>

* Total registration.
### GUARANTEE PERIOD

<table>
<thead>
<tr>
<th>Meter Size (inches)</th>
<th>Age of Meter (Years)</th>
<th>Million* Gallons</th>
<th>Standard Flow Rates (gpm)</th>
<th>Minimum Rate (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8</td>
<td>&gt;5 to &lt;10</td>
<td>1.5</td>
<td>2-15</td>
<td>1/4</td>
</tr>
<tr>
<td>1</td>
<td>&gt;5 to &lt;10</td>
<td>2.5</td>
<td>4-40</td>
<td>3/4</td>
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<td>2</td>
<td>&gt;5 to &lt;10</td>
<td>10.0</td>
<td>15-100</td>
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</tr>
</tbody>
</table>

* Total registration.

3. Minimal acceptable accuracy in percent of low flow registration for turbine meters:

<table>
<thead>
<tr>
<th>Meter Size (inches)</th>
<th>Minimum Flow (gpm)</th>
<th>% Accuracy Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
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<tr>
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<td>95</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
<td>95</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 02527

POLYURETHANE COATINGS ON STEEL OR DUCTILE IRON PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polyurethane coating system for use as steel pipe internal lining and external coatings, and external coating for ductile iron pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. No separate payment will be made for work performed under this Section. Include cost of polyurethane coatings in contract unit prices for steel pipe or ductile iron pipe.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

A. AWWA C 222 - Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings.


02527-1
07/01/2016
H. ASTM G 14 – Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)


J. NACE SP-0188 – Discontinuity (Holiday) Testing of Protective Coatings

K. NAPF 500-03 – Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings

L. SSPC-PA 2 - Measurement of Dry Paint Thickness with Magnetic Gauges.


N. SSPC-SP 1 – Solvent Cleaning Surface Preparation

O. SSPC-SP10 - Near-White Metal Abrasive Blast Surface Preparation

P. SSPC-SP11 – Power Tool Clean to Bare Metal

1.04 SAFETY

A. Secure, from manufacturer, Material Safety Data Sheet (MSDS) for polyurethane coatings and repair materials listed in this Section.

B. Safety requirements stated in this specification and in related sections apply in addition to applicable federal, state and local rules and regulations. Comply with instructions of coating manufacturer and requirements of insurance underwriters.

C. Follow handling and application practices of SSPC-PA Guide 10, and Coating Manufacturer's Material Safety Data Sheet.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit coating manufacturer's catalog sheets, product data sheets, material data sheets and other manufacturer’s information for all material provided. Include manufacturer’s recommendation and instructions for surface preparation, application and curing.

C. Quality Control Submittals. Furnish the following:
1. Shop and field applicator’s experience with list of references substantiating compliance. Submit references of 5 successful projects completed within the last 3 years for each applicator. Each project listed should be at least 500 linear feet in length, unless otherwise approved by Project Manager.

2. Monitoring records for shop coated pipe, including coating “affidavit of compliance” to requirements of this Section stating that coatings were applied in factory, in accordance with manufacturer’s requirements, and AWWA C222.

3. Factory applied coatings: Coating manufacturer’s certification stating that the individual coating applicators have met the qualification certification requirements as specified in this Section.

4. Upon request by Project Manager, provide:
   a. Manufacturer’s coating application Quality Control Manual
   b. Coating Performance Test report with statement that no reformulations have been made subsequent to the coating tests performed for the report.
   c. Current test equipment calibration certificates

5. Provide administrative documents showing that QA/QC personnel in both shop and field are certified as NACE International Coating Inspector (Level III).

6. Field applied coatings: Environmental monitoring records.

1.06 QUALITY ASSURANCE

A. Shop and Field Coating Applicator’s Experience and Certification:

1. Minimum 5 years’ practical experience in application of the specified products required for Coating Applicator and the coating application supervisor (Certified Applicator).

2. Minimum 2 years’ practical experience in application of the specified coating system required for Coating application personnel whom have direct coating application responsibility.

3. Certification by coating manufacturer as an approved coating applicator required for Coating Applicator.

B. Shop: Unless otherwise approved by Project Manager, coating manufacturer’s technical representative to be present for a minimum of three calendar days for
technical assistance and instruction at the start of coating operations within the shop. During this visit, technical representative to observe surface preparation and coating application, and conduct or observe tests of coating to ensure conformance with application instructions, recommended methods, and conditions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Use standard closed containers to prevent gelling, thickening deleteriously or forming of gas within period of one year from date of manufacture.

B. Label each container of separately packaged component clearly and durably to indicate date of manufacture, manufacturer's batch number, quantity, color, component identification and designated name or formula specification, number of coatings together with special instructions. Do not use coating components older than one year.

C. Deliver coating materials to pipe manufacturer in sealed containers showing designated name, batch number, color, date of manufacture and name of coating manufacturer.

D. Store material onsite in enclosures, out of direct sunlight in warm, ventilated and dry area. Protect from freezing.

E. Prevent puncture, inappropriate opening or other action which may lead to product contamination.

1.08 OBSERVATION OF WORK

A. Provide minimum 14 days advance notice to Project Manager before start of coating or lining work to allow for scheduling of shop or field observation.

B. Provide full access to Project Manager for all facilities and documentation regarding surface preparation, environmental conditions and coating applications.

C. Observation by Project Manager or waiver of observation does not relieve Contractor of his responsibility to perform work in accordance with Specifications.

D. Materials are subject to testing for conformance with this specification.

E. Project Manager may retain services of independent, third-party NACE CIP Level III-Certified Inspector for partial or full-time inspection of the work.
PART 2 PRODUCTS

2.01 GENERAL

A. Supply coating material in new, undamaged, labeled, unopened containers clearly and durably displaying date of manufacture, manufacturer’s batch number, component identification, component color, manufacturer’s name and product name. Store and handle in accordance with manufacturer’s written instructions. Discard coating material that exceeds manufacturer’s recommended shelf life, or is stored improperly, prior to usage, and replace with new material.

B. Clean, prime, and coat surfaces of pipe and fittings in accordance with referenced standards, written instructions by coating manufacturer, and these specifications.

C. Provide coating materials from single manufacturer. Product substitutions during project are not permitted without approval from Project Manager.

2.02 COATING MATERIAL

A. Coating System: ASTM D16 Type V thermoset, aromatic polyurethane plastic polymer in accordance with AWWA C222 (referred to as a polyurethane system).

B. Acceptable Materials:

1. DuraShield 210, 310 (External), DuraShield 210-61 NSF, 310-61 NSF (Internal), by LifeLast Inc., Pflugerville, TX,

2. Protec II (External), Protec II PW (Internal) by ITW PolySpec/Futura Coatings, Houston, TX,

3. Polyclad 777PL (External), Polyclad 767 (Internal) by Carboline, St. Louis, MO,

4. or approved equal.

C. Cured Coating Properties. In accordance with AWWA C222 except as follows:

1. ASTM E 96 Permeance using Water Procedure BW (App. X1): no more than 0.16 inch-lb.

2.03 SURFACE PREPARATION

A. The requirements listed below are for surface preparation procedures in the factory. For surface preparation in the field, refer to Part 3 – Execution.

B. Steel Pipe. In accordance with coating manufacturer’s requirements.
C. Ductile Iron Pipe. Prepare surface in accordance with manufacturer’s recommendations and NAPF 500-03.

1. Provide uncoated ductile iron pipe when polyurethane coatings are used. Do not apply asphaltic coating to ductile iron pipe and then attempt to remove prior to polyurethane coating application.

2. Do not apply surface preparation that is designed for steel pipe to ductile iron pipe. Unlike steel surfaces, it is possible to over blast the external surface of ductile iron pipe. Consult ductile iron pipe and polyurethane coating manufacturer regarding method of application and surface preparation to be used.

2.04 FACTORY APPLICATION OF POLYURETHANE

A. Equipment: As required by manufacturer.

B. Temperature: Minimum 5 degrees F above dew point temperature. Temperature of surface shall not be less than 50 degrees F during application or as per manufacturers recommendation.

C. Humidity: Heating of pipe surfaces may be required when relative humidity exceeds 80 percent.

D. Do not thin or mix resins; use as received. Store resins at temperature above 55 degrees F at all times or as manufacturers recommendation.

E. Application: Conform to coating manufacturer's recommendations. Apply directly to substrate to achieve specified thickness. Multiple-pass, one-coat application process is permitted provided maximum allowable recoat time specified by coating manufacturer is not exceeded.

F. Recoat only when coating has cured less than maximum time specified by coating manufacturer. When coating has cured for more than recoat time, follow coating manufacturers recommendations for recoating.

G. Cure and perform cure test in accordance with manufacturer’s recommendations prior to handling, inspection, testing, and placement in service.

2.05 FACTORY INSPECTION

A. Project Manager may inspect coatings at coating applicator's facilities.

B. Inspection procedures to be in accordance with AWWA C222. Conduct inspection any time after coating has reached initial cure. Repair in accordance with manufacturer’s requirements and these specifications.
C. Remove rejected coating from the full length of pipe to bare metal and reapply using proper application methods.

2.06 HOLDBACK COATING SYSTEM
   A. Provide holding primer for corrosion protection of cutbacks or holdbacks compatible with specified joint coating system and weld after backfill requirements, where applicable.
   B. Holdback coating to prevent corrosion of prepared pipe ends for duration of storage and construction, and recommended for buried exposures.
   C. Primer should not result in running or melting of coating and causing toxic fumes when heated during welding on weld after backfill joints.
   D. Apply holding primer in accordance with primer manufacturer’s recommendations, but maintain clearances required for proper joint installation as recommended by pipe manufacturer.
   E. Ductile Iron Joints: Apply coating to unlined pipe surfaces including inside of bell socket and outside of spigot. Coating thickness on sealing areas of spigot end of pipe exterior: minimum 8 mils (0.008 inch), maximum of 10 mils (0.010 inch). Maximum 10 mils may be exceeded in spigot end provided maximum spigot diameter as specified by pipe manufacturer is not exceeded and approved by pipe manufacturer.
   F. Welded joints:
      1. Field welded on the inside: Provide four-inch coating holdback on spigot end and six-inch coating holdback on bell end.
      2. Field welded on the outside: Provide six-inch coating holdback on the spigot end, and four-inch coating holdback on the bell end.

2.07 THICKNESS
   A. External Coatings: Minimum DFT of 25 mils (0.025 inch).
   C. Thickness Determinations: Use Type 1 magnetic thickness gauge as described in SSPC-PA2 specification. No single gauge reading may be less than specified thickness.
   D. Do not accept pipe with deficient coating thickness. If pipe in field is found to have a coating thickness as measured by SSPC PA-2 that is less than the specified thickness, the pipe segment shall be rejected.
FACTORY REPAIR OF INTERNAL AND EXTERNAL COATINGS

A. The procedures listed below are for repairs made to internal and external coatings in the factory. For field repairs, see Part 3 – Execution.

B. Defect size is defined as follows: Minor – less than 6 inches by greatest dimension. Major – exceeds 6 inches by greatest dimension.

C. General

1. Repair areas where holidays are detected or coating is visually damaged, such as blisters, bubbles, cuts, or other defects.

2. Provide coating repair materials that are compatible with the shop-applied coating system and approved by coating manufacturer.

3. Provide repair materials as required for the coating system and repair classification.

D. Repair Materials:

1. Provide polyurethane, single use kits that are supplied by parent coating manufacturer.

2. For major repairs in the shop, reapply using plural component spray equipment by a manufacturer certified coating applicator.

E. For internal coatings, five repairs maximum allowed per 100 square feet of pipe for internal linings. If this number is exceeded, pipe must be stripped of lining, re-blasted, and recoated in factory.

PART 3 EXECUTION

3.01 FIELD ENVIRONMENTAL CONTROLS

A. General

1. Do not apply coatings when:

   a. Surface or ambient temperatures exceed the maximum or minimum temperatures recommended by the coating manufacturer.

   b. In dust or smoke-laden atmosphere, blowing dust or debris, or under conditions that can cause icing on metal surface.
c. When it is expected surface temperatures may drop below 5 degrees above dew point within 4 hours after application of coating.

d. Whenever relative humidity exceeds 85 percent or the maximum recommended by the coating manufacturer.

2. When weather conditions dictate, provide and operate heaters and dehumidification equipment to allow pipe surfaces to be prepared and coated as specified and in accordance with the manufacturers coating application recommendations.

3. Do not proceed with surface preparation and coating application activities until adequate temperature and humidity controls are in place and functioning within environmental limits specified.

4. Monitor ambient temperature, relative humidity, dew point, temperature, and pipe surface temperature (work area only) in strict conformance with manufacturer’s requirements, but not greater than 5 hours between measurements. Document and submit environmental monitoring records to Project Manager upon completion, if requested.

3.02 PIPE INSTALLATION

A. When required by Project Manager, provide services of pipe manufacturer’s representative for period of not less than 2 weeks at beginning of actual pipe laying operations to advise Contractor regarding installation including but not limited to handling and storing, cleaning and inspecting, coatings repairs, and general construction methods as to how they may affect pipe coatings.

B. When required by Project Manager, coating manufacturer’s technical representative to provide a written report to the Project Manager for each visit. Include copies of test data collected, description of observations, and all recommended corrective actions. Submit within five working calendar days after the visit. After corrective actions are complete, representative to certify application complies with manufacturer’s coating application recommendations.

C. Use nylon straps, padded lifts and padded storage skids. Field cuts should be kept to minimum. Repair damage to coating due to handling or construction practices.

D. Just before each section of pipe is to be placed into trench, conduct visual and holiday inspection in accordance with AWWA C222. Repair defects in coating system before pipe is installed.

E. For field-welded joints, drape minimum 18-inch wide strip of heat-resistant material over top half of pipe on each side of the coating holdback to protect from weld spatter.
F. Provide transition from cement mortar lining to polyurethane lining in accordance with coating manufacturer’s recommendations and as approved by Project Manager.

3.03 FIELD REPAIR AND TOUCHUP

A. Apply repair and touchup materials in conformance with manufacturer’s recommendations.

B. Repair Procedure – Joints:

1. External Joints. Provide heat shrink sleeve in accordance with Section 02518 – Steel Pipe for Large Diameter Water Lines. Metal surface must be free of all dirt, dust, and surface corrosion prior to sleeve application. Where corrosion in the holdback area is visible, prepare surface in accordance with SSPC-SP11, Power Tool Cleaning to Bare Metal for steel pipe, or NAPF 500-03-03 Power Tool Cleaning for ductile iron pipe.

2. Internal Joints. Prepare surface and provide environmental controls in accordance with manufacturer’s recommendations.

   a. Remove oil or grease by solvent wiping pipe and adjacent coating in accordance with SSPC-SP1, Solvent Cleaning.

   b. Clean pipe surface in accordance with SSPC-SP11, Power Tool Cleaning to Bare Metal or abrasively blast in the field in accordance with SSPC-SP10, Near-White Metal Blast Cleaning. Clean the full circumference of the pipe and feather the edges of the existing polyurethane coating a minimum of two inches.

   c. Remove loose or damaged pipe lining at joint and repair as specified herein, or extend joint lining.

   d. Apply lining material by hand or spray equipment. Provide material that is compatible with shop lining and approved by manufacturer.

   e. Provide a NACE Level II or III inspector experienced with the applied coating system to inspect surface preparation of the joint lining and document application conditions. Submit documentation to Project Manager.

C. Repair Procedure – Field Defects:

1. Repair Materials (subject to Project Manager’s approval):

   a. Heat-applied repair patches
b. Single use polyurethane coating kits that control mix ratios

c. Coating manufacturer’s polyurethane coating repair products

2. Repair Procedures:

a. Solvent clean in accordance with SSPC-SP1 for steel pipe or NAPF 500-03-01 for ductile iron pipe.

b. Power tool clean in accordance with SSPC-SP11 for steel pipe and NAPF 500-03-03 for ductile iron pipe. Feather the coating and provide overlap in accordance with a manufacturer’s recommendations.

c. Apply repair material as described above in accordance with manufacturer’s recommendations.

d. If a heat-applied repair patch is used, do not overlap patches or use more than one patch for a single repair. If repair area exceeds the size of a single patch, use alternate repair method as listed above.

D. Repair Procedure - Thermite Brazed Connection Bonds:

1. Remove polyurethane coating with power wire brush from area on metal surface which is to receive thermite brazed connection.

2. Grind metal surface to shiny metal with power grinder and coarse grit grinding wheel.

3. Apply thermite-brazed connection using equipment, charge and procedure recommended by manufacturer of thermite equipment.

4. Drape minimum 18-inch wide strip of heat-resistant material over top half of pipe on all sides during welding to protect from weld spatter.

5. After welded surface has cooled to temperature below 130 degrees F, apply protective coating repair material to weld, exposed pipe surface and damaged areas of polyurethane coating. A heat-applied repair patch may be used as approved by Project Manager.

6. Do not cover or backfill freshly repaired areas of coating at thermite-brazed connection until repair material has completely cured. Allow material to cure in conformance with manufacturer's recommendations.

END OF SECTION
SECTION 02528

POLYETHYLENE ENCASEMENT/WRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polyethylene encasement that may be part of the corrosion protection system for pipe, valves, fittings, and other appurtenances in ductile or cast iron systems.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for polyethylene wrap. Include cost of polyethylene wrap in unit price for pipes and fittings to be wrapped.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


G. ANSI/AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.

1.04 SUBMITTALS
A. Submittal Procedures: Submit product data in accordance with Section 01330 - Submittal Procedures.

B. Product Data: Submit product data for proposed film, and tape or plastic tie straps for approval. All film to be used in accordance with this standard specification will be manufactured from virgin polyethylene, will not be recycled and shall be purchased new for the project, clean, sound and without defects.

C. Samples: Submit samples of polyethylene tube and/or sheet for approval. Provide one sample of tube for each pipe diameter and one sample of each sheet material to be used. Samples will be a minimum of 40 square feet of standard production material.

D. Quality Assurance Plan: Submit quality assurance plans for film manufacturing and field application.

1. Film Manufacturing: The manufacturer of polyethylene film for corrosion protection encasement of ductile iron pipe will have a verifiable quality control system to assure that film is produced from only virgin polyethylene and that it complies with all requirements of this specification. Documentation of Quality Control procedures and test results will be submitted and will be made available for inspection for at least one year subsequent to delivery to job site.

2. Field Application: The contractor will develop, and submit for approval, a comprehensive Quality Assurance Plan for installation of polyethylene encasement. Address all aspects of material and pipe handling, bedding, preparation of pipe surface, film installation and anchoring, service taps and backfill. Include written procedures to be used by installers.

E. Manufacturer’s Certification: Submit polyethylene film manufacturer’s certification of compliance with this Section. The polyethylene film manufacturer will provide a notarized statement from an officer of the company that the film meets the inspection and all applicable material specifications of this specification. The manufacturer’s statement of compliance must be verifiable. Statements from distributors or contractors will not be accepted in lieu of a statement from the original manufacturer of the polyethylene film.

F. Installer Qualifications: Polyethylene encasement will only be installed by qualified persons who have been trained in the proper procedures described in Part 3 of these specifications.

Qualified Persons: Qualified persons shall be those that have had training and experience in the installation of polyethylene encasement for corrosion protection of ductile iron pipe. Such persons may be qualified by the Ductile Iron Pipe Research Association, ductile iron pipe manufacturers or engineering/inspection firms who offer training courses in the proper.

G. method(s) of installation. Proof of qualifications shall be submitted with the shop drawings and shall be provided to project inspectors upon request.
PART 2    PRODUCTS

2.01    MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks or defects, conforming to the following requirements.

1. High-Density, Cross-Laminated, Polyethylene: High–density, cross-laminated polyethylene film manufactured from virgin polyethylene material conforming to the following:

   a. Raw Material. Raw materials to meet the requirements of ASTM D 4976:

      1. Group: 2 (Linear)
      2. High-density: 0.940 to 0.960 g/cm³
      3. Volume resistivity: $10^{15}$ ohm-cm, minimum

   b. Physical Properties. Physical properties of finished film to be as follows:

      1. Tensile Strength: 6,300 psi, minimum in machine and transverse direction (ASTM D 882).
      2. Elongation: 100 percent, minimum in machine and transverse direction (ASTM D 882) as measured using rubber lined grips.
      3. Dielectric Strength: 800 volts/mil thickness, minimum (ASTM D 149)
      4. Impact Resistance: 800 grams, minimum (ASTM D 1709 Method B)
      5. Propagation Tear Resistance: 250 grams force, minimum in machine and transverse direction (ASTM D1922)

   c. Thickness: High-density, cross-laminated polyethylene film shall have a nominal thickness of 0.004 in. (4 mils) with a minus 10% tolerance. No where shall the film be less than 0.0036 (3.6 mils).

   d. Color: Supply white polyethylene film with a minimum 2 percent hindered-amine ultraviolet inhibitor.

   e. Polyethylene Tube and Sheet Size: For push-on joint pipe, polyethylene tube and sheet sizes to conform to the following:
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<tr>
<th>Nominal Pipe Diameter</th>
<th>Minimum Polyethylene Width – Inches</th>
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<td>Inches</td>
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2. Large Bell Circumferences: Where bell ends of the pipe are larger than the sheet sizes listed above, use sufficiently large tubes or sheets to cover the joints.

3. Marking: The polyethylene film will be clearly marked every two feet with the following information:

a. Manufacturer's name or trademark
b. Year of manufacture
c. ANSI/AWWA C105/A21.5
d. Minimum film thickness and material type (HDCLPE)
e. Applicable range of nominal pipe diameter size(s)
f. Warning – Corrosion Protection – Repair Any Damage

Letters and numerals used for marking items "a" through "e" shall not be less than 1 inch in height and item "f" shall not be less than 1 1/2 inches in height.
B. Plastic Tape: Provide 1 ½-inch wide, 6 mil thick, PVC tape with 5 mils of PVC backing and 1 mil of rubber adhesive for fitting, anchoring and repairing the encasement.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to effect a snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap. Circumferentially wrap with tape, every two feet along the barrel.

3.02 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to a length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section. Bunch accordion-fashion lengthwise until it clears pipe ends.

2. Make shallow bell hole at joints to facilitate installation of polyethylene tube completely around pipe. Lower pipe into trench and make up pipe joint with preceding section of pipe. Methods other than bell holes shall be allowed, provided the polyethylene tube completely encases the pipe joints, including a minimum overlap of 1-foot.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place.

4. For each pipe length, take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold with tape at quarter points. Avoid a tight fit to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell and spigot
joints, restrained and bolted joints, and fittings; and to prevent damage to film during backfilling. The length of tape to secure wrap shall be no less than 1-foot.

5. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Tubular Type (Method B):

1. Cut polyethylene tube to a length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end.

2. Make shallow bell hole at joints to facilitate installation of polyethylene tube completely around pipe. Lower pipe into trench and make up pipe joint with preceding section of pipe. Methods other than bell holes shall be allowed, provided the polyethylene tube completely encases the pipe joints, including a minimum overlap of 1-foot.

3. Take up slack width at top of pipe to make a snug, but not tight, fit along barrel of pipe, securing fold with tape at quarter points. Avoid a tight fit to prevent stretching the polyethylene where it bridges irregular surfaces, such as bell and spigot joints, restrained and bolted joints, and fittings; and to prevent damage to film during backfilling. The length of tape to secure wrap shall be no less than 1-foot.

4. Before making up joint, slip 4-foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 4-foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least 1 foot; make each end snug and secure.

5. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type (Method C) – Applicable to Valves, Tees, Elbows and Other Fittings Only:

1. Cut polyethylene sheet to a length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Installation in Augured Hole or Directional Drilled Bore:

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E. Install as described in 3.02A. Tubular Type (Method A) with the exception that the polyethylene encasement overlap must face away from the pull direction to avoid the under film accumulation of drilling mud and other foreign matter.

F. Attach pulling head to spigot end of the leading pipe length.

G. Securely anchor the polyethylene tube to the end of the barrel of the leading pipe length by continuously taping the leading two feet of the barrel with overlapping tape wrap. Anchor the first wraps of tape directly on to the barrel of the pipe and extend the continuous taping on to the polyethylene encasement. For the remainder of the leading pipe length, overlap circumferential wraps of tape every one foot.

H. The drilling fluid and cuttings shall not enter under the polyethylene tube during the pull back or other operations. At assembled joints, the polyethylene overlap shall always have the forward pipe’s polyethylene tube overlap the next following pipe’s tube. The polyethylene on both sides of the joint shall be secured with circumferential wraps of tape or plastic tie straps.

I. Continue process by wrapping tape on each side of successive joints and every two feet along barrel.

E. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

F. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. At valve stems and other penetrations, secure polyethylene film with tape.

G. Openings in Encasement: Create openings for branches, saddles, service taps, blowoffs, air valves, and similar appurtenances by making an X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape.

H. Hydrant Drain Relief: For hydrant relief holes and similar orifices, apply 3 wraps of tape completely around the polyethylene encased pipe, then, with a utility knife, cut a hole in the tape and polyethylene that is 1-inch larger in diameter than the orifice/opening.

I. Direct Service Taps: For direct service taps, apply 3 wraps of tape completely around the polyethylene encased pipe to cover the area where the tapping machine and chain will be mounted. After the tapping machine is mounted, install the corporation stop directly through the tape and polyethylene. After the direct tap is completed, the entire circumferential area shall be closely inspected and repaired as needed.

J. Service Connections: Wrap service lines of copper and other dissimilar metals with polyethylene or suitable dielectric tape for a minimum clear distance of 3 feet away from the cast or ductile iron
pipe. Surface preparation and method of application shall follow tape manufacturer’s written instructions.

K. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for at least 3 feet. Secure end with circumferential turns of tape.

L. Installation of Pipe through Casings: Polyethylene encasement shall be used for pipe through casings. Use a single layer of polyethylene film. Casing spacers (insulated type) and casing end seals shall be installed. Do not damage the polyethylene film where these devices are attached to the pipe, over the encasement.

3.03 REPAIRS

Repair any cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

3.04 BACKFILL

Use the same backfill material as that specified for pipe without polyethylene wrap. Prevent damage to the polyethylene wrap when placing backfill. Assure backfill material is free from cinders, refuse, boulders, rocks, stones, or other material that could damage the polyethylene. Follow AWWA C600 for backfilling.

3.05 QUALITY ASSURANCE

A. Freedom from Defects: All polyethylene film shall be clean, sound and free from defects.

B. Inspection: All parts of this Section are subject to inspection by the City of Houston or its designated representative.

C. Non-Compliance: The Contractor will correct any deficiencies in materials or installation at his expense, including excavating the pipe subsequent to backfilling and re-installing the polyethylene wrap.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Preparing surfaces, providing adequate conditions for proper workmanship, furnishing, and applying tape coatings on external surfaces of steel pipe.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for tape coatings. Include payment in unit prices for items to which coatings are applied.

2. Refer to Section 01270 – Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

A. AWWA C 209 – Cold-Applied Tape Coatings for Steel Water Pipe, Special Sections, Connections and Fittings

B. AWWA C 214 – Tape Coatings for Steel Water Pipe

C. AWWA C 216 – Heat-Shrinkable Cross-Linked Polyolefin Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Water Pipelines

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 – Submittal Procedures.

B. Submit tape manufacturer’s catalog sheets, product data sheets, material data sheets and other information for all material provided. Include manufacturer’s recommendation and instructions for surface preparation.

C. Quality Control Submittals. Furnish the following:

1. Shop and field applicator's experience with list of references substantiating compliance. Submit references of 5 successful projects completed within the last 3 years for each
applicator. Each project listed should be at least 500 linear feet in length, unless otherwise approved by Project Manager.

2. Shop applied coatings:
   a. Coating manufacturer’s certification stating that the individual coating applicators have met the qualification certification requirements as specified in this Section.
   b. Monitoring records, including coating "affidavit of compliance" to requirements of this Section stating that coatings were applied in factory, in accordance with manufacturer's requirements, and AWWA C214.

3. Upon request by Project Manager, provide:
   a. Manufacturer's coating application Quality Control Manual
   b. Coating Performance Test report with statement that no reformulations have been made subsequent to the coating tests performed for the report.
   c. Current test equipment calibration certificates

4. Provide administrative documents showing that QA/QC personnel in both shop and field are certified as NACE International Coating Inspector (Level III).

1.05 QUALITY ASSURANCE

A. Shop and Field Coating Applicator’s Experience and Certification:
   1. Minimum 5 years’ practical experience in application of tape coating.
   2. Certification by tape coating manufacturer as an approved applicator.

B. Shop: Unless otherwise approved by Project Manager, coating manufacturer’s technical representative to be present for a minimum of three calendar days for technical assistance and instruction at the start of tape coating application within the shop. During this visit, technical representative to observe surface preparation and coating application, and conduct or observe tests of coating to ensure conformance with application instructions, recommended methods, and conditions.

C. Project Manager may retain services of independent, third-party NACE CIP Level III-Certified Inspector for partial or full-time inspection of the work.

1.06 OBSERVATION OF WORK

A. Provide full access to Project Manager for all facilities and documentation regarding surface preparation, environmental conditions and coating applications.
B. Require the protective coating manufacturer to furnish a qualified technical representative to visit the project site for technical support as may be necessary to resolve field problems attributable to or associated with manufacturer’s products.

C. Materials are subject to testing for conformance with this specification.

D. Project Manager may retain services of independent, third-party NACE Level III-Certified Inspector for partial or full-time inspection of the work.

PART 2 PRODUCTS

2.01 SHOP-APPLIED TAPE COATING

A. Prefabricated polyolefin tape applied as a four layer system consisting of liquid adhesive, corrosion-preventive tape (inner layer), mechanical protective tape (intermediate layer), and mechanical-protective tape (outer layer) in accordance with AWWA C214.

1. For steel pipe fittings, provide hand-applied tape wrap in accordance with AWWA C209 or heat shrink sleeves in accordance with AWWA C216.

B. Acceptable Materials:

1. Polyken® YGIII by Berry Plastics,

2. or approved equal.

C. Provide one 20 mil inner layer for corrosion protection and two 30 mil layers of intermediate and outer tape for mechanical protection. Total nominal thickness: 80 mil.

D. At outlets, prior to applying tape, provide approved filler putty to fill in gap for smooth, sloped transition between top of reinforcing plate and pipe.

E. Liquid Adhesive: Compatible with tape coating, supplied by coating system manufacturer.

F. Coating holdback: 4 to 4 ½ inches from joint end to facilitate joining and welding of pipe. Taper successive layers by 1 inch staggers to facilitate field wrapping and welding of joints.

G. Width: 12 or 18 inches.

H. Do not expose tape coating to direct sunlight longer than recommended by the tape coating manufacturer.
2.02 SURFACE PREPARATION

A. Expel moisture from pipe surface prior to application using pre-heating.

B. Clean bare pipe from mud, mill lacquer, wax, oil, grease, rust, mill scale or other contaminants. Inspect and clean surfaces according to SSPC SP 1. Allow cleaning solvent to dry prior to coating application.

C. Blast clean in accordance with SSPC SP-6. Provide anchor profile of at least 1.5 mils, but no greater than 3.0 mils.

D. Remove surface imperfections such as slivers, scabs, burrs, weld spatter, and gouges by hand filling or grinding. Presence of metallic defects may be cause for rejection of pipe.

E. Before applying inner-layer tape, grind weld seams flush for a distance of 18 in. along the length of pipe on both ends.

F. Cover weld seams with stripping tape when weld reinforcement is greater than 3/32 in. or if profile and position of weld seam prevents conformability of tape coating to the steel surface.

2.03 SHOP APPLICATION

A. Follow procedures as recommended by tape coating manufacturer.

B. Separate tape dispensing equipment far enough apart to visually inspect continuous steps.

C. Make cutbacks straight and for total thickness of coating.

D. State of dryness of liquid adhesive prior to application of weld strip and inner layer of tape to be in accordance with written recommendation of manufacturer.

E. Apply weld strip tape over liquid adhesive and extend minimum of one inch on each side of weld seam. Weld strip tape may contact rollers as long as release liner is in place and adhesion requirements are met.

F. Remove release liner of weld strip tape before applying inner layer of tape.

G. Spirally apply inner layer of tape in direction of pipe helix weld. Overlap each spiral of tape 1 inch or greater with next successive spiral of tape applied.

H. Perform electrical inspection of inner layer of tape before intermediate layer of tape is applied. If holiday is detected, repair immediately using manufacturer-approved tape patch, prior to applying intermediate layer of tape. Patch to extend minimum 3-inches in all directions. Perform electrical retest at repaired area, and if no holidays are found, proceed with outer layer application.
I. Repair holidays visually or electrically discovered in completed tape coating by peeling back and removing outer intermediate and inner layers from damaged area. Repair exposed area by applying liquid adhesive and a layer of inner tape or inner tape patch. Provide lap of 4-inches minimum in all directions. Re-test repaired area with holiday detector. If no holidays are found, cover with intermediate and outer-layer tape patches with minimum lap of 4 inches in all directions beyond inner-tape patch.

PART 3 EXECUTION

3.01 FIELD INSPECTION AND TESTING

A. Inspect pipe coating for holidays and damage to coating.

B. Until final acceptance of the coatings, furnish inspection devices in good working condition for the detection of holidays. Provide the services of a Level II or III NACE certified coating inspector for all holiday detection work until the final acceptance of such coatings. Operate holiday inspection devices in the presence of the Project Manager.

C. Perform test procedure in accordance with NACE Standard RP 02 74. Perform electrical holiday test with 60 cycle current audio detector. Use test voltage below:

<table>
<thead>
<tr>
<th>Total Nominal Coating Thickness (mils)</th>
<th>Test Voltage (Volts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>11,500</td>
</tr>
<tr>
<td>80</td>
<td>12,000</td>
</tr>
</tbody>
</table>

3.02 FIELD REPAIRS

A. If test indicates no holidays and outer or intermediate wrap is torn, remove damaged layers of tape by carefully cutting with sharp razor-type knife. Apply holiday detector to exposed area to confirm that no damage has been made to inner tape layer. Wash with Xylol area to be patched and at least 4 inches of undamaged tape where hand applied tape wrap will overlap. Replace each layer of tape with a tape patch with minimum 4-inches overlap in all directions as specified by manufacturer.

B. If test indicates holiday, remove outer and intermediate layers and expose inner wrap. Prime exposed area and overlaps with light coat of liquid adhesive. Firmly press into place patch of two 35 mil inner wrap tape extending 4 inches from affected area in all directions. Second patch to overlap first patch by 4 inches. Perform holiday test of patch to verify satisfactory installation. Wash exposed outer wrap tape with Xylol and prime with liquid adhesive. Place outer layer patch with an overlap of 4-inches in all directions.
C. For severe outer or intermediate wrap tape tears or damage, and holiday is not detected, remove outer wrap to boundaries of damaged area, taking care not to damage inner wrap coating. Before replacing outer and intermediate wraps, apply holiday detector to exposed area to determine that no damage has been made to the primary coating. After verification that no holidays exist in underlying tape, clean damaged area and use repair patch. Apply as specified herein for repair of areas where bare pipe is exposed.

D. Do not allow bubbles in tape coating regardless of holiday test results. Cut out bubbles and patch as described above.

E. Perform surface preparation and coating applications in the presence of the Project Manager, or his appointed NACE certified coating inspector, unless Project Manager has granted prior approval to perform the work in their absence.

F. Inspection by the Project Manager or the NACE certified inspector, or the waiver of inspection of any particular portion of the work, does not relieve the Contractor of his responsibility to perform the Work in accordance with these Specifications.

END OF SECTION
PART 1    G E N E R A L

1.01 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis, complete in place, including sewer pipe, connections to existing manholes, post installation television inspection and testing. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.

2. Payment for television inspection of existing gravity sanitary sewer will be on a linear foot basis. Measurement will be taken along centerline of pipe from centerline to centerline of manholes. See Section 02558 - Cleaning and Television Inspection.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit proposed methods, equipment, materials and sequence of operations for sewer construction. Plan operations so as to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Videos become property of City.

1.04 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers.
B. Regulatory Requirements.

1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.

2. Make notification to Project Manager when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.

3. Lay gravity sewer lines in straight alignment and grade.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 PRODUCTS

2.01 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Unlined reinforced concrete pipe is not acceptable.

C. Pipe shall be color coded green.

2.02 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in one or more of following Sections:

1. Section 02427 - Plastic Liner for Large-Diameter Concrete Sewers and Structures.

2. Section 02501 - Ductile Iron Pipe and Fittings.

3. Section 02504 - Fiberglass Reinforced Pipe.
4. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe.
5. Section 02506 - Polyvinyl Chloride Pipe.
7. Section 02611 - Reinforced Concrete Pipe.

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.03 APPURTENANCES

A. Stacks. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

B. Service Connections. Conform to requirements of Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.04 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Conform to requirements of Section 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Materials, and Section 02321 - Cement Stabilized Sand.

B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Section 01555 - Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.
C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Section 02260 - Trench Safety System for excavations over 5 feet deep.

D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Project Manager and agency or utility company for repairs or relocations, either temporary or permanent.

E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

F. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

G. Do not allow sand, debris or runoff to enter sewer system.

3.02 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Project Manager.

B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.

C. No sewage shall be diverted into area outside of sanitary sewer.

D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Project Manager so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Project Manager.

3.03 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Section 02317 - Excavation and Backfill for Utilities.
3.04 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Project Manager.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Project Manager.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full 18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 1 foot separation distance.

L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.05 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.
B. For rehabilitation of existing sewer lines, conform to requirements of specification Section 02550 - Sliplining, Section 02556- Cured-In-Place Pipe or Section 02571- Pipe Bursting.

3.06 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections to conform to requirements of Section 2534 - Sanitary Sewer Service Stubs or Reconnections.

B. Stacks. Construct stacks to conform to requirements of 02534 - Sanitary Sewer Service Stubs or Reconnections.

C. Construct manholes to conform to requirements of Section 02081 - Cast-in-Place Concrete Manholes, Section 02082 - Precast Concrete Manholes, and Section 02083 - Fiberglass Manholes, as applicable. Install frames, rings, and covers to conform to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

3.07 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers.

B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Section 02533 - Acceptance Testing for Sanitary Sewers.

C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Section 02533 - Acceptance Testing for Sanitary Sewers. Maintain piezometer installed to conform with Section 01578 - Control of Ground Water and Surface Water, until acceptance testing is completed.

3.08 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Backfill trench in specified lifts only after pipe installation is approved by Project Manager.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Section 02951 - Pavement Repair and Resurfacing.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil as specified in Section 02911 - Topsoil and apply hydromulch according to requirements of Section 02921 - Hydromulch Seeding.

E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as
indicated on Drawings. Provide minimum of 4 inches of topsoil per Section 02911 - Topsoil. Sod disturbed areas in accordance with Section 02922 - Sodding.

3.09 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and closed circuit television inspection. Post installation television inspection shall be performed in accordance with Document 02558 – Cleaning and Television Inspection.

B. Provide TV inspection reports and video submittals in accordance with Document 02558 – Cleaning and Television Inspection for each line segment submitted.

C. Upon completion of video review, Contractor will be notified regarding final acceptance of sewer segment.

END OF SECTION
Section 02534

SANITARY SEWER SERVICE STUBS OR RECONNECTIONS

PART 1  GENERAL

1.01 SECTION INCLUDES

A. Installation of service stubs in sanitary sewers serving areas where sanitary sewer service did not previously exist.

B. Reconnection of existing service connections along parallel, replacement, or rehabilitated sanitary sewers.

C. Installation of sanitary sewer service stubs, within street right-of-way, terminating with a clean-out and a plug at the right-of-way to allow for future connection of a single service, or at a double-wye fitting plugged at both to allow for future connection to two services.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for sanitary sewer service stubs or service reconnections with stacks located within 5 feet of sanitary sewer main centerline is on unit price basis for each stub or reconnection. Payment will be made for each service stub or reconnection installed complete in place, including service connections, couplings, and adapters disconnecting existing services, reconnecting new service, fittings, excavation, and backfill.

2. Payment for sanitary sewer service stubs or service reconnections without stacks located within 5 feet of sanitary sewer main is on unit price basis for each stub or reconnection. Payment will be made for each service stub or reconnection installed complete in place, including service connections, couplings, and adapters disconnecting existing services, reconnecting new service, fittings, excavation, backfill and testing.

3. Payment for sanitary sewer service leads beyond 5 feet from the right-of-way and clean-outs shall be paid as follows:

a. Payment for sanitary sewer service leads beyond 5 feet from the right-of-way clean-out, connection or reconnection shall be paid for on a linear foot basis. Measurement shall be taken along the centerline of the pipe from the centerline of the lead connection or stack at the sanitary sewer main and shall end 5 foot from the right-of-way. Payment will be made for each linear foot.
of pipe installed, complete in place, including sewer pipe, excavation, shoring, bedding, backfill, and accessories. Auger pipe for service stubs will be paid as provided in Section 02448 – Pipe and Casing Augering.

b. Payment for standard 6-inch clean-out on service lead assembly for a single or double future service connection installed at end of lead is on a unit price basis for each assembly and shall include all portions of the lead and service connection with clean-out within 5 feet of the right-of-way. Payment will be made for each assembly installed and complete in place, including excavation, fittings, offsets, plugs, pipe sections, valve boxes, bedding, backfill, and testing.

4. Pay estimates for progress payments will be made as measured above according to following schedule:

   a. An estimate for 95 percent payment will be authorized when reconnection is completely installed and backfilled.

   b. An estimate for 100 percent payment will be authorized when reconnection has been tested as specified in Section 02732 - Acceptance Testing for Sanitary Sewers.

5. One or more connections discharging into common point are considered one service connection. Contractor shall not add service reconnections without approval of Project Manager. Project Manager may require connections to be relocated to avoid having more than two service connections per reconnection.

6. Protruding service connections which must be removed to allow liner insertion are paid as service reconnection when connected. If abandoned, they will be paid as abandoned connection.

7. Payment for abandonment of service connection is on unit price basis for each abandoned connection. No separate payment will be made for abandonment of service connection unless excavation is required. No separate payment will be made for excavation of sanitary sewer services within new or replacement sewer trench.

8. No separate payment will be made for removal of existing sanitary sewer service stubs. Include payment in unit price for Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

9. No separate payment will be made for abandoned service connection when service to be abandoned is within 4 feet of active connection. Payment for only one abandoned service connection will be allowed when second abandoned connection is within 4 feet of first.
10. If faulty remote cut is later corrected using procedures specified for reconnection by excavation, only one reconnection will be allowed for payment.

11. Sanitary Sewer Cleanout on Service Lateral shall be provided in accordance with detail provided. Payment is on per each basis as indicated in Document 00410B.

12. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


D. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.04 PERFORMANCE REQUIREMENTS

A. Accurately locate in field all proposed service stubs along new sanitary sewer main.

B. Accurately locate in field existing service connections and proposed service stubs along alignment of new parallel or replacement sewer main.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for each pipe product, fitting, coupling and adapter.

C. Show reconnected services on record drawings. Give exact distance from each service connection to nearest downstream manhole.

D. Submit Post-installation television inspection videos in accordance with Document 02558 – Cleaning and Television Inspection.
PART 2  PRODUC TS

2.01 PVC SERVICE CONNECTION

A. As stub outs, use PVC sewer pipe of 4-inch through 10-inch diameter, conforming to ASTM D 1784 and ASTM D 3034, with cell classification of 12454. SDR (ratio of diameter to wall thickness) shall be 26 for pipe 10 inches in diameter or less.

B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D 3212.

C. Provide service connection pipe in sizes shown on Drawings. For reconnection of existing services, select service connection pipe diameter to match existing service diameter. Reconnections to rehabilitated sanitary sewer mains shall be limited to following maximum service connection diameter:

<table>
<thead>
<tr>
<th>Sewer Diameter</th>
<th>Maximum Service Connection Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8” or less</td>
<td>4”</td>
</tr>
<tr>
<td>10” or greater</td>
<td>6”</td>
</tr>
</tbody>
</table>

D. Subject to above limits, provide 6-inch service connection when more than one service discharges into single pipe.

E. Connect service pipes to parallel or replacement sewer mains with prefabricated, full-bodied tee or wye fittings conforming to specifications for sewer main pipe material as specified in other Sections for sewers up to 18 inches in diameter.

F. Where sewers are installed using pipe augering or tunneling, or where sewer is greater than 18 inches in diameter, use three-piece service connection or pipe saddle conforming to ASTM C-923 to connect service to sewer main.

2.02 PIPE SADDLES

A. Use pipe saddles only on rehabilitated sanitary sewer mains. Comply with Paragraph 2.01E for new parallel and replacement sanitary sewer mains.

B. Supply one-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish complete seal. Use saddle fabricated to fit outside diameter of connecting pipe. Protruding lip of saddle must be at least 5/8-inch long with grooves or ridges to retain stainless steel band clamps.

C. Use 1/2-inch stainless steel band clamps for securing saddles to liner pipe.
2.03 COUPLINGS AND ADAPTERS

A. For connections between new PVC pipe stubouts and existing service, 4-, 6-, or 8-inch diameter, use flexible adapter coupling consisting of neoprene gasket, stainless steel shear rings with 1/2-inch stainless steel band clamps, and two nut and bolt clamps. For connections that are 10- inches or over, use neoprene gasket, with stainless steel shear band, and two stainless steel nut and bolt or T-Bolt clamps. Thermalized plastics are not allowed. Refer to approved couplings and adaptors.

1. Product characteristics, meet ASTM C1173 and requirements for neoprene rubber and metallic components.

2. Shear Band: ½ inch 300 series stainless steel shear band with two molded on worm gear clamps (ASTM A240)

3. Clamps: 300 Series nut and bolt clamp band fabricated from AISI Type 316 stainless steel (ASTM A240)

B. For connections between new PVC pipe stubout and new service, use approved rubber-gasket adapter coupling conforming to requirements of 2.03A.

C. Couplings and Adaptors components will be in accordance with following Requirements:

1. Neoprene Rubber. 100% rubber. Thermalized plastics are not allowed.
   b. Elongation at break, % (ASTM D412, ASTM D638). Initial value: 200 Value after 112 days: 200
   c. Shore Durometer, Type A, point change max (ASTM D2240). Initial value (1 sec. reading, min): 60. Value point change max: 15
   d. Compression Set -- Chemical exposures, % max (ASTM D395 Method B). Initial Value: 20 max. Value after exposure: 20 max
   e. Compression Set -- Bacteriological, unconditioned surface dry, % max (ASTM D395 Method B): Initial value 20. Value after 112 day: 20
   f. Water Absorption, % max (ASTM D570). Initial value: 4. Value after 112 days: % max ≥4
g. Aged Tensile (psi) -- Tensile strength (after exposure to 300 psi (2100 kPa) oxygen at 158° ± 1.8°F [70° ± 1°C] for 96 hours), % of initial, min (ASTM D572). Initial: 70 min. After accelerated aging: 70 min.

h. Aged Elongation -- Elongation at break (after exposure to 300 psi (2100 kPa) oxygen at 158° ± 1.8°F [70° ± 1°C] for 96 hours), % of initial, min. (ASTM D572). Initial value: 70 min. Test after accelerated aging: 70 min.

i. Ozone resistance (after exposure to 100 pphm ozone for 50 hours at 104° ± 2°F [40° ± 1°C]), (ASTM D518, procedure C, and ASTM D1149). Initial value: No cracking. After exposure: No cracking

j. Weight Change, % max. (approx. specimen size 1.0 x 3.0 x 0.1 inch) (25 x 75 x 2.5mm), (ASTM D543): value before and after exposure ±1.5 max

2. Stainless Steel components 300 series. (ASTM A240).

3. Components can be factory fabricated or mechanically molded

2.04 STACKS

A. Provide stacks for service connections wherever crown of sewer is 8 feet or more below finished grade.

B. Construct stacks of same material as sanitary sewer and as shown on Drawings.

C. Provide stacks of same nominal diameter at sanitary service line.

2.05 PLUGS AND CAPS

A. Seal upstream end of unconnected sewer service stubs with rubber gasket plugs or caps of same pipe type and size.

2.06 THREE PIECE SERVICE CONNECTION (TEE)

A. The connection is comprised of three parts; PVC hub, stainless steel band and rubber boot.

B. PVC hub and rubber boot shall be engineered to accept the wall thickness and internal radius of the pipe. The PVC hub and rubber boot shall protrude no more than ½” into the sewer pipe.

C. The PVC hub shall be in accordance with ASTM D-3034.

D. The rubber boot shall be in accordance with ASTM F 477.
E. The Tee shall be sized to accept 4" or 6" service lines, as required.

F. The Tee shall only be used when approved by the Project Manager.

G. Service Connection (Tee) shall be in accordance with Section 2.03.

2.07 SANITARY SEWER STANDARD CLEANOUT ON SERVICE LATERAL:
Where directed, the contractor shall remove (if existing) and install new sanitary sewer cleanout. This shall include: frame and cover, molded polyethylene, four-way cleanout, 12” Ultra-Rib PVC or SDR35 PVC riser pipe, 2-foot square concrete pad, cement stabilized sand backfill, and all labor, equipment, and site restoration.

A. The standard frame and cover shall be cast iron, embossed with “Sewer Cleanout” “City of Houston”.

B. The molded polyethylene, four-way cleanout shall be the “wastewater access chamber” as manufactured by Uponor ETI Co. or approved equal.

C. Riser pipe shall be 12” Ultra-Rib PVC or SDR35 PVC.

D. Provide sealing material between pipe riser and cleanout cover frame that is a hydrophilic elastic sealant, or approved equal.

2.08 SANITARY SEWER 4” OR 6” CLEANOUT ON SERVICE LATERAL
Where directed, the contractor shall remove (if existing) and install new sanitary sewer cleanout. This shall include: 4” or 6” removable threaded countersunk plug, 4” or 6” SDR 35 PVC riser pipe with 45 degree bend and wye, 3-RT Valve Box MFG by Old Castle Precast Inc or approved equal, and all labor, equipment, and site restoration. Payment made will be made at the unit price set in Document 00410B. Where service lateral to an abandoned house is encountered, install 4” or 6” plug for future house connection. All work shall be performed as per 4-Inch Cleanout Detail on Service Lead or Drawing No. 02534-05. Cleanout box may be installed in accordance with Drawing No. 02085-01.

PART 3 EXECUTION

3.01 PERFORMANCE REQUIREMENTS

A. Provide minimum of 72 hours notice to customers whose sanitary sewer service will potentially be interrupted.

B. Accurately field locate service connections, whether in service or not, along rehabilitated sanitary sewer main. For parallel and replacement sewers, service connections may be located as pipe laying progresses from downstream to upstream.
C. Properly disconnect existing connections from sewer and reconnect to rehabilitated liner, as described in this Section.

D. Reconnect service connections, including those that go to unoccupied or abandoned buildings or to vacant lots, unless directed otherwise by Project Manager. Install a stack and cap the reconnection where the service is to a vacant lot or location where a structure has been demolished, unless directed otherwise by Project Manager.

E. Complete reconnection of service lines within 24 hours after cured-in-place liner installation and within 72 hours after disconnection for sliplining, parallel, or replacement sanitary sewer mains.

F. Reconnect services on cured-in-place liner at 10 feet depth or less by excavation method. Project Manager reserves the right to require service connections by excavation when remote cut service connection damages lines.

G. Reconnection by excavation method shall include stack and fittings and required pipe length to reconnect service line.

H. Connect services 8 inches in diameter and larger to sewer by construction of manhole. Refer to appropriate Section on manholes for construction and payment.

I. All couplings and adapters used to either connect existing or new services to new PVC pipe stubouts shall be eccentric reducers when the coupling or adapter is used as a reducer and when used in the horizontal or on a horizontal slope less than 1:1 or less than a 45° angle (such that the flowline across the pipe size transition shall remain straight; no upset). The Contractor shall properly cut the ends of the two PVC pipes joined by a flexible coupling or adapter such that they do not extend into the transition area of the reducer. Pipe size transitions on existing or new services to new PVC pipe stubouts shall not be made in the vertical (in a stack or riser). Flexible couplings or adapters shall not be allowed for use in the vertical or on a slope greater than 1:1 or greater than a 45° angle.

3.02 PROTECTION

A. Provide barricades, warning lights, and signs for excavations created for service connections. Conform to requirements of Section 01504 - Temporary Facilities and Controls.

B. Do not allow sand, debris, or runoff to enter sewer system.
3.03 PREPARATION

A. Determine existing sewer locations and number of existing service connections from closed-circuit television (CCTV) inspection tapes or from field survey. Accurately field locate existing service connections, whether in service or not. Use existing service locations to connect or reconnect service lines or liner.

B. For rehabilitated sanitary sewer mains, allow liner to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured.

C. For new parallel and replacement sanitary sewer mains, complete testing and acceptance of downstream sewers as applicable. Provide for compliance with requirements of Paragraph 3.01E.

3.04 EXCAVATION AND BACKFILL

A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Perform work in accordance with OSHA standards. Employ Trench Safety System as specified in Section 02260 - Trench Safety System for excavations requiring trench safety.

C. Install and operate necessary ground water and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

D. Determine locations where limited access, buildings or structure preclude use of mechanical excavation equipment. Obtain approval from Project Manager for hand excavation.

E. When the excavation shows that a service line is not connected, abandon the service reconnection and backfill the excavation.

3.05 RECONNECTION BY EXCAVATION METHOD

A. SADDLE METHOD

1. Remove a portion of the existing sanitary sewer main or carrier pipe to expose the liner pipe. Provide sufficient working space for installing a pre-fabricated pipe saddle.

2. Carefully cut a hole in the liner pipe to accept the protrusion on the underside of the saddle. Length of protrusion shall be equal to the wall thickness of the liner pipe.

3. Apply an approximately 1/2" diameter bead of uncured, 100% pure silicone caulk (siliconized caulk will not be allowed), GE or approved equal, to the surface of the gasket that contacts the bottom of the saddle. A 1/2" bead of silicone caulk shall also be placed around the tapped hole in the polyethylene, PVC, or cured-in-place pipe. The beads of caulk should be placed approximately in the center of the gasket and, on the pipe, in the center of the area covered by the gasket. The saddle shall be installed and secured while
the silicone caulk is uniformly fluid and pliable, not hardened or rubbery and with no hardened, rubbery areas or nodules. Adequate quantities of silicone caulk should be applied to allow it to flow or be extruded into any corrugations in the gasket surface and into any irregularities (scratches or gouges) in the surface of the polyethylene, PVC, or cured-in-place pipe.

4. Install the saddle with gasket using stainless steel bands on each side of the saddle. Tighten the bands to produce a watertight seal between the saddle and the liner pipe.

B. THREE PIECE SERVICE CONNECTION METHOD

1. Remove a portion of the existing sanitary sewer main or carrier pipe to expose the liner pipe. Provide sufficient working space to install three piece service connection.

2. Precisely cut a circular hole, per the manufactures recommendations, in the liner pipe that will form a tight fit between the liner pipe PVC stub and rubber boot.

3. Install the rubber boot into the cored hole, making sure the boot is properly oriented to the mainline. Lubricate the rubber boot with a special solution provided by the three piece service connection manufacturer. Make sure the upper and lower ribs of the rubber boot are correctly seated against the inside and outside diameter of the liner pipe.

4. Insert the PVC hub into the rubber boot, per manufacturer’s recommended instructions. Place stainless steel band around the top of the rubber boot and tighten to form a watertight seal.

C. SERVICE LINE CONNECTIONS TO SADDLES OR THREE PIECE SERVICE CONNECTIONS

1. Remove and replace cracked, offset or leaking service line up to 8 feet (measured horizontally) from the center line of the new liner.

2. Make connections between liner and existing service line using PVC sewer pipe and approved couplings/fittings using stainless steel bands to construct new stacks and/or service lines.

3. Test all service connections by smoke testing the sewer main and connections before backfilling.

4. Encase the entire service connection is cement stabilized sand or crushed stone. Place a minimum of 6 inches below and 12 inches above and on each side of the service line and pipe connection.
3.06 RECONNECTION BY REMOTE METHOD

A. Make service reconnections using remote-operated cutting tools on cured-in-place liners at depth greater than 10 feet.

B. Employ method and equipment that restore service connection capacity to not less than 90 percent of original capacity.

C. Immediately open missed connections and repair holes drilled in error using method approved by Project Manager.

3.07 RECONNECTION ON PARALLEL OR REPLACEMENT SEGMENTS

A. Install a full-bodied tee or wye fitting on the new sanitary sewer main for each service connection.

B. Remove and replace cracked, offset or leaking service line for up to 5 feet, measured horizontally, from centerline of sanitary sewer main.

C. Make up connection between main and existing service line using PVC sewer pipe and approved couplings, as shown on Drawings.

D. Test service connections before backfilling.

E. Embed service connection and service line as specified for sanitary sewer main as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities.

3.08 INSTALLATION OF NEW SERVICE STUBS

A. Install service connections on sanitary sewer main for each service connection. Provide length of pipe required to allow sufficient room for standard 6-inch clean-out service lead assembly in accordance with detail 02534-05. Install plug(s) or cap on the upstream end(s) of service stub(s) as needed.

B. Test service connections before backfilling.

C. Embed service connection and service line as specified for sanitary sewer main, and as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities. Install minimum 2-foot length of magnetic locating tape along axis of service stub and 9 inches to 12 inches above crown of pipe, at end of stub.
3.09 TESTING

A. Test service reconnections and service stubs. Follow applicable procedures given in Section 02533 - Acceptance Testing for Sanitary Sewers to perform smoke testing to confirm reconnection.

B. Perform post installation CCTV inspection as specified in Section 02558 - Cleaning and Television Inspection to show locations of service connection.

3.10 CLEANUP

A. Backfill excavation as specified in Section 02317 - Excavation and Backfill for Utilities.

B. Replace pavement or sidewalks removed or damaged by excavation in accordance with Section 02951 - Pavement Repair and Resurfacing. In unpaved areas, bring surface to grade and slope surrounding excavation. Replace minimum of 4 inches of topsoil and seed according to requirements of Section 02921 - Hydro-mulch Seeding.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acceptance testing of sanitary sewers including:
   1. Visual inspection of sewer pipes
   2. Mandrel testing for flexible sewer pipes.
   3. Leakage testing of sewer pipes.
   4. Leakage testing of manholes.
   5. Smoke testing of point repairs.
   6. Television and Video Inspection.

B. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. No payment will be made for acceptance testing under this Section. Include payment in unit price for work requiring acceptance testing.
   2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

B. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

C. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

D. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.


F. ASTM C 1244 Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.

1.04 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 no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Must meet Texas Commission on Environmental Quality (TCEQ) Testing Requirements Chapter-217-57.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Project Manager. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.06 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.
B. Provide testing reports and video tape of television inspection as directed by Project Manager.

C. Upon completion of tape reviews by Project Manager, Contractor will be notified regarding final acceptance of sewer segment.

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 Project Manager. Perform testing under observation of Project Manager.

PART 2 PRODUCTS

2.01 DEFLECTION MANDREL

A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe, dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.

C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 02533-5, Pipe vs. Mandrel Diameter, at end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Project Manager.

2.02 EXFILTRATION TEST
A. Water Meter: Obtain transient water meter from City for use when water for testing will be taken from City system. Conform to City requirements for water meter use.

B. Test Equipment:
   1. Pipe plugs.
   2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

2.03 INFILTRATION TEST

A. Test Equipment:
   1. Calibrated 90 degree V-notch weir.
   2. Pipe plugs.

2.04 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:
   1. Control panel
   2. Low-pressure air supply connected to control panel.
   3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
   4. Air hoses from control panel to:
      a. Air supply.
      b. Pneumatic plugs.
      c. Sealed line for pressuring.
      d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.
2.05 GROUND WATER DETERMINATION
   A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.06 SMOKE TESTING
   A. Equipment:
      1. Pneumatic plugs.
      2. Smoke generator as supplied by Superior Signal Company, or approved equal.

PART 3 EXECUTION

3.01 PREPARATION
   A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.
   B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Section 01578 - Control of Ground Water and Surface Water.

3.02 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS
   A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and relay or replace pipe segment.

3.03 MANDREL TESTING FOR GRAVITY SANITARY SEWERS
   A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.
   B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.
   C. Retest repaired or replaced sewer sections.
3.04 LEAKAGE TESTING FOR GRAVITY COLLECTION SYSTEM PIPES

A. For a collection system pipe that will transport wastewater by gravity flow, test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.

B. Compensating for Ground Water Pressure:

1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.

2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.

C. Exfiltration test:

1. Determine ground water elevation.

2. Plug sewer in downstream manhole.

3. Plug incoming pipes in upstream manhole.

4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.

5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.

6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 02533-1 at end of this Section.

D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).

1. Determine ground water elevation.
2. Plug incoming pipes in upstream manhole.

3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.

4. Allow water to rise and flow over weir until it stabilizes.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 02533-2.

1. Low Pressure Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter. Refer to charts 02533-2 and 02533-3.

2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.05 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 02533-1, Water Test Allowable Leakage, at end of this Section.

B. Low Pressure Air Test:

1. Times in Table 02533-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Commission on Environmental Quality (TCEQ) Design Criteria 217.57

\[
T = 0.0850(D)(K)/(Q)
\]

where:

- \(T\) = time for pressure to drop 1.0 pounds per square inch gauge in seconds
- \(K\) = 0.000419 DL, but not less than 1.0
- \(D\) = average inside diameter in inches
- \(L\) = length of line of same pipe size in feet
- \(Q\) = rate of loss, 0.0015 ft³/min./sq. ft. internal surface
2. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 02533-3, Minimum Testing Times for Low Pressure Air Test.

Notes:
1. When two sizes of pipe are involved, compute time by ratio of lengths involved.
2. Lines with 27-inch average inside diameter and larger may be air tested at each joint.
3. Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4. If joint test is used, perform visual inspection of joint immediately after testing.
5. For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.06 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.

2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 02533-4, Vacuum Test Time Table.

3. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury (Hg).
D. Perform hydrostatic exfiltration testing as follows:

1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.07 SMOKE TEST PROCEDURES FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.
2. Determine when point repairs are properly made.
3. Determine when service connections have been reconnected to rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to City of Houston Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for sliplined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer's recommendation and as approved by Project Manager.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation as approved by Project Manager.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

3.08 TELEVISION AND VIDEO INSPECTION PROCEDURE

A. Refer to Document 02588- Cleaning and Television Inspection

Table 02533-1
WATER TEST ALLOWABLE LEAKAGE

<table>
<thead>
<tr>
<th>DIAMETER OF RISER OR STACK IN INCHES</th>
<th>VOLUME PER INCH OF DEPTH</th>
<th>ALLOWANCE LEAKAGE*</th>
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<tbody>
<tr>
<td></td>
<td>INCH</td>
<td>GALLONS</td>
</tr>
<tr>
<td>1</td>
<td>0.7854</td>
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<tr>
<td>8</td>
<td>50.2655</td>
<td>.2176</td>
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</table>

For other diameters, multiply square of diameters by value for 1” diameter.

Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.
* Allowable leakage rate must not exceed 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain.

<table>
<thead>
<tr>
<th>Pipe Diam. (in)</th>
<th>Min. Time (min:sec)</th>
<th>Length for Min. Time (ft)</th>
<th>Time for Longer Length (sec)</th>
<th>Specification Time for Length (L) Shown (min:sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 ft</td>
</tr>
<tr>
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Table 02533-2
ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG
Table 02533-3
MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

<table>
<thead>
<tr>
<th>PIPE DIAMETER (INCHES)</th>
<th>MINIMUM TIME (SECONDS)</th>
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Table 02533-4
VACUUM TEST TIME TABLE

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*Add T times for each additional 2-foot depth.
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02533-13
01/01/2011
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END OF SECTION
Section 02534

SANITARY SEWER SERVICE STUBS OR RECONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of service stubs in sanitary sewers serving areas where sanitary sewer service did not previously exist.

B. Reconnection of existing service connections along parallel, replacement, or rehabilitated sanitary sewers.

C. Installation of sanitary sewer service stubs, within street right-of-way, terminating with a clean-out and a plug at the right-of-way to allow for future connection of a single service, or at a double-wye fitting plugged at both to allow for future connection to two services.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for sanitary sewer service stubs or service reconnections with stacks located within 5 feet of sanitary sewer main centerline is on unit price basis for each stub or reconnection. Payment will be made for each service stub or reconnection installed complete in place, including service connections, couplings, and adapters disconnecting existing services, reconnecting new service, fittings, excavation, and backfill.

2. Payment for sanitary sewer service stubs or service reconnections without stacks located within 5 feet of sanitary sewer main is on unit price basis for each stub or reconnection. Payment will be made for each service stub or reconnection installed complete in place, including service connections, couplings, and adapters disconnecting existing services, reconnecting new service, fittings, excavation, backfill and testing.

3. Payment for sanitary sewer service leads beyond 5 feet from the right-of-way and clean-outs shall be paid as follows:

a. Payment for sanitary sewer service leads beyond 5 feet from the right-of-way clean-out, connection or reconnection shall be paid for on a linear foot basis. Measurement shall be taken along the centerline of the pipe from the centerline of the lead connection or stack at the sanitary sewer main and shall end 5 foot from the right-of-way. Payment will be made for each linear foot
of pipe installed, complete in place, including sewer pipe, excavation, shoring, bedding, backfill, and accessories.  Auger pipe for service stubs will be paid as provided in Section 02448 – Pipe and Casing Augering.

b.  Payment for standard 6-inch clean-out on service lead assembly for a single or double future service connection installed at end of lead is on a unit price basis for each assembly and shall include all portions of the lead and service connection with clean-out within 5 feet of the right-of-way.  Payment will be made for each assembly installed and complete in place, including excavation, fittings, offsets, plugs, pipe sections, valve boxes, bedding, backfill, and testing.

4. Pay estimates for progress payments will be made as measured above according to following schedule:

a.  An estimate for 95 percent payment will be authorized when reconnection is completely installed and backfilled.

b.  An estimate for 100 percent payment will be authorized when reconnection has been tested as specified in Section 02732 - Acceptance Testing for Sanitary Sewers.

5. One or more connections discharging into common point are considered one service connection.  Contractor shall not add service reconnections without approval of Project Manager.  Project Manager may require connections to be relocated to avoid having more than two service connections per reconnection.

6. Protruding service connections which must be removed to allow liner insertion are paid as service reconnection when connected.  If abandoned, they will be paid as abandoned connection.

7. Payment for abandonment of service connection is on unit price basis for each abandoned connection.  No separate payment will be made for abandonment of service connection unless excavation is required.  No separate payment will be made for excavation of sanitary sewer services within new or replacement sewer trench.

8. No separate payment will be made for removal of existing sanitary sewer service stubs.  Include payment in unit price for Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

9. No separate payment will be made for abandoned service connection when service to be abandoned is within 4 feet of active connection.  Payment for only one abandoned service connection will be allowed when second abandoned connection is within 4 feet of first.
10. If faulty remote cut is later corrected using procedures specified for reconnection by excavation, only one reconnection will be allowed for payment.

11. Sanitary Sewer Cleanout on Service Lateral shall be provided in accordance with detail provided. Payment is on per each basis as indicated in Document 00410B.

12. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


D. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

1.04 PERFORMANCE REQUIREMENTS

A. Accurately locate in field all proposed service stubs along new sanitary sewer main.

B. Accurately locate in field existing service connections and proposed service stubs along alignment of new parallel or replacement sewer main.

1.05 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for each pipe product, fitting, coupling and adapter.

C. Show reconnected services on record drawings. Give exact distance from each service connection to nearest downstream manhole.

D. Submit Post-installation television inspection videos in accordance with Document 02558 – Cleaning and Television Inspection.
PART 2  PRODUCTS

2.01 PVC SERVICE CONNECTION

A. As stub outs, use PVC sewer pipe of 4-inch through 10-inch diameter, conforming to ASTM D 1784 and ASTM D 3034, with cell classification of 12454. SDR (ratio of diameter to wall thickness) shall be 26 for pipe 10 inches in diameter or less.

B. PVC pipe shall be gasket jointed with gasket conforming to ASTM D 3212.

C. Provide service connection pipe in sizes shown on Drawings. For reconnection of existing services, select service connection pipe diameter to match existing service diameter. Reconnections to rehabilitated sanitary sewer mains shall be limited to following maximum service connection diameter:

<table>
<thead>
<tr>
<th>Sewer Diameter</th>
<th>Maximum Service Connection Diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot; or less</td>
<td>4&quot;</td>
</tr>
<tr>
<td>10&quot; or greater</td>
<td>6&quot;</td>
</tr>
</tbody>
</table>

D. Subject to above limits, provide 6-inch service connection when more than one service discharges into single pipe.

E. Connect service pipes to parallel or replacement sewer mains with prefabricated, full-bodied tee or wye fittings conforming to specifications for sewer main pipe material as specified in other Sections for sewers up to 18 inches in diameter.

F. Where sewers are installed using pipe augering or tunneling, or where sewer is greater than 18 inches in diameter, use three-piece service connection or pipe saddle conforming to ASTM C-923 to connect service to sewer main.

2.02 PIPE SADDLES

A. Use pipe saddles only on rehabilitated sanitary sewer mains. Comply with Paragraph 2.01E for new parallel and replacement sanitary sewer mains.

B. Supply one-piece prefabricated saddle, either polyethylene or PVC, with neoprene gasket to accomplish complete seal. Use saddle fabricated to fit outside diameter of connecting pipe. Protruding lip of saddle must be at least 5/8-inch long with grooves or ridges to retain stainless steel band clamps.

C. Use 1/2-inch stainless steel band clamps for securing saddles to liner pipe.
2.03 COUPLINGS AND ADAPTERS

A. For connections between new PVC pipe stubouts and existing service, 4-, 6-, or 8-inch diameter, use flexible adapter coupling consisting of neoprene gasket, stainless steel shear rings with 1/2-inch stainless steel band clamps, and two nut and bolt clamps. For connections that are 10- inches or over, use neoprene gasket, with stainless steel shear band, and two stainless steel nut and bolt or T-Bolt clamps. Thermalized plastics are not allowed. Refer to approved couplings and adaptors.

1. Product characteristics, meet ASTM C1173 and requirements for neoprene rubber and metallic components.

2. Shear Band: ½ inch 300 series stainless steel shear band with two molded on worm gear clamps (ASTM A240)

3. Clamps: 300 Series nut and bolt clamp band fabricated from AISI Type 316 stainless steel (ASTM A240)

B. For connections between new PVC pipe stubout and new service, use approved rubber-gasket adapter coupling conforming to requirements of 2.03A.

C. Couplings and Adaptors components will be in accordance with following Requirements:

1. Neoprene Rubber. 100% rubber. Thermalized plastics are not allowed.


   b. Elongation at break, % (ASTM D412, ASTM D638). Initial value: 200 Value after 112 days: 200

   c. Shore Durometer, Type A, point change max (ASTM D2240). Initial value (1 sec. reading, min): 60. Value point change max: 15

   d. Compression Set -- Chemical exposures, % max (ASTM D395 Method B). Initial Value: 20 max. Value after exposure: 20 max

   e. Compression Set -- Bacteriological, unconditioned surface dry, % max (ASTM D395 Method B): Initial value 20. Value after 112 day: 20

   f. Water Absorption, % max (ASTM D570). Initial value: 4. Value after 112 days: % max ≥4
g. Aged Tensile (psi) -- Tensile strength (after exposure to 300 psi (2100 kPa) oxygen at 158° ± 1.8°F [70° ± 1°C] for 96 hours), % of initial, min (ASTM D572). Initial: 70 min. After accelerated aging: 70 min.

h. Aged Elongation -- Elongation at break (after exposure to 300 psi (2100 kPa) oxygen at 158° ± 1.8°F [70° ± 1°C] for 96 hours), % of initial, min. (ASTM D572). Initial value: 70 min. Test after accelerated aging: 70 min.

i. Ozone resistance (after exposure to 100 pphm ozone for 50 hours at 104° ± 2°F [40° ± 1°C]), (ASTM D518, procedure C, and ASTM D1149). Initial value: No cracking. After exposure: No cracking

j. Weight Change, % max. (approx. specimen size 1.0 x 3.0 x 0.1 inch) (25 x 75 x 2.5mm), (ASTM D543): value before and after exposure ±1.5 max

2. Stainless Steel components 300 series. (ASTM A240).

3. Components can be factory fabricated or mechanically molded

2.04 STACKS

A. Provide stacks for service connections wherever crown of sewer is 8 feet or more below finished grade.

B. Construct stacks of same material as sanitary sewer and as shown on Drawings.

C. Provide stacks of same nominal diameter at sanitary service line.

2.05 PLUGS AND CAPS

A. Seal upstream end of unconnected sewer service stubs with rubber gasket plugs or caps of same pipe type and size.

2.06. THREE PIECE SERVICE CONNECTION (TEE)

A. The connection is comprised of three parts; PVC hub, stainless steel band and rubber boot.

B. PVC hub and rubber boot shall be engineered to accept the wall thickness and internal radius of the pipe. The PVC hub and rubber boot shall protrude no more than ½” into the sewer pipe.

C. The PVC hub shall be in accordance with ASTM D-3034.

D. The rubber boot shall be in accordance with ASTM F 477.
E. The Tee shall be sized to accept 4" or 6" service lines, as required.

F. The Tee shall only be used when approved by the Project Manager.

G. Service Connection (Tee) shall be in accordance with Section 2.03.

2.07 SANITARY SEWER STANDARD CLEANOUT ON SERVICE LATERAL:
Where directed, the contractor shall remove (if existing) and install new sanitary sewer cleanout. This shall include: frame and cover, molded polyethylene, four-way cleanout, 12” Ultra-Rib PVC or SDR35 PVC riser pipe, 2-foot square concrete pad, cement stabilized sand backfill, and all labor, equipment, and site restoration.

A. The standard frame and cover shall be cast iron, embossed with “Sewer Cleanout” “City of Houston”.

B. The molded polyethylene, four-way cleanout shall be the “wastewater access chamber” as manufactured by Uponor ETI Co. or approved equal.

C. Riser pipe shall be 12” Ultra-Rib PVC or SDR35 PVC.

D. Provide sealing material between pipe riser and cleanout cover frame that is a hydrophilic elastic sealant, or approved equal.

2.08 SANITARY SEWER 4” OR 6” CLEANOUT ON SERVICE LATERAL
Where directed, the contractor shall remove (if existing) and install new sanitary sewer cleanout. This shall include: 4” or 6” removable threaded countersunk plug, 4” or 6” SDR 35 PVC riser pipe with 45 degree bend and wye, 3-RT Valve Box MFG by Old Castle Precast Inc or approved equal, and all labor, equipment, and site restoration. Payment made will be made at the unit price set in Document 00410B. Where service lateral to an abandoned house is encountered, install 4” or 6” plug for future house connection. All work shall be performed as per 4-Inch Cleanout Detail on Service Lead or Drawing No. 02534-05. Cleanout box may be installed in accordance with Drawing No. 02085-01.

PART 3 E X E C U T I O N

3.01 PERFORMANCE REQUIREMENTS

A. Provide minimum of 72 hours notice to customers whose sanitary sewer service will potentially be interrupted.

B. Accurately field locate service connections, whether in service or not, along rehabilitated sanitary sewer main. For parallel and replacement sewers, service connections may be located as pipe laying progresses from downstream to upstream.
C. Properly disconnect existing connections from sewer and reconnect to rehabilitated liner, as described in this Section.

D. Reconnect service connections, including those that go to unoccupied or abandoned buildings or to vacant lots, unless directed otherwise by Project Manager. Install a stack and cap the reconnection where the service is to a vacant lot or location where a structure has been demolished, unless directed otherwise by Project Manager.

E. Complete reconnection of service lines within 24 hours after cured-in-place liner installation and within 72 hours after disconnection for sliplining, parallel, or replacement sanitary sewer mains.

F. Reconnect services on cured-in-place liner at 10 feet depth or less by excavation method. Project Manager reserves the right to require service connections by excavation when remote cut service connection damages lines.

G. Reconnection by excavation method shall include stack and fittings and required pipe length to reconnect service line.

H. Connect services 8 inches in diameter and larger to sewer by construction of manhole. Refer to appropriate Section on manholes for construction and payment.

I. All couplings and adapters used to either connect existing or new services to new PVC pipe stubouts shall be eccentric reducers when the coupling or adapter is used as a reducer and when used in the horizontal or on a horizontal slope less than 1:1 or less than a 45° angle (such that the flowline across the pipe size transition shall remain straight; no upset). The Contractor shall properly cut the ends of the two PVC pipes joined by a flexible coupling or adapter such that they do not extend into the transition area of the reducer. Pipe size transitions on existing or new services to new PVC pipe stubouts shall not be made in the vertical (in a stack or riser). Flexible couplings or adapters shall not be allowed for use in the vertical or on a slope greater than 1:1 or greater than a 45° angle.

3.02 PROTECTION

A. Provide barricades, warning lights, and signs for excavations created for service connections. Conform to requirements of Section 01504 - Temporary Facilities and Controls.

B. Do not allow sand, debris, or runoff to enter sewer system.
3.03 PREPARATION

A. Determine existing sewer locations and number of existing service connections from closed-circuit television (CCTV) inspection tapes or from field survey. Accurately field locate existing service connections, whether in service or not. Use existing service locations to connect or reconnect service lines or liner.

B. For rehabilitated sanitary sewer mains, allow liner to normalize to ambient temperature and recover from imposed stretch. For cured-in-place liners, verify that liner is completely cured.

C. For new parallel and replacement sanitary sewer mains, complete testing and acceptance of downstream sewers as applicable. Provide for compliance with requirements of Paragraph 3.01E.

3.04 EXCAVATION AND BACKFILL

A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Perform work in accordance with OSHA standards. Employ Trench Safety System as specified in Section 02260 - Trench Safety System for excavations requiring trench safety.

C. Install and operate necessary ground water and surface water control measures in accordance with requirements of Section 01578 - Control of Ground Water and Surface Water.

D. Determine locations where limited access, buildings or structure preclude use of mechanical excavation equipment. Obtain approval from Project Manager for hand excavation.

E. When the excavation shows that a service line is not connected, abandon the service reconnection and backfill the excavation.

3.05 RECONNECTION BY EXCAVATION METHOD

A. SADDLE METHOD

1. Remove a portion of the existing sanitary sewer main or carrier pipe to expose the liner pipe. Provide sufficient working space for installing a pre-fabricated pipe saddle.

2. Carefully cut a hole in the liner pipe to accept the protrusion on the underside of the saddle. Length of protrusion shall be equal to the wall thickness of the liner pipe.

3. Apply an approximately 1/2" diameter bead of uncured, 100% pure silicone caulk (siliconized caulk will not be allowed), GE or approved equal, to the surface of the gasket that contacts the bottom of the saddle. A 1/2" bead of silicone caulk shall also be placed around the tapped hole in the polyethylene, PVC, or cured-in-place pipe. The beads of caulk should be placed approximately in the center of the gasket and, on the pipe, in the center of the area covered by the gasket. The saddle shall be installed and secured while...
the silicone caulk is uniformly fluid and pliable, not hardened or rubbery and with no hardened, rubbery areas or nodules. Adequate quantities of silicone caulk should be applied to allow it to flow or be extruded into any corrugations in the gasket surface and into any irregularities (scratches or gouges) in the surface of the polyethylene, PVC, or cured-in-place pipe.

4. Install the saddle with gasket using stainless steel bands on each side of the saddle. Tighten the bands to produce a watertight seal between the saddle and the liner pipe.

B. THREE PIECE SERVICE CONNECTION METHOD

1. Remove a portion of the existing sanitary sewer main or carrier pipe to expose the liner pipe. Provide sufficient working space to install three piece service connection.

2. Precisely cut a circular hole, per the manufactures recommendations, in the liner pipe that will form a tight fit between the liner pipe PVC stub and rubber boot.

3. Install the rubber boot into the cored hole, making sure the boot is properly oriented to the mainline. Lubricate the rubber boot with a special solution provided by the three piece service connection manufacturer. Make sure the upper and lower ribs of the rubber boot are correctly seated against the inside and outside diameter of the liner pipe.

4. Insert the PVC hub into the rubber boot, per manufacturer’s recommended instructions. Place stainless steel band around the top of the rubber boot and tighten to form a watertight seal.

C. SERVICE LINE CONNECTIONS TO SADDLES OR THREE PIECE SERVICE CONNECTIONS

1. Remove and replace cracked, offset or leaking service line up to 8 feet (measured horizontally) from the center line of the new liner.

2. Make connections between liner and existing service line using PVC sewer pipe and approved couplings/fittings using stainless steel bands to construct new stacks and/or service lines.

3. Test all service connections by smoke testing the sewer main and connections before backfilling.

4. Encase the entire service connection is cement stabilized sand or crushed stone. Place a minimum of 6 inches below and 12 inches above and on each side of the service line and pipe connection.
3.06 RECONNECTION BY REMOTE METHOD

A. Make service reconnections using remote-operated cutting tools on cured-in-place liners at depth greater than 10 feet.

B. Employ method and equipment that restore service connection capacity to not less than 90 percent of original capacity.

C. Immediately open missed connections and repair holes drilled in error using method approved by Project Manager.

3.07 RECONNECTION ON PARALLEL OR REPLACEMENT SEGMENTS

A. Install a full-bodied tee or wye fitting on the new sanitary sewer main for each service connection.

B. Remove and replace cracked, offset or leaking service line for up to 5 feet, measured horizontally, from centerline of sanitary sewer main.

C. Make up connection between main and existing service line using PVC sewer pipe and approved couplings, as shown on Drawings.

D. Test service connections before backfilling.

E. Embed service connection and service line as specified for sanitary sewer main as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities.

3.08 INSTALLATION OF NEW SERVICE STUBS

A. Install service connections on sanitary sewer main for each service connection. Provide length of pipe required to allow sufficient room for standard 6-inch clean-out service lead assembly in accordance with detail 02534-05. Install plug(s) or cap on the upstream end(s) of service stub(s) as needed.

B. Test service connections before backfilling.

C. Embed service connection and service line as specified for sanitary sewer main, and as shown on Drawings. Place and compact trench zone backfill in compliance with Section 02317 - Excavation and Backfill for Utilities. Install minimum 2-foot length of magnetic locating tape along axis of service stub and 9 inches to 12 inches above crown of pipe, at end of stub.
3.09 TESTING

A. Test service reconnections and service stubs. Follow applicable procedures given in Section 02533 - Acceptance Testing for Sanitary Sewers to perform smoke testing to confirm reconnection.

B. Perform post installation CCTV inspection as specified in Section 02558 - Cleaning and Television Inspection to show locations of service connection.

3.10 CLEANUP

A. Backfill excavation as specified in Section 02317 - Excavation and Backfill for Utilities.

B. Replace pavement or sidewalks removed or damaged by excavation in accordance with Section 02951 - Pavement Repair and Resurfacing. In unpaved areas, bring surface to grade and slope surrounding excavation. Replace minimum of 4 inches of topsoil and seed according to requirements of Section 02921 - Hydro-mulch Seeding.

END OF SECTION
Section 02550

SLIPLINING SANITARY SEWERS

PART 1    GENERAL

1.01    SECTION INCLUDES

A.    Slipping existing sanitary sewers.

1.02    UNIT PRICES

A.    Measurement for slipping is on a linear foot basis for installed liner pipe, measured from center line of upstream manhole to center line of downstream manhole.

B.    Insertion pits, access pits, clamp installation, embedment (bedding, haunching and initial backfill), field quality control (testing), sealing liner at manholes, grouting annular space, building up, shaping and reworking manhole inverts and benches, and pre-installation and post-installation cleaning and television inspection of completed work are included in slipping unit price and not paid for separately.

C.    Excavations initially begun as obstruction removals or point repairs which the Contractor later decides to use as insertion pits are considered as insertion pits and not paid for separately.

D.    Trench safety systems, well pointing and other applicable bid items associated with insertion pits will be paid for at their respective contract unit prices.

E.    Refer to Section 01270 - Measurement and Payment, for unit price procedures.

F.    Payment for Item, 'Mobilization for short segment (<100') will be paid when the contractor is issued a work order containing a line segment that is less than 100 feet in length and is not adjacent to another line segment, or when the total of all adjacent line segments is less than 100 feet.

1.03    REFERENCES


B.    ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.

C.    ASTM D 2122 - Determining Dimensions of Thermoplastic Pipe and Fittings.

D.    ASTM D 2412 - Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

F. ASTM D 2992 - Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings.

G. ASTM D 3262 - "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

H. ASTM D 3350 - Polyethylene Plastics Pipe and Fittings Materials.

I. ASTM D 3681 - Chemical Resistance of "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe in a Deflected Condition.

J. ASTM D 4161 - "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

K. ASTM F 585 - Practice for Insertion of Flexible Polyethylene Pipe Into Existing Sewers.

L. ASTM F 714 - Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

M. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 894 - Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

O. AWWA C 151 - Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

1.04 DEFINITIONS

A. Sliplining: Reconstruction of sanitary sewers by insertion of liner pipe into existing sewers.

1.05 SYSTEM DESCRIPTION
A. Sliplining is accomplished by pulling or pushing liner pipe into existing sewers by use of mechanical or hydraulic equipment. Once in place, liner pipe is allowed time to normalize and is then cut to fit between manholes. Annular spaces between liners and existing sewers are sealed at each manhole. Manhole inverts and benches are reworked and reshaped. Existing sewers remain in operation during sliplining process, with sewage flow diverted around operations in progress.

1.06 QUALITY ASSURANCE

A. Liner Acceptance: Provide liner material manufactured, without defects, to standards and dimensions specified. Causes for rejection include physical defects of liner pipe, such as concentrated ridges, chain marks, discoloration, excessive spot roughness, pitting, visible cracks, foreign inclusions and varying wall thickness.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prevent injury to or abrasion of pipe during loading, transportation and unloading. Do not drop pipe from vehicles nor allow pipe to roll down skids or slopes without proper restraining ropes. Use suitable pads, strips, skids or blocks for each pipe during transportation and while awaiting installation.

B. Do not use, and remove from construction site, pipe with physical damage such as cuts, gashes, nicks or abrasions, whether from manufacturing, shipping, storage or handling, and which is deeper than 10 percent of wall thickness.

C. Use wide belly band slings for lifting and moving pipe. Do not use bare chains in contact with pipe.

1.08 PERFORMANCE REQUIREMENTS

A. Maintain sewage flow by diversion pumping or other method approved by the Engineer.

B. Clear existing sewers of debris, obstructions and other foreign material and make point repairs to existing sewers as specified in Section 02553 - Point Repairs and Obstruction Removals.

C. Install sliplining according to this Section.

D. Grout annular space(s).

E. Shape, refurbish or construct manhole inverts as specified in Section 02555 - Manhole Rehabilitation.

F. Test lines as specified in Section 02533 - Acceptance Testing of Sanitary Sewers.

G. Video inspect completed lines as specified in Section 02558 - Cleaning and Television Inspection.
1.09 SUBMITTALS

A. Comply with Section 01330 - Submittal Procedures, and 01340 - Shop Drawings, Product Data and Samples.

B. Submit manufacturer's product data with complete information on pipeline materials, including physical properties and dimensions pertinent to this job. Furnish certificate(s) of compliance with specifications for materials to be supplied.

C. Submit independent laboratory test reports certifying that polyethylene pipe meets ASTM D 1248 and ASTM D 3350, that fiberglass reinforced plastic (FRP) pipe meets ASTM D 3681, or that PVC pipe meets ASTM F 794 and ASTM D 1784, as applicable.

D. Submit grouting plan showing where grout is to be injected, materials and chemicals to be used in grout, anchoring methods, and planned grouting pressure.

E. Submit video inspection as specified in Section 02558 - Cleaning and Television Inspection.

1.10 TESTING

A. The City may have tests performed on field samples by an independent laboratory following applicable ASTM specifications to verify physical properties and characteristics of supplied materials. Provide product samples as requested by the Engineer.

B. The City will pay for tests on materials which meet specification requirements. Contractor shall pay for failed tests and consequent retesting.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Liner pipe systems shall be polyethylene, fiberglass reinforced plastic (FRP) PVC profile wall or polyethylene profile wall pipe, as approved by the City.

B. Refer to City of Houston Approved Products List for acceptable product manufacturers.

2.02 POLYETHYLENE LINER PIPE AND FITTINGS

A. Provide polyethylene liner pipe, manufactured of solid-wall, high-density, high-molecular-weight polyethylene meeting ASTM D 1248, Type III, Class C, Grade P-34, Category 5, with a PPI rating of PE 3408. Use polyethylene material with a minimum cell classification of 3454 34D or E (inner wall of light color) under ASTM D 3350. Higher-numbered cell classification limits giving desirable higher primary properties, according to ASTM D 3350, are also acceptable. Provide pipe with hydrostatic design value not less than 1600 psi when tested.
according to ASTM D 2837. Dimensions and workmanship shall be in accordance with ASTM F 714 and ASTM D 2122.

B. Provide pipe with maximum Standard Dimension Ratio (SDR) and ratio of outside pipe diameter to wall thickness as specified below. Select SDR for the deeper of two manholes in each pipeline segment.

<table>
<thead>
<tr>
<th>Maximum Liner SDR</th>
<th>Maximum Depth (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>21</td>
<td>15</td>
</tr>
<tr>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>17</td>
<td>Greater than 20</td>
</tr>
</tbody>
</table>

C. Minimum Outside Diameter of liner:

<table>
<thead>
<tr>
<th>Existing Sewer Nominal Diameter (Inches)</th>
<th>Minimum O.D. of Liner (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>7.125</td>
</tr>
<tr>
<td>10</td>
<td>8.625</td>
</tr>
<tr>
<td>12</td>
<td>10.75</td>
</tr>
<tr>
<td>15</td>
<td>14.00</td>
</tr>
<tr>
<td>18</td>
<td>16.00</td>
</tr>
<tr>
<td>21</td>
<td>18.00</td>
</tr>
<tr>
<td>24</td>
<td>22.00</td>
</tr>
<tr>
<td>27</td>
<td>26.00</td>
</tr>
<tr>
<td>30</td>
<td>28.00</td>
</tr>
</tbody>
</table>

2.03 FRP LINER PIPE AND FITTINGS

A. Pipe, joints and fittings: ASTM D 3262, Type 1, Liner 2, Grade 3.

B. FRP Liner Pipe: Reinforced plastic mortar pipe manufactured to produce a dense, nonporous, corrosion-resistant, consistent, composite structure. Minimum stiffness: 46 psi, measured in accordance with ASTM D 2412. Use with a stiffness of 72 psi where specified or shown on the Drawings.

C. Resin Systems: Thermosetting polyester resin, with or without filler, meeting ASTM D 3262.

D. Reinforcing Glass Fibers: Commercial grade E-type glass filaments, with binder and sizing compatible with impregnating resins.

E. Filler: Sand with at least 98 percent silica content, and maximum moisture content of 0.2 percent.
F. **Joints:** Low-profile, fiberglass bell-spigot joints or flush fiberglass bell spigot joints. Either joint shall utilize elastomeric sealing gaskets for watertight joints meeting ASTM D 4161.

G. **Dimensions and Tolerances:**

1. **Pipe outside diameters and tolerances (18” to 48”):** Comply with ASTM D 3262, Cast Iron Pipe Equivalent Outside Diameters, and table below.

2. **When possible, supply pipe in nominal lengths of 20 feet. Where radius curves in existing pipe or limitations in entry pit dimensions restrict pipe length, shorter lengths may be used.**

3. **FRP pipe minimum outside diameters and minimum wall thicknesses for low profile, fiberglass bell-spigot joints:**

<table>
<thead>
<tr>
<th>Existing Sewer Nominal Diameter (Inches)</th>
<th>Minimum Liner O.D. (Inches)</th>
<th>Minimum Wall Thickness 46 psi Stiffness (Inches)</th>
<th>Minimum Wall Thickness 72 psi Stiffness (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>19.50</td>
<td>0.39</td>
<td>0.44</td>
</tr>
<tr>
<td>24</td>
<td>21.60</td>
<td>0.43</td>
<td>0.49</td>
</tr>
<tr>
<td>30</td>
<td>25.80</td>
<td>0.50</td>
<td>0.57</td>
</tr>
<tr>
<td>36</td>
<td>32.00</td>
<td>0.61</td>
<td>0.70</td>
</tr>
<tr>
<td>42</td>
<td>38.30</td>
<td>0.72</td>
<td>0.83</td>
</tr>
<tr>
<td>48</td>
<td>44.50</td>
<td>0.83</td>
<td>0.95</td>
</tr>
<tr>
<td>54</td>
<td>50.80</td>
<td>0.94</td>
<td>1.08</td>
</tr>
<tr>
<td>60</td>
<td>57.10</td>
<td>1.05</td>
<td>1.21</td>
</tr>
<tr>
<td>66</td>
<td>62.90</td>
<td>1.15</td>
<td>1.33</td>
</tr>
<tr>
<td>72</td>
<td>69.20</td>
<td>1.27</td>
<td>1.46</td>
</tr>
<tr>
<td>78</td>
<td>75.40</td>
<td>1.38</td>
<td>1.59</td>
</tr>
</tbody>
</table>
4. FRP pipe minimum outside diameters and minimum wall thickness for flush fiberglass bell spigot joints:

<table>
<thead>
<tr>
<th>Existing Sewer Nominal Diameter (Inches)</th>
<th>Minimum Liner O.D. (Inches)</th>
<th>Nom. Pipe Stiffness (PSI)</th>
<th>Minimum Wall Thickness (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>19.50</td>
<td>426</td>
<td>.75</td>
</tr>
<tr>
<td>24</td>
<td>21.60</td>
<td>310</td>
<td>.75</td>
</tr>
<tr>
<td>30</td>
<td>25.80</td>
<td>187</td>
<td>.76</td>
</tr>
<tr>
<td>36</td>
<td>32.00</td>
<td>143</td>
<td>.86</td>
</tr>
<tr>
<td>42</td>
<td>38.30</td>
<td>95</td>
<td>.90</td>
</tr>
<tr>
<td>48</td>
<td>44.50</td>
<td>82</td>
<td>.99</td>
</tr>
<tr>
<td>54</td>
<td>50.80</td>
<td>74</td>
<td>1.09</td>
</tr>
<tr>
<td>60</td>
<td>57.10</td>
<td>65</td>
<td>1.17</td>
</tr>
<tr>
<td>66</td>
<td>62.90</td>
<td>62</td>
<td>1.27</td>
</tr>
<tr>
<td>72</td>
<td>69.20</td>
<td>71</td>
<td>1.45</td>
</tr>
<tr>
<td>78</td>
<td>75.40</td>
<td>59</td>
<td>1.49</td>
</tr>
</tbody>
</table>

5. Fabricate pipe ends square to pipe axis with a maximum tolerance of 1/8”.

H. Fittings:

1. Flanges, elbows, reducers, tees, wyes and other fittings: Capable of withstanding operating conditions.

2. Fabrication: Contact-molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays.

2.04 PROFILE WALL PIPE

A. Profile wall pipe may be considered as liner pipe if appropriate submittals, including data, specifications and sizes were made and accepted during bid phase.

B. PVC Profile Wall Pipe: Comply with Section 02506 – Polyvinyl Chloride Pipe and ASTM F 794.

1. Minimum pipe stiffness: 46 psi.

2. Pipe joints: Flush gasketed joint system meeting ASTM D 3212. Flush joints shall not increase outside diameter or reduce inside diameter of the pipe.

3. Minimum outside diameter for liners:

   | Existing Sewer Nominal Diameter (Inches) | Minimum O.D. of 02550-7 |
---|-----------------------------------------|-------------------------|
| 01-01-2011 |                                      |
Nominal Diameter  | PVC Profile Wall Liner
---|---
24  | 22.110
30  | 28.232
36  | 31.415
42  | 37.800
48  | 44.220

4. Supply pipe in nominal lengths of 15 feet.

C. Polyethylene Profile Wall Pipe:
   1. Comply with ASTM F 894 and Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe.

2.05 LINER PIPE SEALS AT MANHOLES

A. Sealer for annular spaces between liner pipes and host sewers at manholes: Refer to Specification 02555 – Manhole Rehabilitation when using wall sealing material or the Approved Product List for mechanical seals.

B. All manhole bench/invert work and annular seals shall be completed at the time of the post-TV inspection with Post-TV inspection being verification of completion. Failure to do so may be cause for rejection of the Post-TV inspection and require re-inspection.

2.06 CLAMPS AND GASKETS

A. Clamps: Stainless steel, including bolts and lugs, as manufactured by JCM Industries, Type 108, or equal. Furnish full circle, universal clamp couplings with at least 3/16-inch thick neoprene grid-type gaskets. Select clamps to fit outside diameter of liner pipe as follows:

<table>
<thead>
<tr>
<th>Liner Pipe O.D. (Inches)</th>
<th>Minimum Clamp Length (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.125</td>
<td>15</td>
</tr>
<tr>
<td>8.625</td>
<td>18</td>
</tr>
<tr>
<td>10.750 or greater</td>
<td>30</td>
</tr>
</tbody>
</table>

2.07 BEDDING MATERIAL

A. Bedding: Comply with Section 02320 - Utility Backfill Materials and Section 02321 - Cement Stabilized Sand.

PART 3 EXECUTION
3.01 OBSTRUCTION REMOVAL AND POINT REPAIR

A. Make point repairs and remove obstructions, such as roots, rocks and other debris, prior to installing liner pipe. Remove and dispose of in accordance with Section 01504 - Temporary Facilities and Controls, or Section 01576 - Waste Material Disposal.

B. Refer to Section 02553 - Point Repairs and Obstruction Removals, for requirements and procedures for point repairs and obstruction removals.

3.02 DIVERSION PUMPING

B. Refer to Section 01506 - Diversion Pumping.

3.03 INSERTION OR ACCESS PITS

A. Locate pits so that the total number is minimized and footage of liner pipe installed in a single pull is maximized. Where possible, use excavations at point repair locations for insertion pits.

B. Before excavating, locate all utilities, costs of utility repairs, temporary service and other cost arising out of damage to or interruption of utilities, resulting from operations under this Contract, shall be borne by Contractor at no additional cost to City.

C. Perform excavation and backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

D. Perform work in accordance with OSHA standards. Comply with Section 02260 - Trench Safety System, for excavations requiring trench safety.

E. Install and operate necessary dewatering and surface water control measures in accordance with Section 01578 - Control of Ground and Surface Water.

3.04 POLYETHYLENE LINER PIPE INSTALLATION

A. Joints:

1. Assemble and join sections of polyethylene liner pipe on site, above ground. Make joints by heating and butt-fusion method in strict conformance to manufacturer's instructions.

2. Use operators who are experienced with butt-fusion field-jointing of pipe. Operators shall be trained in fusing polyethylene pipe with similar equipment using proper jigs and tools in accordance with pipe manufacturer's standard procedures.

3. Form joints with smooth, uniform double-rolled back beads made while applying proper melt, pressure and alignment. Joints will be inspected by the Engineer before insertion.
B. Preparation: After completing insertion pit excavation, remove top of existing sanitary sewer line down to spring line. Connect power winch cable to end of liner by use of suitable pulling head equal to outside diameter of liner. Secure pulling head to liner and attach to power winch cable so that liner can be satisfactorily fed and pulled through sanitary sewer line. Prevent ragged edges of existing pipe from scarring liner pipe. Follow insertion procedures in ASTM F 585. Do not allow sand or other debris to enter liner.

C. Pulling Liner:

1. Maximum length of continuous liner assembled above ground and pulled at any one time: do not exceed length recommended by manufacturer's printed instructions.

2. Limit pulling force exerted on liner to that indicated below for the appropriate outside diameter of the polyethylene liner. Provide a suitable pulling force measuring device connected to the winch or pulling mechanism.

<table>
<thead>
<tr>
<th>Polyethylene Liner O.D. (Inches)</th>
<th>Maximum Pulling Force (Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.125</td>
<td>3.5</td>
</tr>
<tr>
<td>8.625</td>
<td>5.0</td>
</tr>
<tr>
<td>10.750</td>
<td>8.0</td>
</tr>
<tr>
<td>12.750</td>
<td>12.0</td>
</tr>
<tr>
<td>14.0</td>
<td>14.0</td>
</tr>
<tr>
<td>16.0</td>
<td>19.5</td>
</tr>
<tr>
<td>20.0</td>
<td>29.0</td>
</tr>
<tr>
<td>28.0</td>
<td>52.0</td>
</tr>
</tbody>
</table>

D. Alternate Insertion Techniques: Pushing, or a combination of pulling and pushing, may be used subject to the Engineer's approval. Avoid liner buckling or dimpling by limiting stroke of pushing implement. Cut out and remove portions damaged during insertion process.

3.05 FRP LINER PIPE INSTALLATION

A. FRP liner pipe may be pushed or pulled into existing sewers. Insert pipes, spigot end first, with bell end trailing. Apply pushing force to pipe wall end inside bell in accordance with manufacturer's instructions. Do not apply jacking loads to end of bell. Maximum allowable joint angular deflection shall be one degree. Keep within safe jacking loads as follows:
Nominal Diameter | Maximum Jacking Load (Tons) for 46 psi Stiffness
---|---
21 | 22
24 | 30
30 | 42
36 | 50
42 | 65
48 | 80
54 | 100
60 | 120
66 | 140
72 | 160
78 | 180

3.06 PROFILE WALL PIPE INSTALLATION

A. PVC Profile Wall Pipe

1. Evaluation: Prior to each installation of PVC profile wall pipe, pull trail liner approximately 15 feet long and of the same diameter proposed, to make sure proposed pipe will completely pass through existing line.

2. Preparation:

   a. After completing insertion pit excavation, remove top of existing sanitary sewer host pipe down to spring line to expose channel for liner placement. Prevent ragged edges of host pipe from scarring liner pipe.

   b. Regulate sewer flow so pipe is flowing approximately one-third full. Do not allow sand or other debris to enter liner or annular space during pipe insertion.

3. Installation:

   a. Pushing Liner: Place liner pipe in channel and push forward. Use pushing plate or insertion ring to distribute load from hydraulic or mechanical pipe pusher to end of profile wall pipe. Attach device for measuring jacking/pushing force to pipe pusher. Constantly monitor jacking/pushing force. If jacking/pushing force exceeds 12 tons, stop insertion and consult pipe manufacturer for specific instructions and recommendations. Notify the Engineer each time there is deviation from proposed installation plan. Maximum length of PVC profile wall pipe inserted/pushed: Do not exceed manufacturer’s recommendations.

   b. Joints: After insertion of liner pipe, lubricate gasketed couplings and grooved spigots with special subaqueous lubricant furnished by pipe manufacturer.
Closely monitor grouting pressures; not to exceed 5 psi. Remove liner pipe collapsed by excess grouting pressure or improper procedure and replace with undamaged liner pipe.

B. Polyethylene Profile Wall Pipe

1. Evaluation: Prior to each installation of profile wall pipe, pull trial liner approximately 15 feet long and of the same diameter proposed, to make sure proposed pipe will completely pass through existing line.

2. Preparation:
   a. After completing insertion pit excavation, remove top of existing sanitary sewer host pipe down to spring line to expose channel for liner placement. Prevent ragged edges of host pipe from scarring liner pipe.
   b. Do not allow sand or other debris to enter liner or annular space during pipe insertion.

3. Installation:
   a. Jack or push liner pipe into host pipe without obstruction such as dropped or shifted joints. Constantly monitor jacking/pushing force during the insertion. Place insertion ring or pushing plate between pushing/jacking device and end of pipe. Jacking/pushing force shall not exceed 10 tons.
   b. Joints:
      1. Place gasket facing correct direction and properly seated in spigot groove.
      2. Apply lubricant to entire spigot groove, to exposed gasket surface and to entire inner surface of bell.
   c. Grout pressure: Do not exceed collapse resistance of the liner. Remove liner pipe collapsed by excess grouting pressure or improper procedure and replace with undamaged liner pipe.

3.07 CLAMP INSTALLATION

A. Where excavations for liner pipe insertion are made between two manholes, cut ends of liner pipe smooth and square to pipe axis. Join liner pipes with appropriately sized stainless steel universal clamp couplings. Butt together gap between ends of liner pipe with space between ends not exceeding 2 inches.
B. Bedding: Install cement-stabilized sand in accordance with Section 02321 - Cement Stabilized Sand. Extend bedding 12 inches above clamp/liner pipe.

3.08 FRP COLLAR/CLOSURE

A. Install FRP collar closure pieces in accordance with manufacturer’s recommendations.

3.09 FIELD QUALITY CONTROL

A. After liner installation, perform the following tests:

1. Low pressure air test: Perform before sealing liner in place at manholes, and before making service reconnections to liner. Check integrity of joints made, and verify that liner has not been damaged.

2. Service lateral connection test: After all service laterals have been completed for a particular sewer section, verify integrity of re-connections at points where they join liners and existing service lines by performing smoke test.

3. Refer to Section 02533 - Acceptance Testing for Sanitary Sewers, for applicable test procedures.

3.10 SEALING LINER IN MANHOLE

A. Allow liner pipe to normalize to ambient temperatures and recover from imposed stretch before cutting to fit between manholes, sealing at manholes and shaping manhole invert. Allow at least 12 hours for normalization of polyethylene.

B. Cut liner so it extends 4 inches into manholes. Make smooth, vertical cuts and slope areas over top of exposed liner using non-shrink grout.

C. Seal annular spaces between liner and sanitary sewer main at each manhole with chemical seal and nonshrink grout or mechanical seals.

D. Finish seal liner pipe to host pipe with non-shrink grout placed around annular space from inside manhole. Apply grout in a band at least 6 inches wide. Obtain the Engineer’s approval of sealing methods, including seal chemicals and materials.

E. Use cementitious grout to form smooth transitions with reshaped inverts and raised manhole benches to eliminate sharp edges of liner pipe, concrete benches, and channeled inverts. Build up and smooth manhole invert to match flow line of new liner.

F. Build up the existing invert, in accordance with Document 02555 – Manhole Rehabilitation.

3.11 GROUTING ANNULAR SPACE

A. Obtain approval of grouting plan from the Engineer before proceeding with the Work.
B. Grout annular space between the outside of liner and inside of existing pipe for sewer pipe 18 inches in diameter and larger.

3.12 POST-INSTALLATION VIDEOTAPE RECORDING

A. Provide the Engineer with video inspection showing completed work including condition of restored connections. Comply with Document 02533 - Acceptance Testing for Sanitary Sewers, and Document 02558 - Cleaning and Television Inspection.

3.13 FINAL CLEANUP

A. Upon completion of installation and testing, clean and restore project area affected by work of this Section. Restore site in accordance with Section 01740 - Restoration of Site Improvements.

END OF SECTION
Section 02551

SANITARY SEWER RENEWAL BY SPIN CAST PIPE LINING METHOD

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Proposed methods and materials for the renewal of deteriorated gravity sewer pipes by the Spin Cast Pipe Lining (SCPL) method.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Measurement and payment for SCPL is on a linear foot basis, measured along centerline of pipe from centerline to centerline of manholes or junction boxes, and shall be considered full compensation for all labor and materials required to install the liner to specified requirements. The depth range for payment is based on greatest depth measured at manholes from natural ground level to flow line of sanitary sewer for each pipeline segment.

2. No separate payment will be made for the following items of work. Include cost in the unit price for installing SCPL:

   a. Sealing the liner in manholes/services.

   b. Temporary meter and municipal water obtained from a City fire hydrant.

   c. Antimicrobial System, Epoxy (only when directed by Engineer) or approved substitute.

3. No separate payment will be made for pre-installation and post-installation cleaning and television inspection as specified in Section 02558 – Cleaning and Television Inspection.

4. Where post-installation thickness measurements or physical property testing is performed, payment for installed SCPL shall be made as follows:

   a. Full payment: If thickness, compressive strength and flexural modulus of elasticity of installed SCPL are all 95 percent or better of specified values, full payment shall be made.

   b. Adjusted payment: If thickness, compressive strength or flexural modulus of elasticity is between 90 percent and 95 percent of specified values, payment shall be made based on an Adjusted Unit Price, which shall equal the Unit Price bid, multiplied by a Value Factor calculated as follows:
"Value Factor" shall not exceed 100 percent.

5. Payment for point repairs and obstruction will be made according to Section 02553 – Point Repairs and Obstruction Removals.

6. Payment for repair of sags in the line will be made either according to Section 02553 – Point Repairs and Obstruction Removals, or according to the diameter and depth of the pipe if "Remove and Replace" is the method of repair designed by the Engineer.

7. Measurement and payment for repairs of defects to the interior surface of the pipe due to acid erosion or abrasion is on a cubic foot basis.

8. Refer to Section 01270 – Measurement and Payment

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

1.03 REFERENCES

A. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

B. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete

C. ASTM C293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)

D. ASTM C 469 - Standard Test Method for Static Modulus of Elasticity and Poisson’s Ratio of Concrete in Compression

E. ASTM F 2414 – Standard Practice for Sealing Sewer Manholes Using Chemical Grouting

F. ASTM E 2149 - Standard Test Method for Determining the Antimicrobial Activity of Immobilized Antimicrobial Agents under Dynamic Contact Conditions

G. ACI Field Technician Certification Programs: Grade 1 Technician

1.04 SYSTEM DESCRIPTION

A. SCPL involves renewal of deteriorated gravity sanitary sewer pipe that is centrifugally applied through a spin caster or hand sprayed to the interior surface of the host pipe after it has been properly prepared and cleaned. The finished surface shall have flow characteristics that closely match the original pipe.
B. A spin cast liner cures into a hard, impermeable, smooth, corrosion-resistant liner of specified thickness and physical properties, with a uniform interior surface.

C. Spin Cast Material and Installation: Comply with ASTM C 39. The City reserves the right to approve materials or installation practices which differ from these standards.

1.05 SUBMITTALS

A. Make submittals in accordance with Section 01330 – Submittal Procedures.

B. Spin Cast Geopolymer Liner Material:
   1. Submit product data with physical and chemical properties.
   2. Submit results of testing performed by liner manufacturer demonstrating compliance with specified chemical properties requirements for each product batch.
   3. Submit manufacturer-certified batch analysis for basic physical properties performed at manufacturing facility.

C. Installed Geopolymer Liner:
   1. Submit field measurements of cured liner thickness for determining payment.
   2. Samples shall be obtained by ACI Certified, Grade 1 Technicians.
   3. Submit representative sample(s) of the cured liner required for testing in Accordance with ASTM C 39.
   4. Submit post-installation television inspection video as specified in Section 02558-Cleaning and Television Inspection.

1.06 QUALITY ASSURANCE

A. During the course of the Work, make no substitutions of materials, design values or Procedures for those specified without the prior written approval of the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Geopolymer Liner:
   1. The geopolymer lining material shall be a micro-fiber reinforced ultra-dense geopolymer. The material shall provide a high strength fiber reinforced mortar specifically designed for ease of mechanical pumping, spraying and spin casting. The geopolymer liner shall not clog spinner heads or spray equipment.
   2. The geopolymer liner shall be designed to produce a liner with improved compressive and flexural strength, high adhesion to damp surfaces, lower permeability and increased resistance to aggressive chemical attack.
3. The fiber reinforced formula shall be engineered to improve hydraulic abrasion resistance, provide dimensional stability and protect against penetration by substances such as fats, oils, gases, and where high corrosion exists within a sanitary sewer environment.

B. Anti-Microbial System (AMS):

1. Application of Antimicrobial Liquid, or Epoxy (only when directed by Engineer), to prevent Microbiologically Induced Corrosion (MIC). The work consists of rolling, spraying or centrifugally applying AMS Liquid, approved substitute, or epoxy to the inside of the newly cast pipe. Equipment required for application can include centrifugal spray mechanisms, pneumatic spray pumps, hand pumps or paint style roller.

2. The Antimicrobial Liquid, or Epoxy, shall be used full strength as received from the manufacturer and shall not be diluted.

3. The Antimicrobial Liquid, shall be applied during the application of the geopolymer liner or anytime thereafter. Epoxies shall be applied after proper curing of the liner.

4. The Antimicrobial Liquid shall be applied adequately to achieve surface saturation. Epoxies must be applied at a minimum thickness of 125 mils.

5. The Antimicrobial Liquid, or Epoxies, must be allowed to cure for a minimum of 12 hours, or meet manufacturer recommended cure time, prior to releasing bypass or opening to any traffic.

2.02 TESTING REQUIREMENTS


B. Test Results: Submit test results including at least the following:

1. Raw data for each test specimen for each test performed

2. Calculated average test results for each test performed

3. Using calculated averages for each test, calculate the average test result.

2.03 PHYSICAL PROPERTIES

A. Minimum Geopolymer Liner Thickness after Curing: As specified in the table below, the minimum liner thickness is based on the maximum sewer depth for the segment being rehabilitated. The thickness installed must meet the manufacturers written requirements. The standard conditions utilized in the table below include: a pipe in the fully deteriorated condition, the water table is assumed to be at the surface; soil is assumed at 130 lbs/cubic foot, and a traffic loading of HS-20. The installed liner system, complete in place, must meet or exceed site specific conditions.

Minimum Geopolymer Liner Thickness:

02551-4
07/01/2016
<table>
<thead>
<tr>
<th>Sewer Pipe Diameter</th>
<th>Maximum Invert Depth 0 to 10 feet</th>
<th>Maximum Invert Depth 10-15 feet</th>
<th>Maximum Invert Depth 15-20 feet</th>
<th>Maximum Invert Depth 20-25 feet</th>
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<tr>
<td>30”</td>
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<td>1.8”</td>
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<tr>
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<td>1.9”</td>
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<td>2.0”</td>
<td>2.3”</td>
<td>2.5”</td>
</tr>
<tr>
<td>120”</td>
<td>***</td>
<td>2.1”</td>
<td>2.4”</td>
<td>2.6”</td>
</tr>
</tbody>
</table>

Note: If host pipe condition is deemed to be more severe than assumed conditions, liner thickness may be increased upon approval by the Engineer.

B. The geopolymer liner material shall also conform to the minimum requirements demonstrated in the following table:

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>ASTM Reference</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressive Strength</td>
<td>ASTM C 39</td>
<td>Minimum 8,000 psi @ 28 days</td>
</tr>
<tr>
<td>Modulus of Elasticity</td>
<td>ASTM C 469</td>
<td>Min. 5,000,000 psi @ 28 days</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM C 293</td>
<td>Minimum 800 psi @ 28 days</td>
</tr>
</tbody>
</table>

C. If different conditions are encountered in the field, design considerations may change, if required by the Project Manager. Required thickness may be increased or decreased based on specific design. The thickness may be changed in increments of 0.2 inches and payment shall be made or deducted at the rate of 7.5% of the bid item amount for each increment. However, the Contractor shall not be allowed to change any required thickness unilaterally, or offer credits after the fact as remedy for liners not meeting the required thickness. Prior approval shall always be required for any changes in geopolymer liner thickness. Refer also to “Non-Confirming Work” in Section 3.10.

2.04 FIELD TESTING

A. For each section length designated by the owner in the Contract documents, the geopolymer liner material may be collected at the mixer, immediately before discharge into the pump, at the pump discharge, or at the end of the hose near the discharge point. Use cylinders as in accordance with Test Method ASTM C 39, A 4-inch by 8-inch cylinder shall be used to sample the material. ACI grade 1 certified technicians shall be used to obtain the sample. Documentation showing the field sample technicians ACI status shall be available onsite. Sample frequency shall not be less than once daily.

B. Make cylinders for each contract specified section and label each with the date, location, project, and product batch numbers. The product batch numbers are located on each liner material bag or on the pallet. ACI technicians shall be used to properly collect and store the samples. The 4-inch by 8-inch samples cylinders must be air mist cured per manufacturers’ recommendation.
C. Thickness can be verified with a wet gage at any point of the new interior surface. Thickness measurements shall be taken at the beginning and end of any section of pipe being rehabilitated. The measurements shall be written in a daily log that includes the date, properly identifies the section of pipe, the actual measurements recorded (to tenths of an inch), and the name of the person taking the measurements.

D. When requested by Project Manager, the contractor shall remove a test core from the installed liner pipe at the contractor’s expense, at established intervals. Contractor shall mark the core sample with the date that the liner was installed, the date that the core was removed, and the location within the pipe segment. The inspector shall initial the test coupon and provide it to the testing lab. A caliper or other suitable measuring device shall be used to test liner thickness. When requested by Project Manager, the pipe liner sample shall be cored at three different clock positions, and the average thicknesses measured shall be taken as the actual thickness of the spin cast liner. If a sample fails the test, additional material shall be applied to meet the thickness requirements.

PART 3 EXECUTION

3.01 PRE-INSTALLATION CLEANING AND TELEVISION INSPECTION

A. Perform a pre-installation television inspection in accordance with Section 02558- Cleaning and Television Inspection. Verify that sewer is clean and pipe conditions are suitable for installation of the geopolymer liner. Notify Project Manager if conditions exist which will impact the installation.

3.02 OBSTRUCTION REMOVAL, POINT REPAIR AND SAG ELIMINATION

A. If pre-installation video inspection reveals an obstruction in the line segment (such as heavy solids, dropped joints, protruding service connections or collapsed pipe) that cannot be removed by conventional sewer cleaning equipment and the obstruction will prevent completion of the lining process, perform point repairs or obstruction removal prior to the geopolymer liner installation. Obtain approval of the Project Manager before performing work. Follow Requirements in Section 02553 – Point Repairs and Obstruction Removals.

B. If the pre-installation video inspection reveals a sag in the sewer that has a vertical displacement greater than one-half the pipe diameter, eliminate the sag by performing a point repair as specified in Section 02553 – Point Repairs and Obstruction Removals, or by removal and replacement of the sewer segment. Obtain approval of the Project Manager before performing work.

C. If the pre-installation video inspection reveals defects and failures on the interior pipe surface, due to acid erosion or abrasion, the repairs shall be made when directed by Project Manager. Measures shall be taken to provide a continuous slope to the pipe, including the use of a flowable fill or the introduction of the wall lining material onto the pipes surface.

D. If the pre-installation video inspection reveals open, separated, or offset joints, the joints shall be sealed with the geopolymer lining material prior to the lining of the pipe.
3.03 CLEANING

A. All internal debris shall be removed from the original pipeline. Gravity pipes shall be cleaned with hydraulically powered equipment, high-velocity jet cleaners, or mechanically powered equipment. If pipe diameters allow for manned entry, the use of high-pressure washers delivering a minimum of 3500-psi, may be utilized. The use of higher-pressure washers may be required to achieve the desired surface condition. In some instances mechanical cleaning methods may be required. The surface of the pipe to be lined shall be capable of directly receiving the lining material.

3.04 DIVERSION PUMPING

A. Maintain commercial and residential sanitary sewer service during the installation process.

B. Install and operate diversion pumping equipment to maintain sewage flow around the segment of pipe being rehabilitated, and to prevent backup or overflow, as specified in Section 01506 – Diversion Pumping.

3.05 INSTALLATION PROCEDURES

A. Notification: Inform the Project Manager of work schedules for SCPL.

B. Conduct operations in accordance with applicable OSHA standards, including safety requirements involving work on elevated platforms and entry into confined spaces. Take suitable precautions to eliminate hazards to personnel near construction activities when pressurized air is being used.

C. Mixing: Combine all of the packaged geopolymer liner dry mix with the specified amount of potable water while mixing until proper consistency is obtained, as described by the manufacturer. The mixer must be capable of regulating the amount of water added to the mix on a consistent basis. Water shall not be added by hand to the mixing chamber. Water temperatures shall be monitored when ambient temperatures are above 90 degrees F or below 40 degrees F. Tempering of the material above the manufacturers published limits is not allowed. Continue to agitate the geopolymer liner material to prevent thickening beyond the desired fluidity. The working time shall be as per manufacturer’s recommendation.

D. Application: Position the rotating casting applicator within the center of the sewer pipe and commence pumping the mixed geopolymer liner material. As the geopolymer liner begins to be centrifugally cast evenly around the interior, retrieve the applicator head at the predetermined speed for applying the thickness that has been selected. The geopolymer liner is installed in several stages at a predetermined thickness per application. If flows are interrupted for any reason, arrest the retrieval of the applicator head until flows are restored. Liner thickness shall be applied to the thickness specified by the engineer but no less than ½ in. (1.3 cm). The retrieval speed is varied to create different thicknesses as the condition may dictate to provide sufficient strengths. If the measured pipe ovality is greater than five percent, a licensed engineer must review and approve application design thickness requirements. Retrieval speed will be calculated prior to application and will be adjusted for conditions, pipe diameter, design thickness, and pumping rate to meet the engineer’s specifications. The retrieval mechanism must be capable of producing a consistent retrieval rate and be repeatable within 5 percent of the speed specified. Where the geopolymer liner meets other pipes/liners, the joints shall be flush with no gaps, providing a uniform surface.
E. Curing:

1. Follow manufacturer’s recommended cure schedule in curing of the geopolymer liner.

2. Refer to ACI 305R-99 Hot Weather Concreting. Do not apply geopolymer liner material when ambient and surface temperatures are 100°F or 35°C and above. Shade the material and prepare the surface to keep it cool. To extend working time, mix the material with cool water or ice-cooled water. The substrate shall be saturated surface dry (SSD) before application begins. Follow ACI 305R-99 guidelines for the proper use of curing agents.

3. The geopolymer liner shall not be placed when the ambient temperature is 37 degrees Fahrenheit and falling or when the temperature is anticipated to fall below 32 degrees Fahrenheit during the next 24 hours, unless specific precautions are employed. At temperatures near 45°F or 7°C, warm the material, water, and substrate. Properly ventilate the area when heating. Protect the new liner from freezing.

F. If additional thickness is desired at any section, place the spin cast applicator at that level and recommence pumping and retrieval until that area is thickened. The geopolymer product design and application process shall result in a monolithic liner.

G. Finished Pipe: The spin cast renewal system using the geopolymer liner material produces a finely textured surface that requires no additional troweling or finishing.

3.06 SEALING AT MANHOLES/SERVICES

A. Form tight seals between the geopolymer wall liner and the manhole walls at pipe penetrations and form tight seals at service connections. Place the geopolymer material around the pipe opening from inside the manhole in a band at least 4 inches wide. Complete sealing procedures for each liner segment as required.

B. Reshape and smooth the manhole invert and build up the existing invert until it is full pipe depth (equal in depth to the diameter of the largest/outgoing pipe) across the manhole bottom up to 15” pipe diameter.

C. Build inverts for all lateral sewers entering the manhole whose flow line elevation is between the crown and flowline elevations of the outgoing/downstream pipe. Maximum depth of lateral invert shall be up to full pipe depth (equal in depth to the diameter of lateral/upstream sewer when the top of the proposed sloped bench is the same elevation as the crown of the lateral sewer) at the upstream end and full pipe diameter of the outgoing/downstream sewer at the downstream end up to 15” maximum pipe diameter.

3.08 POST-INSTALLATION TELEVISION INSPECTION

A. Make and submit videos showing complete work, including condition of restored Connections. Refer to Section 02558 – Cleaning and Television Inspection.

B. All manhole bench/invert work shall be completed at time of Post-TV, with Post-TV being verification of completion.
3.09 FINAL CLEANUP

A. Upon completion of renewal work and testing, clean and restore project area affected by the Work in accordance with Section 01740 – Restoration of Site Improvements.

3.10 NON-CONFORMING WORK

A. If the thickness, or the compressive strength or the compressive modulus of elasticity of the installed spin cast pipe lining is less than 90 percent of the specified values, the product is considered unacceptable. Submit a proposed method of repair or replacement for review and approval by the Project Manager. Work required to remedy non-conforming work shall be at no additional cost to the City.

B. If it is determined that the geopolymer liner material did not match the submitted manufacturers claims, the product is considered unacceptable and non-conforming. Submit proof that the geopolymer liner meets the requirements of the specification through the use of samples analyzed or retained at the manufacturing facility, or submit a method for replacement of the sewer segment liner for review and approval by the City. Work required to remedy non-conforming work shall be at no additional cost to the City.

C. For all instances, where the geopolymer liner is deemed unacceptable, other than thickness, or compressive strength, as described in this specification section, submit a proposed method of repair or replacement for review and approval by the Project Manager. Work required to remedy non-conforming work shall be at no additional cost to the City.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair of sanitary sewer lines by replacing short lengths of failed pipe with new pipe.

B. Repair of service lines located within the utility easement or street right-of-way, by replacing short lengths of failed pipe with new pipe.

C. Obstruction removal by remote device or excavation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Point Repair:

   a. Measurement for sewer line point repair is on a unit price basis for each point repair performed. The length of pipe to be replaced under each point repair pay item, as determined by depth of sewer line measured from natural ground to flowline at the location of the point of repair, is as follows:

      (1) Six (6) feet minimum length for sewers up to ten (10) feet deep.

      (2) Ten (10) feet minimum length for sewers over ten (10) feet deep.

   b. Measurement for sewer line pipe replacement beyond point repair is on a linear foot basis in excess of minimum replacement lengths specified above.

   c. Payment for service line point repair is on a linear foot basis for all sizes of service lines and for all depths (same unit price per linear foot, regardless of size and depth). No separate payment will be made for point repair done within the limits of a service line reconnection as defined in Section 02534 - Sanitary Sewer Service Stubs or Reconnections. Minimum length of service line point repair is 3 feet.

   d. Measurement for hand excavation is on a cubic yard basis when authorized by the Project Manager in locations where excavation by machine is not suitable.
e. Measurement for abandonment of point repair by excavation is on a per each basis for excavation required to expose existing pipe. Separate measurement will be made for machine excavation and hand excavation.

f. Measurement for abandonment of point repair by video inspection is on a linear foot basis for TV Inspection and Cleaning.

g. The cost of the following items of work are included in the unit prices for point repairs unless included as a bid item in Document 00410 – Bid Form:

(1) Excavation, embedment and backfill.

(2) Hauling away and lawful disposal of excess excavated materials and debris.

(3) Pipe, pipe fittings, adapters and concrete collars.

(4) Smoke testing and any required testing.

(5) Restoration of site improvements, including sodding.

(6) Pre- and post-cleaning video inspection.

h. Pipe replacement required as part of a new or replacement manhole installation, due to existing deteriorated or inadequate pipe, shall be paid for under the Pipe Replacement Beyond Point Repair pay item appropriate for the size and depth of the sewer. Pipe replacement required due to damage by or for the convenience of the Contractor shall be paid by the Contractor.

i. Storm sewer replacement required to properly rehabilitate the sanitary sewer shall be paid under the Point Repair pay item appropriate to the storm sewer size and depth being replaced. Additional length shall be paid under the Pipe Replacement Beyond Point Repair pay item appropriate to the storm sewer size and depth being replaced.

j. Point Repairs performed due to sag in the sewer line shall be paid for under the Point Repair pay item appropriate for the size and depth of the line.

2. Obstruction Removal:

a. Obstruction removal by excavation will be paid on a unit price basis according to depth for each removal. Obstruction removal can be submitted for payment when the obstruction has been cleared from the sewer line to be lined. Liner work must proceed at least 6 feet before payment for removal of another obstruction will be considered (i.e., all obstruction within a distance of 6 feet is considered to be part of the same obstruction.)
b. Depth shall be measured from natural ground level to the flow line at the point of obstruction removal.

c. The cost of the following items of work are included in the unit prices for obstruction removal by remote device or excavation:

(1) Cleaning of sanitary sewers due to broken pipe, roots, dirt, loose deposits, etc.

(2) Television inspection.

(3) Excavation, embedment and backfill.

(4) Hauling away and lawful disposal of excess excavated material and debris.

(5) Restoration of site improvements, including sodding.

d. Payment will not be made for obstruction removal if the existing sewer line, service line or tap is damaged and a point repair is required. Payment will not be made for removal of a protruding tap if the service reconnection is performed by excavation.

e. Removal of hard deposits, concrete, debris, pipes or any other material in a manhole, or that is accessible from the manhole wall, will be cleared under work items for rehabilitation of sanitary sewer pipes and manholes.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 PERFORMANCE REQUIREMENTS

A. Point Repair:

1. Locate and replace small lengths of one or more pipe sections where isolated line failure has occurred due to settlement, corrosion, crushing, or separation of joints.

2. The Project Manager may identify potential locations for point repair, but the Contractor is responsible for verifying locations. Point repairs to sewer lines are listed in Point Repair Rehabilitation Tables. Point repairs to service lines are listed in Lateral Line Rehabilitation Tables.
3. Determine the location of service line repairs by smoke testing the manhole section in which the failed pipe is located. The Project Manager will authorize the Contractor to make point repairs based on results of smoke testing.

4. Conduct all smoke testing in accordance with the City of Houston “Procedures to Conduct Physical Inspections of the Wastewater Collection System”. Smoke testing shall not be performed within 24 hours of a rainfall event or if ponded or standing water is present on the ground or in the drainage channels in the area planned for smoke testing.

5. Smoke testing shall be accomplished utilizing two (2) minimum 1,750 CFM blowers designed specifically for smoke testing of sewers. Place blower on the upstream and downstream manhole of the line section to be tested. Place sandbags in the upstream and downstream manholes to isolate the section being tested and prevent the migration of smoke into sections not being tested. Utilize smoke bombs as necessary to ensure a continuous supply of smoke is provided for the entire duration of the test period.

6. Determine the location of point repairs by smoke testing or closed circuit television inspection of the failed pipe location. The Project Manager will authorize the Contractor to make point repairs.

7. The Project Manager will authorize each point repair after failure points are located. Do not make point repairs without prior authorization of the Project Manager. Perform point repairs only on those portions of service lines which are located in an easement or right-of-way; perform no repairs to service lines on private property.

8. Replace carrier pipe for point repairs unless otherwise directed by the Project Manager.

B. Obstruction Removal: Remove obstructions by one of the following methods:

1. Obstruction removal by remote device:
   a. Protruding taps: Service lines that protrude more than one inch into the sewer.
   b. Other obstructions: Hanging gaskets, fixed debris, stabilized sand, hardened mineral deposits, roots, rust scale, tuberculation, etc.

2. Obstruction removal by excavation: Obstructions encountered during liner insertion that are removed by digging and exposing the pipe.
1.04 DEFINITIONS

A. Point Repair: Repair of broken or collapsed gravity sanitary sewer lines on public property, including mains, collectors and service lines, by replacing, at the point of failure, the length of failed pipe with new pipe.

B. Obstruction Removal: Clearing sewer mains of obstructions to allow for rehabilitation.

C. Sewer Lines: Gravity flow pipe lines in the easement or right-of-way which collect sanitary sewer discharges from commercial or residential service lines and discharge into another sewer line (main or collector), or into a lift station or treatment plant.

D. Service Lines: Those gravity flow sewer lines from commercial or residential property that discharge into a sewer line.

1.05 SUBMITTALS

A. Submittals: Comply with Section 01330 - Submittal Procedures.

B. Submit product data for each pipe product, fitting and jointing material.

C. Submit Pre and Post inspection videos in accordance with Documents 02558- Cleaning and Television Inspection.

1.06 SEQUENCING

A. Before rehabilitating a sewer line section between adjacent manholes, complete point repair and obstruction removal on that section.

B. Clean the line and perform a post-installation video inspection for each point repair on a sewer line not scheduled for additional rehabilitation.

C. Post-installation video inspection of the service line point repair is not required.

PART 2 PRODUCTS

2.01 PVC PIPE

A. PVC Sewer Pipe and Joints: 4-inch through 24-inch pipe complying with Section 02506 - Polyvinyl Chloride Pipe. If point repair is located at a service connection, use a full-bodied fitting for the service connection. No field fabrication of fittings allowed.
2.02 DUCTILE IRON PIPE


B. Fittings: Push-on end-joint fittings with bell-and-spigot ends, with bells modified for push-on joints, complying with Section 02501 - Ductile Iron Pipe and Fittings.

C. Interior Coating: Comply with Section 02501 - Ductile Iron Pipe and Fittings.

D. Exterior coating: 8-mil polyethylene tubular material conforming to requirements of Section 02528 – Polyethylene Wrap.

2.03 REINFORCED CONCRETE PIPE

A. Reinforced Concrete Pipe and Joints: Comply with Section 02611 - Reinforced Concrete Pipe. Reinforced concrete pipe may be used for sewers 21 inches in diameter and larger.

2.04 FRP PIPE

A. FRP Pipe: Comply with Section 02504 - Centrifugally Cast Fiberglass Pipe.

2.05 JOINTING MATERIALS

A. Use flexible adapters secured with 1/2-inch stainless steel bands, Flexible adapter must comply with ASTM C-1173.

B. Form a concrete collar around each joint using concrete complying with Section 03315 - Concrete for Utility Construction.

PART 3 EXECUTION

3.01 PROTECTION

A. Provide barricades, warning lights and signs for excavations created by point repairs. Comply with Section 01504 - Temporary Facilities and Controls.

B. Do not allow soil, sand, debris or runoff to enter sewer system.

3.02 DIVERSION PUMPING

A. Install and operate diversion pumping equipment as required to maintain sewage flow and to prevent backup or overflow. Comply with Section 01506 - Diversion Pumping.
3.03 EXCAVATION

A. Excavate and backfill trenches in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Perform work in accordance with OSHA standards. Employ a trench safety system as required in Section 02260 - Trench Safety System.

C. Install and operate necessary dewatering and surface water control measures as required in Section 01578 – Control of Ground Water and Surface Water.

D. Remove and lawfully dispose of excess excavated material and debris from the work site daily.

3.04 TYPICAL SEQUENCE OF POINT REPAIR

A. Perform pre-installation video inspection to verify the location of sewer line point repairs. Perform service testing between manholes to verify location of service line point repairs.

B. After the location of a point repair, excavate the required length for the point repair.

C. Prior to replacing pipe, determine condition of the existing line on both sides of the point repair by lamping the line at least 10 feet in each direction. Determine whether additional lengths of line (beyond "minimum length" criteria) need replacement. Report need for additional replacement to the Project Manager and obtain authorization before proceeding.

D. Remove the damaged pipe and replace with new pipe, shaping the bottom of the trench and placing the required pipe bedding so that the grade of the replaced pipe matches the grade of the existing line. Establish proper grade for the pipe being replaced using methods acceptable to the Project Manager.

E. Connect the new pipe to existing pipe using flexible adapters. If joints cannot be made watertight using flexible adapters, place waterstop gaskets on each joint and encase in a reinforced concrete collar as indicated on Drawing 02531-04, Sanitary Sewer Pipe Transition for 36" Sewer and Smaller. Place concrete as specified in Section 03315 - Concrete for Utility Construction. Reconnect affected service connections or stacks using full-bodied fittings. No field fabrication of fittings allowed.

F. After completion of point repair, but prior to backfill, perform a smoke test to demonstrate the integrity of the repair, in the presence of the Project Manager. Test as specified in Section 02533 - Acceptance Testing for Sanitary Sewers. Repair and retest sections that fail until repair passes test.

G. Encase exposed pipe in cement stabilized sand complying with Section 02321 – Cement Stabilized Sand.
H. Backfill the excavation as specified in Section 02317 - Excavation and Backfill for Utilities.

I. Complete site restoration as specified in Section 01740 - Site Restoration.

J. Perform a post-installation video inspection as specified in Document 02558 - Cleaning and Television Inspection. Point repairs that show offset joints, non-uniform grade, incorrect alignment, excessive deflection or similar conditions are considered defective work. Replace pipe and bedding as required to correct defective work.

K. Extra length of Pipe Replacement beyond the Point Repair limits may be extended to the entire section either way, even to the next continuous section, as directed by the Project Manager.

3.05 ABANDONMENT OF POINT REPAIR

A. If a pipe is exposed by excavation and found to be in good condition, not requiring a point repair, the point repair shall be abandoned. Notify the Project Manager.

B. If pre-installation video inspection reveals that no point repair is required, the Contractor shall notify the Project Manager and the point repair shall be abandoned.

C. Backfill the excavation, replace pavement or sidewalk, and repair and seed or sod unpaved areas, as specified in Section 01740 - Site Restoration.

3.06 OBSTRUCTION REMOVAL

A. Remote Device: Remove obstructions identified during video inspection of a sanitary sewer line segment which could cause a non-uniform liner pipe installation or obstruction of the liner during installation. Obtain authorization from the Project Manager for obstruction removal with a remote device before proceeding.

1. Use a power-driven cutting device (robotic cutter) to remove protruding taps. Cut protruding taps so that protrusions are no greater than 3/4 inch. If a protruding tap cannot be removed by the cutting device, then a point repair may be performed. Obtain authorization from the Project Manager before proceeding.

2. To remove other obstructions, use a remote device. Pull or drive the device from manhole to manhole up to a continuous length of 500 feet using a solid steel mandrel, porcupine, root saw, bucket, robotic cutter or similar device to remove the obstruction. Select a device that is adequately sized to remove the obstruction.
B. Excavation: Use excavation as the method of obstruction removal when installation of the liner in the sanitary sewer is in progress. If during the liner insertion operation, a collapsed sewer, off-set joint or other obstruction is encountered which prevents or blocks the passage or insertion of the liner, notify the Project Manager for authorization to excavate. Uncover and remove the obstruction as follows:

1. Excavate at the point where there is an obstruction. Use a trench safety system as required.

2. Break out the existing sanitary sewer pipe (carrier pipe) as directed by the Project Manager. Remove only that amount of material which is causing the obstruction. Remove the minimum amount of carrier pipe.

3. Under such conditions, replacement of the carrier pipe is not required. Do not disturb the existing sewer bedding during excavation. However, if embedment is disturbed during the obstruction removal procedure, place cement-stabilized sand or crushed stone beneath the liner.

4. When the liner is completely in place, encase it with crushed stone or cement stabilized sand as shown on Drawing No. 02317-01, Sanitary Sewer Embedment and Trench Zone Backfill for Dry or Wet Stable Trench.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair, rehabilitation or replacement of deteriorated, leaking or structurally unsound manholes and cleanouts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Rehabilitated Manholes:

   a. Measurement for manhole wall lining (including bench work) is on a vertical foot basis to the nearest tenth of a foot, measured from the bottom of the frame to the top of the bench. If the bench is not required, measurement will be from the bottom of the frame to the top of the effluent pipe. (Refer to Drawing No. 02534-03A).

   b. Measurement for the adjustment using a new watertight manhole frame and cover, including raising or lowering the height of the cover within one vertical foot, is on a unit price basis, per manhole.

   c. Measurement for the adjustment of an existing manhole frame and cover, including raising or lowering the height of the cover within one vertical foot, is on a unit price basis, per manhole.

   d. Measurement for new or existing manhole frame and cover adjustment of over one foot is on a vertical foot basis, measured to the nearest tenth of a foot.

   e. Backfill, including cement-stabilized sand, is included in the unit prices for rehabilitated manholes; no separate payment will be made.

   f. Measurement for pavement restoration will be in accordance with Section 02951 - Pavement Repair and Resurfacing.

   g. Measurement for new manhole insert dishes will be on a unit price basis, per manhole.
h. Chemical grout injection to stop water intrusion is included in the unit prices for the rehabilitated manholes; no separate payment will be made.

i. Manhole Benches constructed without wall lining, when directed by the Project Manager, will be paid for separately on a unit price basis.

j. Payment for rehabilitation of manholes or junction boxes other than 4’ diameter circular manholes will be on an equivalent 4’ diameter manhole vertical foot basis. The square feet rehabilitated shall be converted to an equivalent vertical feet of a 4’ diameter manhole by dividing the square feet by 12.57.

k. Refer to Section 01270 - Measurement and Payment, for unit price procedures.

2. New/Replacement Manholes:

a. Measurement for abandoned manholes is on a unit price basis per manhole abandoned.

b. Measurement for new manholes is on a unit price basis, per manhole. Price includes excavation, removal of existing manhole/cleanout/end of line, new frame and cover, sealant and backfill materials. Price also includes up to 6 feet of sewer pipe, in each and every direction, measured from the outside wall of the manhole.

c. Backfill, including cement-stabilized sand, is included in the unit price for new/replacement manholes; no separate payment will be made.

d. Measurement for pavement restoration will be in accordance with Section 02951 - Pavement Repair and Resurfacing.

e. Refer to Section 01270 - Measurement and Payment.

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

1.03 REFERENCES


B. ASTM C 293 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Center-Point Loading)

C. ASTM C 490 - Standard Practice for Use of Apparatus for the Determination of Length Change of Hardened Cement Paste, Mortar, and Concrete
D. ASTM C 496 – Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

E. ASTM C 882 – Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete By Slant Shear

F. ASTM C 1140 - Standard Practice for Preparing and Testing Specimens from Shortcrete Test Panels.

1.04 PERFORMANCE REQUIREMENTS

A. Perform work needed to make manholes structurally sound, improve flow, prevent entrance of inflow or groundwater, prevent entrance of soil or debris, and provide protection against hydrogen sulfide gas attack.

B. Manufacturer's Product Support: When requested by the Project Manager, provide a representative employed by the manufacturer having technical training in admixture and manhole wall liner available for consultation on site with 48 hours notice.

1.05 QUALITY ASSURANCE

A. Obtain all chemical grouting materials from a single manufacturer.

B. Installation shall be completed by firms and individuals trained in methods of installation by the manufacturer with at least five years of experience.

C. Personnel shall have confined space entry certification, where needed.

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 Project Manager may obtain core samples at his discretion.

1.06 SUBMITTALS

A. Submittals: Comply with Section 01330 - Submittal Procedures.

B. Product Data: Submit product data, including surface preparation instructions and application instructions, from pre-approved manufacturer of wall repair materials, hydraulic cements, quick-set mortars, specialized sealants, grouts, manhole inserts, manhole frame covers and frame-to-manhole seals.

C. Installer Qualifications: Installers of liners and wall repair systems shall submit qualifications to the Project Manager. List installer’s personnel who have satisfactorily completed manufacturer’s training in product application within the previous 2 years. Include date of certification for each person.
1.07 PROJECT CONDITIONS

A. Manholes Containing Mechanical or Electrical Equipment:

1. Drawings may not show locations of flow monitoring equipment. If a manhole contains any mechanical hardware or electrical flow monitoring equipment, immediately notify the Project Manager. Reschedule work based on instructions provided by the Project Manager.

2. Do not subject manholes with mechanical hardware or electrical equipment to diversion or bypass pumping.

3. Damage to installed equipment, due to Contractor’s failure to adhere to this instruction, will be repaired by the City and cost of repairs charged to the Contractor.

B. Field Location of Manholes, Cleanouts and End of Lines:

1. Contractor is responsible for locating and uncovering all manholes, cleanouts and ends of lines. If Contractor is unable to locate manholes, cleanouts or ends of lines, Contractor shall notify the Project Manager in writing.

2. Manholes may be located within project limits which are not part of the system being rehabilitated. Properly identify manholes before starting work.

1.08 SALVAGE

A. Manhole covers and frames from abandoned manholes remain the property of the City. Unless indicated to be re-used in the work, deliver salvaged items to location(s) designated by the Project Manager.

1.09 MATERIAL HANDLING, DELIVERY AND STORAGE

A. Materials shall be delivered in the original unopened containers. Each container shall be clearly labeled with the following:

1. Product name

2. Manufacturers name

3. Component designation

4. Product mix ratio

5. Health and safety information
B. Provide equipment and personnel to handle the materials which prevent damage. The Contractor shall promptly inspect delivered materials for damage.

C. Store materials in accordance with manufacturer’s recommendations.

PART 2  PRODUCTS

2.01  SURFACE PREPARATION

A. High Pressure Water: 3500 psi minimum force.

B. Cleaners: Detergent or muriatic acid capable of removing dirt, grease, oil and other matter which would interfere with bond of sealing material to wall; refer to sealing material manufacturer's recommendations.

2.02  WALL REPAIR MATERIALS

A. Hydraulic Cements: Use a blend of cement powders or hydraulic cement to stop active leaks in the manhole structure that meet the following:

1. Compressive strength of 5500 psi in 28-days

2. Tensile strength of 650 psi in 28-days

3. Bond strength of 880 psi in 28 days

B. Quick-set Mortar: Use a quick-set mortar to repair wide cracks, holes or disintegrated mortar.

2.03  MANHOLE WALL LINERS, BENCH FORMING AND REPAIR MATERIAL

A. Sprayable Restoration Mortar: Use blend of portland cement or polymer modified cement, micro-silica, densifiers, admixtures and other modifiers that produces a high strength and low permeability mortar for rehabilitation of deteriorated concrete and brick surfaces, and meet the following requirements.

1. Compressive Strength (ASTM C109) of 9,000 psi (minimum) in 28 days

2. Flexural Strength (ASTM C293) of 1,000 psi (minimum) in 28 days

3. Tensile strength (ASTM C496) of 600 psi (minimum) in 28 days

4. Bond Strength (ASTM C882) of 2,000 psi (minimum) in 28 days

5. Shrinkage (ASTM C490) of 0% in 28 days
5. Shrinkage/length change (ASTM C596) of less than 0.04% in 28 days

6. ‘Very Low’ Chloride Ion Penetrability at 28 days (ASTM C1202)

B. Refer to City of Houston Wastewater Approved Products List.

2.04 MANHOLES COVERS, FRAME INSERTS AND FRAME-TO-MANHOLE SEALS

A. New Covers/Frames: Comply with Section 02090 - Frames, Grates, Rings, and Covers, and with Drawing 02090-1.

B. Watertight Covers and Frames shall each have at least three bolts and a gasket to seal cover to frame, as manufactured by Neenah Foundry Company, Vulcan, or approved equal. Fabricate watertight frames and covers to comply with details shown on the Drawings and Section 02090 - Frames, Grates, Rings, and Covers.

C. Provide manhole inserts including new dishes, gaskets and relief valves. Select appropriate watertight inserts to fit walls and frames of manholes.
   1. Stainless steel (18 gauge minimum) inserts; Southwestern Packing and Seals “Rain Stopper,” or approved equal.
   2. Stamp inserts with the words, "Property of City of Houston”.
   3. Inserts shall have a handle of plastic-coated stainless steel installed on the body of the insert dish. The handle shall be attached with a #6 high-grade stainless steel rivet. Each dish shall have a factory-installed 5-foot-long, 3/16” braided stainless steel retaining cable to connect the dish to the manhole frame.

D. Frame-to-Manhole Seals: As manufactured by Cretex, or approved equal.

E. Sealing materials between adjustments rings and manhole frame shall be a hydrophilic elastic sealant, which adheres to both concrete and metal, or approved substitute.

PART 3 EXECUTION

3.01 PROTECTION

A. Provide barricades, warning lights and signs for manhole or cleanout removal excavations. Comply with Section 01504 - Temporary Facilities and Controls.

B. Do not allow soil, sand, debris or runoff to enter sewer system.

3.02 EXCAVATION
A. Excavate in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. Perform work in accordance with OSHA standards. Employ a trench safety system as required in Section 02260 - Trench Safety System.

C. Install and operate necessary dewatering and surface water control measures as required in Section 01578 - Control of Ground and Surface Water.

3.03 DIVERSION PUMPING

A. Install and operate diversion pumping equipment to maintain sewage flow and to prevent backup or overflow as specified in Section 01506 - Diversion Pumping.

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 Project Manager so that required reporting can be made to the Texas Commission on Environmental Quality and U.S. Environmental Protection Agency.

3.04 CLEANOUT/END OF LINE REMOVAL AND REPLACEMENT

A. Replace removed cleanouts/ends of lines with shallow manholes complying with Drawing No. 02082-01, if the depth is less than or equal to 5 feet. For cleanouts/ends of lines greater than 5 feet, replace with 4-foot-diameter manholes complying with Drawing No. 02082-02.

3.05 ABANDONMENT OF CLEANOUTS AND MANHOLES

A. Abandon manholes that are designated on Drawings or directed by the Project Manager to be abandoned.

B. Dismantle manholes to be abandoned, including frames, to 2 feet below ground level.

C. If a manhole is to be abandoned on a rehabilitated line, install a carrier pipe through the manhole structure and fill the manhole with cement-stabilized sand, compacted to a level 2 feet above the top of carrier pipe.

D. If a manhole is to be abandoned on an abandoned line, plug all lines in the manhole and backfill in accordance with Section 02317 - Excavation and Backfill for Utilities.

E. If a manhole to be abandoned is in a paved street, backfill manhole as described above, but with cement-stabilized sand to underside of pavement repair in lieu of select backfill material. Patch paving in accordance with Section 02951 - Pavement Repair and Resurfacing.
F. If an abandoned manhole is not located in a paved street, fill remainder of manhole with select backfill material to 2 feet below ground level. Restore surface in accordance with Section 01740 - Restoration of Site Improvements. Provide at least 4 inches of topsoil complying with Section 02911 - Topsoil, and either seed according to Section 02921 - Hydromulch Seeding, or Sod according to Section 02922 - Sodding, as required.

3.06 MANHOLE WALL CLEANING

A. Clean bench/invert floor and interior walls of manholes by removing deleterious material, including dirt, grease and other debris. Use high pressure water at a minimum force of 3500 psi. If required, use detergent or muriatic acid to remove grease, oil and other matter which would interfere with bond between existing manhole wall and approved repair materials.

B. Prepare interior surfaces as recommended by the wall liner material manufacturer. Remove brick steps and cast iron steps prior to wall lining.

3.07 MANHOLE WALL SEALING

A. Seal active leaks in manhole structures with a blend of cement powder or hydraulic cement.

B. Remove loose or defective wall material. Wipe or brush surfaces clean prior to application of hydraulic cements.

C. Stopping Leaks: Drill weep holes at bottom of manhole walls to relieve hydrostatic pressure. Plug pressure-relief holes after leaks are stopped using hydraulic cement materials.

D. Repair wide cracks, holes and disintegrated mortar with quick-set mortars following manufacturer's instructions and recommendations.

E. Reshape manhole inverts before wall-sealing work. Apply concrete to cleaned manhole benches as specified in Section 03315 - Concrete for Utility Construction.

F. After active leaks have been stopped, clean and prepare walls for application of selected liner material.

G. Properly apply sealing compound to provide the minimum required uniform coating to the wall surface.

H. Prevent foreign material from entering adjoining pipes. Remove droppings of foreign and wall sealant materials before they harden on the bottom of the manhole.

I. Strictly follow product manufacturers’ published instructions and recommendations for surface preparation, application and proportioning.
3.08 MANHOLE REMOVAL AND REPLACEMENT

A. When indicated on the Drawings or instructed by the Project Manager, excavate and properly remove and dispose of the existing manhole, including base. Employ a trench safety system and keep the excavation dry from sewage flow and surface or ground water.

B. Replace manhole with a new manhole as specified in Section 02082 - Precast Concrete Manholes or Section 02083 - Fiberglass Manholes. New manholes shall comply with Drawings 02082-1, 02082-2, 02082N-2, 02082-3, 02083-3, New & Replacement Pre-Cast Concrete Manhole on MRC Sanitary Sewer, or New & Replacement Fiberglass Manhole on MRC Sanitary Sewer.

C. Construct or reconstruct drop connections whenever the flowline elevation of an influent line is more than 24 inches above the bench elevation.

D. Sewer pipe up to 6 feet outside new manholes may be replaced with new sewer pipe in conjunction with manhole removal and replacement.

E. Properly backfill replacement manholes as required in Section 02082 - Precast Concrete Manholes or Section 02083 - Fiberglass Manholes.

F. Furnish replacement manholes with new 32-inch frames and covers as indicated on Drawing 02090-1 and specified in Section 02090 - Frames, Grates, Rings and Covers.

3.09 MANHOLE BENCHES/INVERTS

A. Remove obstructions and loose materials from benches prior to shaping inverts. Form smooth, U-shaped inverts having minimum depths of one-half the pipe diameter and channel it across the floor of the manhole using an approved manhole rehabilitation material. Control flow to allow sufficient setting time for material used.

B. If no bench and invert exists in the manhole or if the manhole is new with a poured-in-place base then construct invert channels to provide a smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to the following criteria:

1. Slope of invert bench: 1 inch per foot minimum; 1-1/2 inches per foot maximum.
2. Construct full pipe depth inverts (equal in depth to the diameter of the largest or outgoing/ downstream pipe).
3. Construct inverts for laterals (upstream) sewer(s) that enters the manhole such that the flowline elevation of the lateral sewer is between the crown of the outgoing/downstream pipe and manhole invert.
4. Trim all sewer pipes that enter or exit the manhole such that they have a smooth edge and are flush with the manhole wall.
5. Begin the invert channel from where the lateral pipe enters the manhole to where the lateral invert channel intersects the invert of the through outgoing/downstream pipe.

6. The maximum depth of the lateral invert shall be up to full pipe (equal in depth to the diameter of the lateral pipe when the top of the proposed sloped bench is the same elevation as the crown of the lateral sewer) at the upstream end and full pipe diameter of the outgoing pipe at the downstream end.

7. If no inverts exist in the manhole then inverts shall be constructed such that the inverts for all laterals shall have a smooth, uniform curvature, with a maximum radius of curvature that sweeps into the direction of flow (towards the downstream/outgoing pipe.)

C. If inverts already exist in the manhole then:

1. Trim all sewer pipes that enter or exit the manhole so that they are smooth edges and flush with the manhole wall.

2. Build up the existing invert until it is full pipe depth (equal in depth to the diameter of the largest/outgoing pipe) across the manhole bottom.

3. Build inverts for all lateral sewers entering the manhole whose flowline elevation is between the crown and flowline elevations of the outgoing/downstream pipe. Maximum depth of lateral invert shall be up to full pipe (equal in depth to the diameter of lateral/upstream sewer when the top of the proposed sloped bench is the same elevation as the crown of the lateral sewer) at the upstream end and full pipe diameter of the outgoing/downstream sewer at the downstream end.

4. Invert shall match the sweep (or curvature, if any) of the existing lateral sewer invert.

5. If no inverts exist in the manhole then inverts shall be constructed such that the inverts for all laterals shall have smooth, uniform curvature, with a maximum radius of curvature that sweeps into the direction of flow (towards the downstream/outgoing pipe).

D. All benches and invert channels shall be smooth and free of sharp edges, protrusions and concrete droppings.

3.10 MANHOLE COVERS AND FRAMES

A. Adjust manhole frames and covers found above or below grade and reset loose frames. Combine precast concrete adjustment rings so that the elevation of the installed frame and cover extends 6 inches above the natural ground in unpaved areas. In paved areas, set flush and smooth with pavement grades. An approved sealant shall be applied between the top adjustment ring and the manhole frame. No less than two beads shall be applied 1/2-inch
wide and 3/4-inch high. An approved manhole cementitious lining material shall be applied between the rings and no less than 1-inch of lining material shall be applied to the inside and outside face of the adjustment rings.

B. Install new watertight manhole covers and frames at locations shown on the Drawings or where instructed by the Project Manager. Use new frames and covers.

3.11 MANHOLE INSERTS

A. Install stainless steel manhole inserts at locations shown on the Drawings or where directed by the Project Manager.

B. Exercise care in selecting the proper insert dish to fit properly with the manhole frame and cover. The insert flange should have an outside diameter 3/16 inch less than the inside diameter of the manhole frame. Once proper fit is established, clean manhole frame surface of all dirt, grit and debris with a wire brush. Fully seal insert on the manhole frame, providing a watertight seal.

C. Securely attach retaining tether to the manhole frame following manufacturer’s instructions with a tamper-proof anchoring device.

D. Replace damaged, tight-fitting or missing inserts identified prior to final inspection at no cost to the City.

E. For new sanitary sewer manholes subject to loading or differential movement at manhole frames, and for rehabilitated manholes, install manhole chimney seals to prevent inflow between manhole frames and masonry chimneys. Refer to Section 02090 - Frames, Grates, Rings and Covers.

3.12 FRAME-TO-MANHOLE SEALS

A. Surfaces on which the sleeve or extension is to be compressed shall be circular, clean, reasonably smooth and free of loose material and excessive voids. If a surface is rough or irregular and would not provide an effective seal, smooth it with an approved microsilica-enhanced grout. Repair flaws in manhole frames, such as cracks, pits or protrusions, by filling with concrete or grinding smooth. This type of surface work will need to be done on manholes that have not been lined; manholes that have been lined should not need any surface work in order to install the seal.

B. Install seals following manufacturer’s installation instructions. Arrange for manufacturer’s representative to train Installer’s personnel in proper methods of installing seals and assist the Installer and Contractor with any problems they might encounter installing the seals.

C. If internal surfaces of the chimney or corbel section of the manhole exceed a slope of 1 in 3, do not use a frame-to-manhole seal.
D. Install frame-to-manhole seals so as to prevent water migration between manhole frames and manhole structures.

3.13 FIELD QUALITY CONTROL

A. Inform the Project Manager immediately if materials being used are not producing required results or need modification. The Project Manager has the right to stop the use of any material at any time.

3.14 INSPECTION

A. After manhole wall sealing or manhole rehabilitation is complete, visually inspect manholes in the presence of the Project Manager. Check for cleanliness and for elimination of active leaks.

B. At completion of manhole rehabilitation, assist the Project Manager in verifying installation of minimum coating thickness of concrete liner. Test several points on manhole walls. Repair verification points prior to final acceptance for payment.

3.15 TESTING

A. Perform leakage testing for manholes, refer to Section 02533 - Acceptance Testing for Sanitary Sewers.

B. Perform Testing on cementious products according to ASTM C 1140.

3.16 BACKFILL

A. Backfill and compact soil in area of excavation surrounding manholes in accordance with Section 02317 - Excavation and Backfill for Utilities.

B. In unpaved areas, grade surface at a uniform slope of 1 to 5 from the manhole frame to natural grade. Provide at least 4 inches of topsoil complying with Section 02911 - Topsoil, and either seed according to Section 02921 – Hydro Mulch Seeding, or sod according to Section 02922 - Sodding, as required.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Approved methods and materials for the rehabilitation of deteriorated gravity sewer lines by the Cured-In-Place Pipe (CIPP) method.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Measurement and payment for cured-in-place pipe is by the linear foot, measured along centerline of pipe from centerline to centerline of manholes or junction boxes, and shall be considered full compensation for all labor and materials required to install the liner to specified requirements. Depth range for payment is based on greatest depth measured at manholes from natural ground level to flow line of sanitary sewer for each pipeline segment.

2. No separate payment will be made for the following items of work. Include cost in the unit price for installing cured-in-place pipe:

   a. Sealing the liner in manholes.

   b. Reworking inverts and benches for manholes.

   c. Temporary meter and municipal water obtained from a City fire hydrant.

3. No separate payment for pre-installation and post-installation cleaning and television inspection as specified in Section 02558 - Cleaning and Television Inspection.

4. Where post-installation thickness measurements or physical property testing is performed, payment for installed cured-in-place pipe shall be made as follows:

   a. Full payment: If thickness, flexural strength and flexural modulus of elasticity of installed CIPP are all 95 percent or better of specified values, full payment shall be made.

   b. Adjusted payment: If thickness, flexural strength or flexural modulus of elasticity is between 90 percent and 95 percent of specified values, payment shall be made based on an Adjusted Unit Price, which shall equal the Unit Price bid, multiplied by a Value Factor calculated as follows:
actual thickness \( \times \) actual flexural strength \( \times \) actual flexural modulus of elasticity

"Value Factor" shall not exceed 100 percent.

5. Payment for point repairs and obstruction removals will be made according to Section 02553 - Point Repairs and Obstruction Removals.

6. Payment for repair of sags in the line will be made either according to Section 02553 - Point Repairs and Obstruction Removals, or according to the diameter and depth of the pipe if “Remove and Replace” is the method of repair designated by the Engineer.

7. Payment for Item, 'Mobilization for short segment (<350')’ will be paid when the contractor is issued a work order containing a line segment that is less than 350' in length and is not adjacent to another line segment, or when the total of all adjacent line segments is less than 350'.

8. Refer to Section 01270 - Measurement and Payment.

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

1.03 REFERENCES


E. ASTM D 3567 - Standard Practice for Determining Dimensions of Reinforced Thermosetting Resin Pipe (RTRP) and Fittings.

F. ASTM D 3574-11 - Standard Test Methods for Flexible Cellular Materials—Slab, Bonded, and Molded Urethane Foams


H. ASTM D 5035 - Test Method for Breaking and Elongation of Textile Fabrics (Strip Method).

J. ASTM D 5813- Standard Specification for Cured-In-Place Thermosetting Resin Sewer Pipe.

K. ASTM E 1252 - Standard Practice for General Techniques for Qualitative Infrared Analysis.

L. ASTM F 1216 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.

M. ASTM F 1743 - Standard Practice for the Rehabilitation of Existing Pipelines and Conduits by the Pulled-In-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP).

N. ASTM F 2019 - Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)

1.04 SYSTEM DESCRIPTION

A. Resin-impregnated flexible tubes inserted into existing sewers, expanded against the existing sewer interior surfaces, and cured by circulating heated water, steam, ambient temperature water or air, or ultraviolet light, throughout the tube from manhole to manhole.

B. CIPP cures into a hard, impermeable, corrosion-resistant liner of specified thickness and physical properties, with a uniformly smooth interior surface.

C. CIPP Material and Installation: Comply with ASTM D 5813, ASTM F 1216, ASTM F 1743 and ASTM F 2019, as modified by this specification. The City reserves the right to approve materials or installation practices which differ from these standards.

1.05 SUBMITTALS

A. Make submittals in accordance with Section 01330 - Submittal Procedures.

B. Resin:

1. Submit product data stating physical and chemical properties.

2. Submit results of testing performed by resin manufacturer demonstrating compliance with specified chemical resistance requirements.

3. Submit manufacturer-certified infrared spectrum analysis (chemical fingerprint) of proposed resin system in accordance with ASTM E 1252.

C. Flexible Tube:

1. Submit product data stating physical properties meeting ASTM D 5035.
2. Submit tabular summary by sewer segment noting required CIPP thickness specified. Provide certification that liner’s “dry” thickness meets or exceeds the required cured laminate thickness (es). Measure thickness in accordance with ASTM D 5199.

D. Cured-In-Place Pipe:

1. Submit field measurements of cured liner thickness for determining payment.

2. Submit representative sample(s) of the cured liner required for testing in accordance with ASTM D 790.

3. Submit post-installation television inspection videos as specified in Section 02558 - Cleaning and Television Inspection.

E. Chemical Grout: Submit product data, including surface preparation instructions and application instructions from the manufacturer.

1.06 QUALITY ASSURANCE

A. During the course of the Work, make no substitutions of materials, design values or procedures for those specified without the prior written approval of the Engineer.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Refer to City of Houston Approved Products List for acceptable product manufacturers.

B. Do not use products of manufacturers not noted on this list.

C. Use current list in effect as of the specified bid date and time for this project.

2.02 MATERIALS

A. Flexible Felt Tube:

1. Provide flexible tube manufactured and fabricated under manufacturer’s quality-controlled conditions. Use tube sized so as to snugly fit the internal circumference of the existing sewer and produce specified cured thickness and physical properties.

2. Tube Length: Fully and continuously span the distance between manholes, including sufficient material for sealing at manholes and product sampling (when required).

3. Fabric tube minimum tensile strength in both longitudinal and transverse directions, when tested in accordance with ASTM D 5035: 750 psi.
4. Identify all tubes with manufactured thickness when tested in accordance with ASTM D 5199.

B. Fiberglass Tube (Ultraviolet Light Curing Application):
   1. The fiberglass material shall be chemically resistant EC-R Glass.
   2. The tube shall be homogeneous throughout, uniform in color, free of cracks, holes, foreign materials, blisters and other surface defects.
   3. The glass fiber tubing shall include an exterior and interior film that protects and contains the resin in the liner. The exterior film shall be UV resistant.
   4. The tube shall be properly sized to be fitted against and in contact with the wall of the host pipe throughout its length or remnants thereof.
   5. The tube shall be constructed to withstand stretching during the pull-in process and installation pressures as required by Manufacturer’s recommendations.
   6. The impregnated tube shall have a uniform thickness, that when compressed at installation pressures will meet or exceed the required thickness.
   7. Use tube sized so as to snugly fit the internal circumference of the existing sewer and produce specified cured thickness and physical properties.
   8. The tube shall be sized to fit irregular pipe sections and negotiate bends of up to 20 degrees and shall have sufficient strength to bridge missing pipe sections with the use of canvas sleeve if necessary.
   9. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color.
   10. The liner shall be seamless in its cured state to insure homogenous physical properties around the circumference of the cured liner.

C. Resin for Tube Saturation: Liquid thermosetting polyester, vinyl ester, or epoxy resin meeting specified requirements.

D. Chemical Grout:
   1. Chemical grout shall react freely with water to form a strong polyurethane foam.
   2. Chemical grout shall be resistant to hydrogen sulfide gas.
   3. Chemical grout shall meet the following criteria:
      
      Tensile Strength: 20 psi
      Elongation: 190%
Tear Strength: 4.9 lbs/in
Density/Specific Gravity: 0.18

2.03 TESTING REQUIREMENTS

A. Manufacturer’s Chemical Resistance Testing: Perform chemical resistance testing of resin in accordance with ASTM C 581, as modified herein. Perform testing to demonstrate chemical resistance to a solution with a pH of 0.5 and a solution with a pH of 10. Use reagents or solutions as required to establish and maintain the minimum and maximum pH values specified for the duration of the testing. Exposure to the minimum and maximum pH values shall produce an average loss of not more than 20 percent in the initial flexural properties for each test interval, and an average loss of not more than 15 percent for a period of one year, as determined according to ASTM D 790. Perform testing at a temperature of 73.4 F (plus or minus 3.6 F). Test specimens shall not have more than 1.5 percent gain or loss in weight over a period of one year. Test frequency and sample preparation: Follow ASTM C 581.

B. Test Results - Submit test results including at least the following:
   1. Raw data for each test specimen for each test interval performed
   2. Calculated average test results for each test interval
   3. Using calculated averages for each test interval, calculate the average test result for the duration of testing.

2.04 PHYSICAL PROPERTIES FOR TRADITIONAL CIPP (FELT TUBE)

A. Minimum CIPP Thickness after Curing: As specified below, based on the liner material and the maximum sewer invert depth for the segment being rehabilitated.

<table>
<thead>
<tr>
<th>NOMINAL SEWER DIAMETER (INCHES)</th>
<th>MAXIMUM PIPE SEGMENT INVERT DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 10 feet</td>
</tr>
<tr>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>8</td>
<td>6.0</td>
</tr>
<tr>
<td>10</td>
<td>6.0</td>
</tr>
<tr>
<td>12</td>
<td>6.0</td>
</tr>
<tr>
<td>15</td>
<td>7.5</td>
</tr>
<tr>
<td>18</td>
<td>9.0</td>
</tr>
<tr>
<td>20-21</td>
<td>10.5</td>
</tr>
</tbody>
</table>
B. CIPP minimum flexural properties after curing using steam, hot water or ambient temperature water or air:

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>REFERENCE</th>
<th>MINIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural Strength (Modulus of Rupture)</td>
<td>ASTM D 790</td>
<td>4,500 psi</td>
</tr>
<tr>
<td>Tangent Modulus of Elasticity</td>
<td>ASTM D 790</td>
<td>250,000 psi</td>
</tr>
</tbody>
</table>

C. If different conditions are encountered in the field, design considerations may change, if required by the Project Manager. Required thickness may be increased or decreased based on specific design. The thickness may be changed in increments of 1.5 mm and payment shall be made or deducted at the rate of 2.50% of the bid item amount for each increment. However, the Contractor shall not be allowed to change any required thickness unilaterally, or offer credits after the fact as remedy for liners not meeting the required thickness. Prior approval shall always be required for any changes in CIPP thickness. Refer also to “Non-Confirming Work” in Section 3.09.

2.05 PHYSICAL PROPERTIES FOR UV CIPP (FIBERGLASS TUBE)

A. Minimum CIPP Thickness after Curing: As specified below, based on the liner material and the maximum sewer invert depth for the segment being rehabilitated.

<table>
<thead>
<tr>
<th>NOMINAL SEWER DIAMETER (INCHES)</th>
<th>MAXIMUM PIPE SEGMENT INVERT DEPTH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 10 feet</td>
</tr>
<tr>
<td>6</td>
<td>2.0</td>
</tr>
<tr>
<td>8</td>
<td>2.5</td>
</tr>
</tbody>
</table>
B. CIPP minimum flexural properties after curing using ultraviolet light:

<table>
<thead>
<tr>
<th>Property</th>
<th>Reference</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexural Strength (Modulus of Rupture)</td>
<td>ASTM D 790</td>
<td>6,500 psi</td>
</tr>
<tr>
<td>Tangent Modulus of Elasticity</td>
<td>ASTM D 790</td>
<td>725,000 psi</td>
</tr>
</tbody>
</table>

C. If different conditions are encountered in the field, design considerations may change, if required by the Project Manager. Required thickness may be increased or decreased based on specific design. The thickness may be changed in increments of 1.5 mm and payment shall be made or deducted at the rate of 2.50% of the bid item amount for each increment. However, the Contractor shall not be allowed to change any required thickness unilaterally, or offer credits after the fact as remedy for liners not meeting the required thickness. Prior approval shall always be required for any changes in CIPP thickness. Refer also to “Non-Confirming Work” in Section 3.09.

2.06 FIELD TESTING

A. Flexible Tube Thickness - Prior to wet-out; provide access to all flexible tubes intended for the use on the project. Clearly identify flexible tubes with their manufactured thickness. Do not use flexible tubes which fail to meet the specified thickness. Testing will be performed in accordance with ASTM D 5199.

B. Infrared Spectrum Analysis (Chemical Fingerprinting) - Provide access to the resin intended for the use on the project for sampling and chemical fingerprint testing. All testing will be performed in accordance with ASTM E 1252. If sample fails test, work is non-conforming. See paragraph 3.09.

C. Physical Property Testing - Post installation physical property testing of the cured composite tube will be performed in accordance with ASTM D 790. Provide sufficient
samples for conducting the testing required under ASTM D 790. If sample fails test, work is non-conforming. See paragraph 3.09.

D. The Contractor shall provide samples for testing from the actual installed CIPP liner. Samples shall be provided from one location per 500 linear feet of CIPP installed or per line section, whichever is greater. The sample shall be cut from a section of CIPP that has been inverted or pulled through a like diameter pipe, which has been held in place by a suitable heat sink, such as sandbags. The sample shall be marked with the date the liner was installed, the date the sample was removed, and the upstream and downstream manholes. The cutting of the sample shall be witnessed by the City. On pipelines greater than 15 inches in diameter, the City may, at its discretion, require plate samples cured with the CIPP.

PART 3 EXECUTION

3.01 PRE-INSTALLATION CLEANING AND TELEVISION INSPECTION

A. Perform a pre-installation television inspection in accordance with Section 02558 - Cleaning and Television Inspection. Verify that sewer is clean and pipe conditions are suitable for installation of the CIPP. Notify Engineer if conditions exist which will impact the installation.

3.02 OBSTRUCTION REMOVAL, POINT REPAIR AND SAG ELIMINATION

A. If pre-installation video inspection reveals an obstruction in the line segment (such as heavy solids, dropped joints, protruding service connections or collapsed pipe) that cannot be removed by conventional sewer cleaning equipment and the obstruction will prevent completion of the insertion process, perform point repairs or obstruction removal prior to CIPP installation. Obtain approval of the Engineer before performing work. Follow requirements in Section 02553 - Point Repairs and Obstruction Removals.

B. If pre-installation video inspection reveals a sag in the sewer that has a vertical displacement greater than one-half the pipe diameter, eliminate the sag by performing a point repair as specified in Section 02553 - Point Repairs and Obstruction Removals, or by removal and replacement of the sewer segment. Obtain approval of the Engineer before performing work.

3.03 DIVERSION PUMPING

A. Maintain commercial and residential sanitary sewer service during the installation process.

B. Install and operate diversion pumping equipment to maintain sewage flow around the segment of pipe being rehabilitated, and to prevent backup or overflow, as specified in Section 01506 - Diversion Pumping.

3.04 INSTALLATION PROCEDURES

A. Notification: Inform the Engineer of work schedules for CIPP installation.
1. Provide 24-hour notice so that the Engineer may witness the “wet-out” procedure.

2. Provide 24-hour notice so that the Engineer may witness inversion and curing of liner.

B. Conduct operations in accordance with applicable OSHA standards, including safety requirements involving work on elevated platforms and entry into confined spaces. Take suitable precautions to eliminate hazards to personnel near construction activities when pressurized air is being used.

C. Wet-out: Designate a location where the flexible tube will be impregnated with resin. Thoroughly saturate flexible tube prior to installation. Use catalyst systems or additives compatible with resins and flexible tubes complying with manufacturer’s recommendations. Handle resin-impregnated flexible tubes to retard or prevent resin setting until ready for curing.

D. Insertion: Insert flexible tubes through existing manholes or access structures by inversion, pull-in or other approved procedure in accordance with manufacturer’s recommendations.

E. Curing using Steam, Hot Water or Ambient Temperature Water or Air:

1. Follow manufacturer’s recommended cure schedule in curing of liner.

2. After insertion is completed, apply a suitable recirculation system capable of delivering steam, hot water or ambient temperature water or air, uniformly throughout the section to achieve consistent cure of the resin. Maintain curing temperature as recommended by the resin/catalyst system manufacturer.

3. Provide suitable monitors near the heat source to gauge temperatures of incoming and outgoing water or steam supply. Place additional temperature sensors between the impregnated tube and invert of the original pipe at each manhole to monitor the outside temperature of the liner while curing.

4. Continue uninterrupted heating until the required curing temperature is achieved. Accurately measure temperatures at both ends of the CIPP. Initial cure is considered complete when exposed portions of the flexible tube pipe appear to be cured and the remote temperature sensors have achieved the external temperature recommended by the resin/catalyst system manufacturer.

5. Cool Down: Initiate controlled cool-down of the hardened pipe to a temperature below 110° F, in accordance with the manufacturer’s recommended cure schedule. Take care in releasing the water column so that a vacuum does not develop that could damage newly-installed pipe. Do not discharge water hotter than 110° F into the sanitary sewer system.

F. Curing using Ultraviolet Light:
1. Curing shall be in accordance with ASTM F2019 and/or manufacturers specifications.

2. The UV light source shall be assembled in accordance with the manufacturer’s specification for the liner diameter.

3. The ultraviolet curing lamps shall operate in a sufficient frequency range to insure proper curing of the resin.

4. A camera shall be located on the ultraviolet light assembly to enable the video inspection of the liner and to insure that the liner has been properly inflated and any liner problems can be identified before curing begins.

5. During the curing process, sensors shall be used to record curing data that shall be submitted to the Engineer upon request. The recording shall include rate of travel of the ultraviolet light assembly, curing speed, internal temperatures and pressures during the curing process.

G. Finished Pipe: Provide a finished CIPP which is continuous and as free as commercially practicable from visual defects such as foreign inclusions, dry spots, and pinholes.

H. If point repair is required after the liner has cured, use a tube segment to splice across the point repair. Overlap on each end shall be twice the diameter, or 12 inches, whichever is greater. Cure the segment using the same process specified for the original liner.

3.05 SERVICE RECONNECTIONS

A. Complete service reconnections within 24 hours after completion of the cured-in-place process.

B. Reconnect services by excavation, man-entry or remote-operated cutting tool. Follow procedures for reconnecting sewer service specified in Section 02534 - Sanitary Sewer Service Stubs or Reconnections.

3.06 SEALING AT MANHOLES

A. Form tight seals between the CIPP and the manhole walls at pipe penetrations. Do not leave annular gaps. Seal annular spaces with Oakum bands soaked in chemical grout following chemical grouting manufacturer’s recommendations for installation. Finish off seals with non-shrink grout or cementitious liner materials placed around the pipe opening from inside the manhole in a band at least 4 inches wide. Complete sealing procedures for each liner segment immediately after the liner is cured.

B. Reshape and smooth the manhole invert and build up the existing invert until it is full pipe depth (equal in depth to the diameter of the largest/outgoing pipe) across the manhole bottom up to 15” maximum pipe diameter.
C. Build inverts for all lateral sewers entering the manhole whose flowline elevation is between the crown and flowline elevations of the outgoing/downstream pipe. Maximum depth of lateral invert shall be up to full pipe depth (equal in depth to the diameter of lateral/upstream sewer when the top of the proposed sloped bench is the same elevation as the crown of the lateral sewer) at the upstream end and full pipe diameter of the outgoing/downstream sewer at the downstream end up to 15” maximum pipe diameter.

3.07 POST-INSTALLATION TELEVISION INSPECTION

A. Make and submit video(s) showing completed work, including condition of restored connections. Refer to Section 02558 - Cleaning and Television Inspection.

B. All manhole bench/invert work and annular seal shall be completed at time of Post-TV, with Post-TV being verification of completion.

3.08 FINAL CLEANUP

A. Upon completion of rehabilitation work and testing, clean and restore project area affected by the Work in accordance with Section 01740 - Restoration of Site Improvements.

3.09 NON-CONFORMING WORK

A. If the thickness, flexural strength or flexural modulus of elasticity of the installed CIPP is less than 90 percent of the specified values, the product is considered unacceptable. Submit a proposed method of repair or replacement for review and approval by the Engineer. Work required to remedy non-conforming work shall be at no additional cost to the City.

B. If it is determined that the resin utilized did not match the submitted and approved resin via the Infrared Spectrum Analysis, the product is considered unacceptable and non-conforming. Submit proof that the resin actually utilized meets the requirements of the specification or submit a method for replacement of the sewer segment liner for review and approval by the City. Work required to remedy non-conforming work shall be at no additional cost to the City.

C. For all instances where CIPP is deemed unacceptable, other than thickness, flexural strength, and flexural modulus of elasticity, as described in this specification section, submit a proposed method of repair or replacement for review and approval by the Engineer. Work required to remedy non-conforming work shall be at no additional cost to the City.

END OF SECTION
Section 02557

FOLDED AND FORMED PIPE

PART I   GENERAL

1.01   SECTION INCLUDES

A. Rehabilitation of existing gravity sewer lines using the Folded and Formed Pipe process.

1.02   MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Measurement for installing folded and formed pipe is on a linear-foot basis for actual footage of liner pipe installed from centerline to centerline of manholes. Payment shall be based on the depth of the deeper flow line of the rehabilitated segment.

2. Costs for the following are included in the unit price for the liner; no separate payment for them will be made.

   a. The cost of sealing the liner in the manholes and reworking the manhole inverts and benches.

   b. The cost for eliminating offset joints with greater than 90 percent clearance.

   c. The cost for testing the liner pipe after installation.

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

1.03   REFERENCES


D. ASTM D 1693 - Test for Environmental Stress-cracking of Ethylene Plastics.


02557-1
01-01-2011
F. ASTM D 2837 - Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.


1.04 DEFINITIONS

A. Folded and Formed Pipe: The Folded and Formed Pipe process is the reconstruction of sanitary sewers by insertion of a folded liner pipe into the existing sewer and the reformation of the folded liner pipe into a circular liner pipe. The liner is reformed by a combination of hot water circulation and pressurization, or similar technique, to reform the folded liner pipe into its original extruded configuration. When reformed, the new liner pipe extends over the length of the insertion in a continuous pipe-within-a-pipe installation.

1.05 SYSTEM DESCRIPTION

A. Folded and formed pipe is installed by insertion within the carrier pipe to create a continuous liner over the entire length of each pipe segment from manhole to manhole. The liner pipe passing through or terminating in a manhole is carefully cut to form an invert or termination as described in these Specifications and shown on the Drawings. The invert and benches are streamlined and improved for smooth flow. The finished liner pipe is pressure tested to meet the leakage requirements test as specified.

1.06 SUBMITTALS

A. Make submittals accordance with Section 01330 - Submittal Procedures.

B. Submit engineering data covering design and installation. Required data includes the following:

1. Before beginning work, submit the vendor’s specific technical data with complete physical properties of pipe and pipe dimensions pertinent to this job. Submit full descriptions of component materials and their properties to the City Engineer for approval. Include a "Certificate of Compliance" with Specification for materials to be incorporated in the work, and manufacturer’s standard printed instructions.

2. Submit a work plan for review by the City Engineer. In the work plan address procedures required for pre-installation and installation. Describe procedures to be followed for installation of the Folded and Formed Pipe method selected, even though the process is pre-approved. Before installation, submit the standard reforming temperature/pressure/cool-down schedule. Proposed changes in preinstallation or installation procedures require submittal of revised procedures for review by the City Engineer.
3. Submit post-installation video inspection tapes as specified in Section 02956 - Cleaning and Video Inspection.

1.07 QUALITY ASSURANCE

A. Though the installation process is licensed and proprietary in nature, Contractor shall not change any material, thickness, design values or installation procedure stated in submittals without the City Engineer’s prior written approval.

PART 2 PRODUCTS

2.01 PREAPPROVED MANUFACTURERS

A. Folded and Formed Pipe Process:

B. Other manufacturers of similar processes must be preapproved by the City. Refer to Document 00100 - Instructions to Bidders for information regarding product preapproval procedures.

2.02 MATERIALS

A. Properties:
   1. Solid Wall High-Density Polyethylene Pipe:
      a. Provide liner pipe manufactured from a high-density high-molecular-weight polyethylene resin complying with ASTM D 1248, meeting requirements for Type III, Class B, Grade P34, Category 5, and having a PPI rating of PE 3408 when compounded.
      b. Pipe produced from the specified resin shall have a minimum cell classification of 345434D or E (inner wall shall be light in color) under ASTM D 3350, and demonstrate a long-term hydrostatic strength rating of 1600 psi or more, in accordance with ASTM D 2837. When the environmental stress crack resistance of the compound is measured in accordance with ASTM D 1693, Condition C, the compound shall withstand not less than 192 hours in 100 percent solution Igepal CO-630 at 100 F before reaching a 20 percent failure point.
      c. The liner pipe shall have the following minimum physical properties:
         Flexural Stress (Yield): 3,000 psi ASTM D 638
         Flexural Stress (Break): 4,500 psi ASTM D 638
         Flexural Stress of Elasticity: 133,000 psi ASTM D 790
2. Poly Vinyl Chloride (PVC) Pipe:
   a. The PVC compound used for the folded pipe shall conform to ASTM D 1784 classification 13223-B or 12344-B. Compound that have different cell classifications because one or more properties are superior to those of the specified compounds are also acceptable.
   b. The installed pipe shall have the following minimum physical properties:
      - Flexural Modulus of Elasticity: 320,000 psi
      - Flexural Strength: 9,000 psi
      - Tensile Strength: 5,000 psi

B. Alternative Materials: Alternative materials for liner pipe shall be pre-approved. Refer to Document 00100 - Instructions to Bidders for information regarding product preapproval procedures.

C. Markings: Use liner pipe marked at not more than 5-foot intervals with a coded number system to indicate manufacturer, size (diameter and SDR), material, extrusion date and production shift that fabricated the pipe liner. Have the marking code changed with each production shift change.

D. Dimensions:
   1. Diameter and Wall Thickness: Select fabricated pipe with an outside diameter and minimum wall thickness that will fit the internal circumference of the carrier pipe with a close mechanical fit leaving a minimum annular space.
   3. Length: Minimum length is that length necessary to effectively span the distance from the inlet to the outlet of adjacent manholes, unless otherwise specified. Verify lengths in the field before manufacturing. Individual insertion runs may be made over more than one pipe segment through adjacent manholes as determined in the field by the Contractor and approved by the Project Manager.

2.03 SOURCE QUALITY CONTROL

A. Inspect and test each production lot of polyethylene liner pipe at the time of manufacture for defects in accordance with ASTM D 2837 and D 1963. Verify that liner pipe is homogeneous, uniform in color, free of cracks, holes, foreign materials, blisters and deleterious faults. Mark each production lot of liner pipe with unique markings to clearly differentiate one production lot from another.

B. Inspect and test each manufactured length of PVC pipe for extrusion quality, workmanship, impact resistance and pipe flattening in accordance with ASTM D 3034. Verify that pipe is
homogeneous, uniform in color, free of cracks, holes, foreign materials, blisters and deleterious faults.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine liner pipe for gashes, nicks, abrasions, or any such physical damage which may have occurred during storage or handling which produced physical damage deeper than 10 percent of the wall thickness. Inspect liner pipe to verify that it is free from visual defects such as foreign inclusions, concentrated ridges, discoloration, pitting, varying wall thickness and other deformities. Reject and remove from the project site liner pipe with physical damage or visual defects. The liner pipe passing through or terminating in a manhole shall be carefully cut out in a shape and manner approved by the Project Manager. The invert and benches shall be streamlined and improved for smooth flow. The installed liner pipe shall meet the leakage requirements of the pressure test as specified.

3.02 PREPARATION

A. Safety: Conduct operations in strict conformance with applicable OSHA standards and regulations. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space.

B. Cleaning: Clean the sewer to be rehabilitated and remove debris immediately before the videotape inspection, as specified in Section 02956 - Cleaning and Videotape Inspection.

C. Pre-installation Videotape Inspection: Perform a pre-installation videotape inspection of the sewer pipe immediately before the pipe installation to ensure that pipe conditions are acceptable to receive Folded and Formed pipe, as specified in Section 02956 - Cleaning and Videotape Inspection.

D. Diversion Pumping: When required for acceptable completion of the Folded and Formed Pipe process, provide for continuous sewage flow around the sections of pipe designated for the installation of liner pipe by use of diversion pumping. Select pumps and bypass lines with adequate capacity and size to handle the flow in accordance with Section 01506 - Diversion Pumping.

E. Sewer Obstructions: If pre-installation videotape inspection reveals an obstruction in the existing sewer, such as heavy solids, dropped joints, protruding service taps or collapsed pipe, which will prevent pipe installation, and that cannot be removed by conventional sewer cleaning equipment, then an obstruction removal (by remote device) or point repair may be made with the approval of the City Engineer. Refer to Section 02952 - Point Repairs and Obstruction Removals.

F. Protruding Taps: If service reconnection is not by excavation, remove protruding taps which will obstruct or hinder insertion of the liner pipe. Refer to Section 02952 - Point Repairs and Obstruction Removals.
CITY OF HOUSTON
STANDARD SPECIFICATION
FOLDED AND FORMED PIPE

G. Offset Joints: If pre-installation videotape inspection reveals an offset joint with less than 90 percent clearance, take the necessary steps to eliminate the offset joint as a part of the liner installation. If pre-installation video inspection reveals an offset joint with less than 80 percent clearance, the Contractor shall eliminate the offset joint by use of a point repair in accordance with Section 02952 - Point Repairs and Obstruction Removals. Percentage of clearance will be determined by the Project Manager.

H. Sags in Sewer: If pre-installation videotape inspection reveals a sag in the existing sewer that is greater than 30 percent of the length of the line or one-half the diameter of the existing pipe, notify the Project Manager prior to performing any line rehabilitation. Take necessary steps, with approval of the City Engineer, to eliminate these sags.

3.03 INSTALLATION

A. Liner Insertion:

1. Insert liner pipe into the existing sewer with an inside diameter equal to or greater than the formed outside diameter of the liner pipe. Use a power winch and steel cable connected to the end of the liner using an appropriate pulling head. A second pulling head may be attached to the trailing end of the liner for attachment of a tag line to pull the liner back out of the sewer, if necessary. Length of the liner pipe to be inserted is governed by the winch drum capacity and the winching power available with consideration for the size and condition of the sewer.

2. During insertion, provide a bumper to prevent the ragged edges of the existing pipe from scarring the outside of the liner as it is pulled into the pipe.

3. Once insertion is initiated, continue the pull to completion without interruption.

B. Perform liner reformation and PVC liner reformation according to manufacturer’s printed instructions submitted to City Engineer for review.

C. Manhole Sealing and Benches:

1. Install liner pipe with tight-fitting seals at manholes with no annular gaps. Seal annular spaces at each manhole with oakum soaked in Scotchseal 5600 gel. Finish with non-shrink grout placed from inside the manhole, covering a nailer space and circling the pipe penetration in a band not less than 6 inches wide.

2. Neatly cut the top half of the pipe within the manhole at least four inches away from the manhole walls. Do not break or shear off the pipe penetration. Form a channel in the manhole that is a smooth continuation of the pipes, merged with other lines or channels, if any. Make the channel cross-section U-shaped, with a minimum length of half the pipe diameter for 6-inch to 12-inch diameter pipe, and between half the pipe diameter and three-fourths the diameter for 15-inch and larger pipe. Build up the sides of the channels with
mortar or concrete, as specified in Section 02959 - Manhole Rehabilitation, to provide benches at not more than 1 in 12 pitch toward the channel.

3. Seal liner pipe in the manhole as specified above before proceeding on to the next manhole section. The Project Manager will individually inspect manholes for liner pipe cut-offs, benches and sealing work.

D. Service Reconnection by Excavation or Remote: After the liner pipe has been reformed and pressure tested, reconnect existing live service connections. Reconnect services by excavation or remote cutting method in accordance with Section 02551 - Sanitary Sewer Service Reconnections.

3.04 FIELD QUALITY CONTROL

A. Test liner pipe after it has been installed in existing pipe. Perform a low-pressure air test of the liner pipe before it has been sealed in place at the manholes and before any service connections to the liner pipe have been made. This test checks the integrity of the liner pipe and verifies that the liner pipe has not been damaged during insertion.

B. Low Pressure Test:

1. After a manhole-to-manhole section of sewer pipe has been lined, plug it at each manhole with pneumatic plugs. Use plugs designed so that they will hold against the test pressure without requiring external blocking or bracing. One of the plugs shall have three air hose connections, one for inflation of the plug, one for reading of the air pressure into the sealed line, and one for introducing air into the sealed line.

2. Pressurize the test section to 4 psi and hold it above 3.5 psi for not less than 2 minutes. Add air if necessary to keep the pressure above 3.5 psi. At the end of this two-minute stabilization period, record the pressure (at least 3.5 psi minimum) and start the time period. If the pressure drops 0.5 psi in less than the time given in the table below, the section of pipe fails the test. Use a pressure gauge having minimum divisions of 0.010 psi.

3. When the prevailing groundwater is above the sewer liner pipe being tested, increase the test pressure 0.43 psi for each foot that the water table is above the invert of the pipe.

<table>
<thead>
<tr>
<th>SEWER SIZE (inches)</th>
<th>MINIMUM TEST TIME (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>7.5</td>
</tr>
</tbody>
</table>

4. If the time of the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, immediately re-pressurize the line to 3.5 psi and repeat the test.
C. Post-installation Videotape Inspection: Provide post-installation videotape inspections, tapes, and reports in accordance with Section 02956 - Cleaning and Videotape Inspection.

END OF SECTION
CITY OF HOUSTON
STANDARD SPECIFICATION
STREET LIGHTING CONDUIT

Section 02581

STREET LIGHTING CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pull box and conduit installation for electrical service to thoroughfare street lights.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for conduit is on linear foot basis measured horizontally between pull holes, pull boxes and terminal poles.

2. Refer to Section 01270 - Measurement and Payment for Unit Price Procedures.

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

1.03 REFERENCES


PART 2 PRODUCTS

2.01 MATERIALS

A. HL&P furnished material:

1. Materials Specifications in Paragraph 3.0 of HL&P Specifications Number 007-371-08.

B. Provide following material:

1. Materials specified in Paragraphs 7, 8, and 9 of HL&P Specifications number 007-371-08.
PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct. Determine if existing underground utilities or other obstructions may conflict with conduit installation shown on Drawings. Notify Project Manager of potential conflicts.

3.02 PREPARATION

A. Order pull boxes and warning tape from HL&P Customer Relations Representative three working days in advance of need. Verify requirements for "driveway" pull boxes for concrete areas subject to vehicular traffic and confirm total number of pull boxes required with HL&P Customer Relations Representative.

B. Obtain HL&P furnished materials Tuesday through Friday, excluding holidays, from Street Light Office at Magnolia Park Service Center, 104 North Greenwood, Houston.

3.03 INSTALLATION

A. Notify HL&P street lighting Engineer at least 2 working days in advance of scheduled conduit installation.

B. Install conduit in accordance with Paragraphs 7 through 9 and drawings pages 9 through 12 of HL&P Specification Number 700-371-08.

3.04 QUALITY CONTROL

A. Correct nonconforming conduit and pull box installations and obtain written notification from inspector that installation meets HL&P requirements.

B. Forward one copy of notification to HL&P Customer Relations Representative.

3.05 PROTECTION

A. Protect conduits and pull holes from damage or blockage until street light and circuit installation by HL&P.

B. Clear blockage in conduits prior to HL&P circuit installation.

END OF SECTION
Section 02611

REINFORCED CONCRETE PIPE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforced concrete pipe for sanitary sewers and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for reinforced concrete pipe under this Section. Include cost in unit price Work as specified in following Sections:

a. Section 02426 - Sewer Line in Tunnels.

b. Section 02531 - Gravity Sanitary Sewers.

c. Section 02631 - Storm Sewers.

2. Refer to Section 01270- Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this section is included in total Stipulated Price.

1.03 REFERENCES


C. ASTM C 497 - Standard Test Method for Concrete Pipe, Manhole Sections, or Tile.

D. ASTM C 506 - Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe

E. ASTM C 507 – Standard Specification for Reinforced Concrete Elliptical Culverts, Storm Drains and Sewer Pipe


1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit complete product data for pipe, fittings and gaskets for approval. Indicate conformance to appropriate reference standards.

C. Submit manufacturer’s certificate that concrete pipes meet applicable standards.

D. For jacking pipe, submit drawings and data describing grouting port design and closure procedures when required by Section 02431 - Tunnel Grout, including liner repair, as applicable.

PART 2 PRODUCTS

2.01 REINFORCED CONCRETE PIPE

A. Conform circular reinforced concrete pipe to requirements of ASTM C 76, Class III. Conform to rubber gasket joints for sanitary sewers and storm sewers per ASTM C443 and tongue and groove joints for roadside ditch culverts with joints per ASTM C 990.

B. Conform reinforced concrete arch pipe to requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 443 or tongue & groove joints shall conform to ASTM C 990 with external sealing bands conforming to ASTM C 877. For roadside ditch culverts only, external sealing bands are not required.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Use rubber gasket joints conforming to ASTM C 877. Rubber gasket joints shall conform to ASTM C
443. Tongue & groove joints shall conform to ASTM C 990 with external sealing bands conforming to ASTM C 877. For roadside ditch culverts only, external sealing bands are not required.

D. Conform reinforced concrete D-load pipe requirements of ASTM C 655.

2.02 GASKETS

A. When no contaminant is identified, furnish joints per section 2.01

B. Use the following gasket materials for pipes to be installed in potentially contaminated areas, especially where free product is found near elevation of proposed sewer:

<table>
<thead>
<tr>
<th>CONTAMINANT</th>
<th>GASKET MATERIAL REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum (diesel, gasoline)</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Other Contaminants</td>
<td>As recommended by pipe manufacturer, Engineer of the Record and approved by City Engineer prior to installation</td>
</tr>
</tbody>
</table>

2.03 LINERS FOR SANITARY SEWER PIPE

A. Reinforced concrete pipe for sanitary sewers shall be PVC lined and conform to Section 02427 - Plastic Liner for Large Diameter Concrete Sewers and Structures.

B. Reinforced concrete pipes to be installed in potentially contaminated areas shall have liners recommended by manufacturer as resistant to contaminants identified in Phase II Environmental Site Assessment Report.

2.04 SOURCE QUALITY CONTROL

A. Representatives of City Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3  E X E C U T I O N

3.01 INSTALLATION

A. Conform to requirements of following Sections, as applicable:

1. Section 02448 - Pipe and Casing Augering for Sewers.
2. Section 02531 - Gravity Sanitary Sewers.

3. Section 02631 - Storm Sewers.


B. Install reinforced concrete pipe in accordance with ASTM C 1479 and manufacturer's recommendations.

END OF SECTION
PART 1    G E N E R A L

1.01 SECTION INCLUDES

A. Geotextile, also called filter fabric, in applications including pipe embedment wrap, around exterior of tunnel liner, around foundations of pipeline structures, and slope stabilization.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. No separate payment will be made for Work performed under this Section. Include cost of Work in unit prices for Work requiring geotextile.
   2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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


1.04 SUBMITTALS
A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit standard manufacturer's catalog sheets and other pertinent information, for approval, prior to installation.

C. Submit installation methods, as part of Work plan for tunneling or for excavation and backfill for utilities. Obtain approval from Project Manager for filter fabric material and proposed installation method prior to use of filter fabric.

PART 2 PRODUCTS

2.01 GEOTEXTILE

A. Provide geotextile (filter fabric) designed for use in geotechnical applications. Filter fabric shall provide permeable layer or media while retaining soil matrix.

B. Use fabric which meets physical requirements for Class A subsurface drainage installation conditions as defined in AASHTO M 288 and as specified in Paragraph 2.02, Properties.

2.02 PROPERTIES

A. Material: Nonwoven, nonbiodegradable, fabric consisting of continuous chain polymer filaments or yarns, at least 85 percent by weight polyolefins, polyesters or polyamide, formed into dimensionally stable network.

B. Chemical Resistance: Inert to commonly encountered chemicals and hydrocarbons over pH range of 3 to 12.

C. Physical Resistance: Resistant to mildew and rot, ultraviolet light exposure, insects and rodents.

D. Minimum Test Values:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value (Min.)</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Strength</td>
<td>180 lbs.</td>
<td>ASTM D 4632</td>
</tr>
<tr>
<td>Trapezoidal Tear Strength</td>
<td>50 lbs.</td>
<td>ASTM D 4533</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>80 lbs.</td>
<td>ASTM D 4833</td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
<td>290 psi.</td>
<td>ASTM D 3786</td>
</tr>
<tr>
<td>Apparent Opening Size(1)</td>
<td>0.25 mm</td>
<td>ASTM D 4751</td>
</tr>
<tr>
<td>Permittivity (sec⁻¹)</td>
<td>0.2</td>
<td>ASTM D 4491</td>
</tr>
</tbody>
</table>

(1) Maximum average roll value.
PART 3  EXECUTION

3.01  LINE WORK

A. Conform use of geotextile to backfill for utilities to Section 02317 - Excavation and Backfill for Utilities.

3.02  TUNNEL WORK

A. Use geotextile outside of tunnel primary liner to prevent migration of soil fines into excavated tunnel resulting in voids or settlement. Select geotextile, subject to minimum requirements of Paragraph 2.02, meeting tunnel liner design requirements and installation conditions.

1. Sewers: Conform to Section 02426 - Sanitary Sewer Line in Tunnel.

2. Waterlines: Conform to Section 02517 - Waterline in Tunnels.

END OF SECTION
Section 02631

STORM SEWERS

PART 1  G E N E R A L

1.01 SECTION INCLUDES

A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for storm sewers, including elliptical or box storm sewer, installed by open-cut, augered with or without casing, or tunneling is on linear foot basis. Measurement for storm sewers and roadside ditch culverts will be taken along center line of pipe from center line to center line of manholes or from end to end of culverts. Measurement for storm sewer will be taken along center line of storm sewer from inside wall of storm sewer junction box when installed in conjunction with storm sewer junction box. Payment will be made for each linear foot installed complete in place, including connections to existing manholes and inlets.

2. Payment for storm sewer leads, including elliptical leads, is on a linear foot basis.

3. Payment for corrugated metal pipe storm sewer outfall, including timber bents, is on a linear foot basis.

4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

1.04 QUALITY ASSURANCE
A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections.

B. Provide manufacturer's certification to Specifications.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations.

B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use Materials cracked, gouged, chipped, dented, or otherwise damaged shall not be use materials for installation.

C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.

E. Keep interiors of pipe and fittings free of dirt and foreign matter.

F. Store PVC pipe out of direct sunlight.

PART 2 PRODUCTS

2.01 PIPE

A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.

B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Project Manager or otherwise shown on Drawings.

C. Existing pipe that has been removed during construction cannot be reused.

2.02 PIPE MATERIAL SCHEDULE

A. Storm Sewer Pipe: Use pipe materials that conforming to requirements specified in one or more of the following Sections as shown on the Drawings.

1. Section 02506 - Polyvinyl Chloride Pipe. Not allowed in the following applications:

a. Potentially Petroleum Contaminated Areas (PPCA).
b. Augering/jacking

2. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe. For use only where Storm Sewers are associated with Local Streets, where Local Street is defined by City of Houston Code of Ordinances 42-122.

3. Section 02611 - Reinforced Concrete Pipe.

4. Section 02641 - Monolithic Reinforced Concrete Sewers.

5. Section 02612 - Precast Reinforced Concrete Box Sewers.

6. Section 02642 - Corrugated Metal Pipe use only where Corrugated Metal Pipe is shown on Drawings.

B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials conforming to requirements specified in one or more of the following Sections as shown on the Drawings.

1. Section 02505 - High Density Polyethylene (HDPE) Solid and Profile Wall Pipe Use for Residential Culverts only. Use Concrete Pipe for long run culverts.

2. Section 02611 - Reinforced Concrete Pipe.

3. Section 02641 - Monolithic Reinforced Concrete Sewers.

4. Section 02612 - Precast Reinforced Concrete Box Sewers.

C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

D. Pipe materials other than those listed above shall not be used for storm sewers.

2.03 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill Material: Conform to requirements of Sections 02317 - Excavation and Backfill for Utilities, Section 02320 - Utility Backfill Material, and Section 2321 – Cement Stabilized Sand, and 02322 – Flowable Fill.

B. Topsoil: Conform to requirements of Section 02911 - Topsoil.

PART 3 EXECUTION

3.01 PREPARATION
A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affects traffic. Conform to requirements of Section 01555 Traffic Control and Regulation.

B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Section 01555 - Traffic Control and Regulation. Maintain barricades and warning lights for streets and intersections while Work is in progress or where traffic is affected by Work.

C. Immediately notify agency or company owning utility lines which are damaged, broken, or disturbed. Obtain approval from Project Manager and agency for repairs or relocations, either temporary or permanent.

D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Section 02221 - Removing Existing Pavements and Structures.

E. Install and operate dewatering and surface water control measures in accordance with Section 01578 - Control of Ground Water and Surface Water.

3.02 EXCAVATION

A. Earthwork. Conform to requirements of Section 02317 - Excavation and Backfill for Utilities. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Project Manager. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of Work. Or use appropriately sized grade boards which are substantially supported.

C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 12 inches.

3.03 PIPE INSTALLATION

A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.

B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Project Manager.

C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.
D. Install pipe with bells of pipe facing upstream of anticipated flow.

E. Form concentric joint with each section of adjoining pipe to prevent offsets.

F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Project Manager, provide end protection to prevent damage while using back hoes or similar powered equipment to drive home newly laid sections.

G. Keep interior of pipe clean as installation progresses.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.

J. For PVC Pipe:
   1. Provide a minimum cover as per City Standard detail from top of pavement to top of pipe, but no less than 2 feet.
   2. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.
   3. Provide pipe sections in standard lengths with minimum length of 13 feet. Pipe may be field modified to shorten length no less than 4 feet, unless otherwise approved by Project Manager. Field modify pipe per manufacturer's recommendations.
   4. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.
   5. Provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.

3.04 PIPE INSTALLATION OTHER THAN OPEN CUT

A. Conform to requirements of Section 02448 - Pipe and Casing Augering for Sewers where required.

B. Conform to requirements of Section 02441 - Microtunneling and Pipe-Jacking Tunnels where required.

C. Not allowed for plastic sewer pipe.

3.05 INSTALLATION OF APPURTENANCES
A. Construct manholes to conform to requirements of Sections 02081 - Cast-in-place Concrete Manholes, and Section 02082 - Precast Concrete Manholes, and Section 2087 - Brick Manholes for Storm Sewers. Install frames, grate rings, and covers to conform to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

B. Install PVC pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars. Refer to City Standards detail for end treatment requirements.

C. Install HDPE pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars. Refer to City Standards detail for end treatment requirements.

D. Install inlets, headwalls, and wingwalls to conform to requirements of Section 02632 - Cast-in-place Inlets, Headwalls, and Wingwalls and Section 02633 - Precast Concrete Inlets, Headwalls, and Wingwalls.

E. Rehabilitate existing manholes to conform to requirements of Section 02555 – Manhole Rehabilitation. Adjust manhole covers and inlets to grade conforming to requirements of Section 02086 - Adjusting Manholes, Inlets, and Valve Boxes to Grade.

F. Dimension for Type C and Type E manholes shall be as shown on Drawings.

3.06 INSPECTION AND TESTING

A. Perform post installation television inspection in accordance with Section 02531 – Gravity Sanitary Sewers. Hand held cameras may be used in storm sewers in lieu of requirements of Paragraph 3.09 of Section 02531 – Gravity Sanitary Sewers. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.

3.07 BACKFILL AND SITE CLEANUP

A. Backfill trench after pipe installation is inspected and approved by Project Manager.

B. Backfill and compact soil in accordance with Section 02317 - Excavation and Backfill for Utilities.

C. Repair and replace removed or damaged pavement and sidewalks as specified in Section 02951 - Pavement Repair and Restoration.

D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and seed according to requirements of Section 02921 Hydromulch Seeding, or Section 02922 - Sodding, as required.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Cast-in-place headwalls including wingwalls for storm sewers.

C. Cast-in-place junction box with lid or grate top.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for inlets is on unit price basis for each inlet installed.

2. Payment for headwalls including wingwalls is on unit price basis for each headwall including wingwall installed.

3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.

4. Payment for inlets and for culvert headwalls including wingwalls and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings for approval of design and construction details for cast-in-place units which differ from units shown on Drawings.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.
PART 2  PRODUCTS

2.01 MATERIALS

A. Concrete: Class A concrete with minimum compressive strength of 4000 psi conforming to requirements of Section 03315 - Concrete for Utility Construction, unless otherwise indicated on Drawings.

B. Reinforcing Steel: Conform to requirements of Section 03315 - Concrete for Utility Construction.

C. Concrete Bricks - Conform to requirements of Section 04210 - Brick Masonry for Utility Construction. Use manhole bricks.

D. Mortar and Hydraulic Cement - Conform to requirements of Section 04061 - Mortar.

E. Miscellaneous metals: Cast-iron frames, grates, rings, and covers conforming to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

PART 3  EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

A. Construct units complete in place to dimensions, lines and grades as shown on Drawings.

B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

C. Construct box section of inlet of Class A concrete or brick.

D. Plaster brick inlets with 1/2 inch mortar on inside. Use walls for brick inlets minimum of 8 inches thick. Conform to the requirements of Section 04210 - Brick Masonry for Utility Construction.

E. Forms required for both outside and inside faces of concrete inlet walls, however, when nature of material excavated for inlet can be hand trimmed to smooth vertical face, outside forms may be omitted with approval of Project Manager.
F. Place reinforcing steel to conform to details shown on Drawings. Provide positive means for holding steel cages in place during concrete placement. Welding of reinforcing steel is not permitted unless noted on Drawings. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.

G. Chamfer exposed edges unless otherwise indicated on Drawings.

3.03 FINISHES

A. Cut off inlet leads neatly at inside face of inlet wall. Point up with mortar.

B. When box section of inlet complete, shape floor of inlet with mortar to conform to detailed Drawings.

C. Finish concrete surfaces in accordance with requirements of Section 03315 - Concrete for Utility Construction.

3.04 QUALITY CONTROL

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS

A. Connect inlet leads to inlets.

B. Seal leads inside and outside with hydraulic cement.

3.06 BACKFILL

A. Backfill area of excavation surrounding each completed inlet according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Precast concrete headwalls and wingwalls for storm sewers.

C. Precast junction box with lid or grate top.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for inlets is on unit price basis for each inlet installed.

2. Payment for headwalls and wingwalls is on unit price basis for each headwall and wingwall installed.

3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.

4. Payment for inlets, headwalls, wingwalls, and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.05 STORAGE AND SHIPMENT

A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4000 psi.

B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:

1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.

2. Welding of reinforcing steel is not permitted unless noted on Drawings.

C. Mortar and Hydraulic Cement: Conform to requirements of Section 04261 - Mortar.

D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Section 02090 - Frames, Grates, Rings, and Covers.

2.02 SOURCE QUALITY CONTROL

A. Tolerances: Allowable casting tolerances for concrete units are plus or minus 1/4 inch from dimensions shown on Drawings. Concrete thickness in excess of that required will not
constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:

1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.

2. Surface defects indicating honeycombed or open texture.

3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.

D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.

E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Project Manager, repaired units conform to requirements of these specifications.

PART EXECUTION

3.01 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.02 INSTALLATION

A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.

B. Excavate in accordance with requirements of Section 02317 - Excavation and Backfill for Utilities.

C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.

D. Provide adequate means to lift and place concrete units.
3.03 FINISHES
A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.
B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.
C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.

3.04 INLET WATERTIGHTNESS
A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.05 CONNECTIONS
A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.06 BACKFILL
A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Section 02317 - Excavation and Backfill for Utilities.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Foundation course of compacted mixture of coarse and fine aggregates, and asphalt binder.

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hot mix asphalt base is on a per ton basis.

2. Payment for hot mix asphalt base for transitions and base repairs is on a per ton basis.

3. No separate payment will be made for hot mix asphaltic base for temporary driveway, temporary detour pavement, temporary roadway shoulders, etc. Include payment in unit price for respective driveway (02714) or temporary pavement (02741) section.

4. Measurement:

   a. Match actual pavement area placed or replaced but no greater than maximum pavement replacement limits and thickness designated or shown on Drawings.

   b. Include installed hot mix asphalt base course material that extends one foot beyond outside edge of pavement to be replaced, except where proposed pavement section shares common edge with existing pavement section.

   c. Actual quantity for payment purpose as measured and calculated in this section shall not exceed the maximum volume-weight conversion rate of 105 pounds per square yard area per inch thickness.

5. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  REFERENCES

A. AASHTO T201 - Standard Specification for Kinematic Viscosity of Asphalts (Bitumens).

C. ASTM C 33 - Standard Specifications for Concrete Aggregate.


G. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.


I. TxDOT Tex-200-F - Sieve Analysis of Fine and Coarse Aggregates.

J. TxDOT Tex-203-F - Sand Equivalent Test.

K. TxDOT Tex-204-F - Design of Bituminous Mixtures.

L. TxDOT Tex-207-F - Determining Density of Compacted Bituminous Mixtures.

M. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

N. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certificates that asphalt materials and aggregates meet requirements of Paragraph 2.01, Materials.

C. Submit proposed mix and test data for each type of base course in Work.

D. Submit manufacturer's description and characteristics of mixing plant for approval.

E. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 PRODUCTS

2.01 MATERIALS
A. Coarse Aggregate:

1. Use crushed gravel or crushed stone, or combination retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic, or other injurious material occurring either free or as coating on aggregate. Conform aggregate to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

2. Reclaimed asphalt pavement (RAP) or reclaimed Portland cement concrete pavement (RPCCP) are permitted as aggregates for hot mix asphalt base course if combined aggregate criteria, gradation, and mixture properties are met.

B. Fine Aggregate: Sand or stone screenings, or combination thereof, passing No. 10 sieve. Conform aggregate to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other deleterious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by TxDOT Tex-106-E. Sand equivalent shall have minimum value of 45 when tested by TxDOT Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with ASTM C 136. Provide either coarse or fine aggregate where designated on the Drawings.

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Type A Coarse</th>
<th>Type B Fine Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1/2&quot;</td>
<td>98.0-100.0</td>
<td>-</td>
</tr>
<tr>
<td>1 1/4&quot;</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1&quot;</td>
<td>78.0-94.0</td>
<td>98.0-100.0</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>64.0-85.0</td>
<td>84.0-98.0</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>50.0-70.0</td>
<td>-</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>-</td>
<td>60.0 to 80.0</td>
</tr>
<tr>
<td>#4</td>
<td>30.0-50.0</td>
<td>40.0 to 60.0</td>
</tr>
<tr>
<td>#8</td>
<td>22.0-36.0</td>
<td>29.0-43.0</td>
</tr>
<tr>
<td>#30</td>
<td>8.0-23.0</td>
<td>13.0-28.0</td>
</tr>
<tr>
<td>#50</td>
<td>3.0-19.0</td>
<td>6.0-20.0</td>
</tr>
<tr>
<td>#200</td>
<td>2.0-7.0</td>
<td>2.0-7.0</td>
</tr>
<tr>
<td>VMA % Minimum</td>
<td>12.0</td>
<td>13.0</td>
</tr>
</tbody>
</table>

*2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.

D. Asphalt Binder: Moisture-free homogeneous material meeting following requirements:
<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>PG 64 – 22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average 7-day Maximum Pavement Design Temperature, degrees C(^a)</td>
<td>&lt;64</td>
</tr>
<tr>
<td>Minimum Pavement Design Temperature, degrees C(^a)</td>
<td>&gt;22</td>
</tr>
<tr>
<td>Original Binder</td>
<td></td>
</tr>
<tr>
<td>Flash Point Temperature, T48, Minimum degrees C</td>
<td>230</td>
</tr>
<tr>
<td>Viscosity, ASTM D 4402, (^b) Maximum 3 Pa.s (3000cP), Test Temperature,</td>
<td>135</td>
</tr>
<tr>
<td>degrees C</td>
<td></td>
</tr>
<tr>
<td>Dynamic Shear, TP5; (^c)G*/sine[], Minimum, 1.00kPa Test Temperature @</td>
<td>64</td>
</tr>
<tr>
<td>10rad/sec, degrees C</td>
<td></td>
</tr>
<tr>
<td>Rolling Thin Film Oven (T240) or Thin Film Oven (T179) Residue</td>
<td></td>
</tr>
<tr>
<td>Mass Loss, Maximum, %</td>
<td>- 1.00</td>
</tr>
<tr>
<td>Dynamic Shear, TP5; G*/sine[], Minimum, 2.20 kPa Test Temperature @ 10rad/sec,</td>
<td>64</td>
</tr>
<tr>
<td>degrees C</td>
<td></td>
</tr>
<tr>
<td>Pressure Aging Vessel Residue (PPI)</td>
<td></td>
</tr>
<tr>
<td>PAV Aging Temperature, degrees C(^d)</td>
<td>100</td>
</tr>
<tr>
<td>Dynamic Shear, TP5; G*/sine[], Maximum, 5000 kPa Test Temperature @ 10rad/sec,</td>
<td>25</td>
</tr>
<tr>
<td>degrees C</td>
<td></td>
</tr>
<tr>
<td>Physical Hardening(^e)</td>
<td>Report</td>
</tr>
<tr>
<td>Creep Stiffness, TP1;(^f)S, Maximum, 300 Mpa; m-value, Minimum, 0.300 Test</td>
<td>-12</td>
</tr>
<tr>
<td>Temperature @ 60 sec, degrees C</td>
<td></td>
</tr>
<tr>
<td>Direct Tension, TP3;(^f) Failure Strain, Minimum, 1.0%; Test Temperature @</td>
<td>-12</td>
</tr>
<tr>
<td>1.0 mm/min, degrees C</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
\(^a\) Pavement temperature can be estimated from air temperatures using algorithm contained in TxDOT testing procedures.
\(^b\) The requirement may be waived at discretion of Project Manager if supplier warrants that asphalt binder can be adequately pumped and mixed at temperatures that meet applicable safety standards.
\(^c\) For quality control of unmodified asphalt cement production, measurement of viscosity of original asphalt cement may be substituted for dynamic shear measurements of G*/sine [ ] at test temperature where asphalt is Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary or rotational viscometry (AASHTO T 201 or T202).
\(^d\) The PAV aging temperature is based on simulated climatic conditions and is one of three temperatures: 90 C, 100 C, or 110 C. The PAV aging temperature is 100 C for PG64 and PG70.
\(^e\) Physical Hardening - TP 1 is performed on a set of asphalt beams according to Section 13.1, except conditioning time is extended to 24 hours plus of minus 10 minutes at 10 C above minimum performance temperature. The 24-hour stiffness and m-value are reported for information purposes only.
\(^f\) If creep stiffness is below 300 MPa, the direct tension test is not required. If creep stiffness is between 300 and 600 MPa the direct tension failure strain requirement can be used in lieu of creep stiffness requirement. The m-value requirement must be satisfied in both cases.

E. Reclaimed asphalt pavement (RAP) may be used at a rate no greater than 20 percent.
2.02 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuous mixtures meeting specifications. With exception of a drum mix plant, the plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors.

B. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device
2. Dryer
3. Screens
4. Aggregate weight box and batching scales
5. Mixer
6. Asphalt storage and heating devices
7. Asphalt measuring devices
8. Truck scales

C. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix. One cold feet bin per stockpile is required.

2.03 MIXES

A. Employ certified testing laboratory to prepare design mixes.

1. Test in accordance with TxDOT Tex-126-E, TxDOT Tex-204-F, TxDOT Tex-208-F, and TxDOT Tex-227-F.

2. Verify mixture design properties for plant-produced mixture. Demonstrate that asphalt plant is capable of producing mixture meeting design volumetric and stability requirements before placement begins.

B. Density, Stability, and Air Voids Requirements. Select asphalt binder content for base courses to result in 3 to 5 percent air voids in laboratory molded specimens, while meeting minimum VMA requirement for selected mixture classification.
PART 3  E X E C U T I O N

3.01  PREPARATION

A. Complete backfill of new utilities below future grade.

B. Verify lines and grades are correct.

C. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation or Section 02336 - Lime Stabilized Subgrade and Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and 02338 - Portland Cement Stabilized Subgrade. Subgrade preparation may also refer to Section 02321 - Cement Stabilized Sand or Section 02713 - Recycled Crushed Concrete Base Course.

D. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

3.02  PLACEMENT

A. Place base when surface temperature taken in shade and away from artificial heat is above 40 degrees F and rising. Do not place asphalt base when temperature of surface to receive base course is below 50 degrees F and falling.

B. Haul prepared and heated asphalt base mixture to project in tight vehicles previously cleaned of foreign material. Mixture shall be at temperature between 250 degrees F and 325 degrees F when laid.

C. Place hot mix asphalt base course in compacted lifts no greater than 4 inches thick, unless permitted in writing by Engineer.

D. Place courses as nearly continuously as possible. Place material with approved mechanical spreading and finishing machine of screeding or tamping type. Spread lifts to attain smooth course of uniform density to section, line, and grades as indicated on Drawings.

E. In areas with limited space where use of paver or front-end loader is impractical, spread by hand and compact asphalt by mechanical means. Carefully place materials to avoid segregation of mix; do not broadcast material. Remove lumps that do not break down readily.

3.04  JOINTS
A. Transverse Joints. Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back placed material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

B. Existing pavement. When new asphalt is laid against existing asphalt pavement, saw cut existing asphalt to full depth creating vertical face. Clean joint and apply tack coat before placement.

3.05 COMPACTION

A. Construct test strip to identify correct type, number, and sequence of rollers necessary to obtain specified in-place density or air-voids. Prepare test strip at least 500 feet in length, comparable to placement and compaction conditions for Project.

B. Begin rolling while pavement is still hot and as soon as it will bear roller without undue displacement or hair line cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water; do not use petroleum by-products.

C. Compact surface thoroughly and uniformly with power-driven equipment capable of obtaining required compaction. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mat temperature drops below 175 degrees F.

D. Along walls, curbs, headers, similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

E. Compact base course to a minimum density of 91 percent (TxDOT Tex-227-F).

3.06 TOLERANCES

A. Pavement Repairs.

1. Furnish templates for checking surface of finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/4 inch.

2. Completed surface, when tested with 10 foot straight edge laid parallel to center line of pavement, shall show no deviation in excess of 1/4 inch in 10 feet. Correct surface not meeting this requirement.

3.07 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.
B. For in-place depth and density, take minimum of one core at random locations for each 1000 feet of single lane pavement. On a 2-lane pavement, take samples at random every 500 feet from alternating lanes. Take cores for parking lots every 500 square yards of base to determine in-place depth and density. If cul-de-sac or streets are less than 500 feet, minimum of 2 cores (one per lane) will be procured. On small projects, take a minimum of two cores for each day’s placement. For first days placement and prior to coring, minimum of 5 nuclear gauge readings will be performed at each core location to establish correlation between nuclear gauge (wet density reading) and core (bulk density). This process will continue for each day’s placement until engineer determines that a good bias has been established for that nuclear gauge.

C. Determine in-place density in accordance with TxDOT Tex-207-F and Tex-227-F from cores or sections of asphaltic base located near each core. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Project Manager.

D. Request, at option, three additional cores within a 5-foot radius of core indicating nonconforming in-place depth at no additional cost to City. In-place depth at these locations shall be average depth of four cores.

E. Fill cores and density test sections with new compacted asphalt base or cold patch material.

3.08 NONCONFORMING PAVEMENT

A. Re-compact and retest nonconforming street sections not meeting surface test requirements. Patch asphalt pavement sections in accordance with procedures established by Asphalt Institute. Retesting is at no cost to the City.

B. Remove and replace areas of asphalt base found deficient in thickness by more than 10 percent. Remove and replace areas of asphalt base found deficient in density. Use new asphalt base of thickness shown on Drawings.

C. Replace or correct nonconforming pavement sections at no additional cost to City.

3.09 PROTECTION

A. Do not open base to traffic until 12 hours after completion of rolling, or as shown on Drawings.

B. Maintain asphalt base in good condition until completion of Work.

C. Repair defects immediately by replacing base to full depth.

END OF SECTION
PART 1   GENERAL

1.01 SECTION INCLUDES

A. Foundation course of cement stabilized crushed stone.
B. Foundation course of cement stabilized bank run gravel.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. Payment for cement stabilized base course is on square yard basis. Separate pay items are used for each different required thickness of base course.
   2. Payment for asphaltic seal cure is by gallon.
   3. Refer to Section 01270 - Measurement and Payment for unit price procedures.
   4. Refer to Paragraph 3.09, Unit Price Adjustment.

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

C. ASTM D 698 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.


G. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

H. TxDOT Tex-110-E - Particle Size Analysis of Soils.

I. TxDOT Tex-120-E - Soil-Cement Testing.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit samples of crushed stone, gravel, and soil binder for testing.

C. Submit manufacturer's description and characteristics for pug mill and associated equipment, spreading machine, and compaction equipment for approval.

1.05 TESTS

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform tests and analysis of aggregate and binder materials in accordance with ASTM D 1557 and ASTM D 4318.

1.06 DELIVERY, STORAGE AND HANDLING

A. Make stockpiles from layers of processed aggregate to eliminate segregation of materials. Load material by making successive vertical cuts through entire depth of stockpile.

B. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 PRODUCTS

2.01 CEMENT

A. ASTM C 150 Type I; bulk or sacked.

2.02 WATER

A. Clean, clear; and free from oil, acids, alkali, or vegetable matter.
2.03 AGGREGATE

A. Crushed Stone: Material retained on No. 40 Sieve meeting following requirements:

1. Durable particles of crusher-run broken limestone, sandstone, or granite obtained from approved source.

2. Los Angeles abrasion test percent of wear not to exceed 40 when tested in accordance with ASTM C 131.

B. Gravel: Durable particles of bank run gravel or processed material.

C. Soil Binder: Material passing No. 40 Sieve meeting following requirements when tested in accordance with ASTM D 4318:

1. Maximum Liquid limit: 35.


D. Mixed aggregate and soil binder shall meet the following requirements:

1. Grading in accordance with TxDOT Tex-101-E and Tex-110-E within the following limits:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crushed</td>
</tr>
<tr>
<td>1 3/4 inch</td>
<td>0 to 10</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>-</td>
</tr>
<tr>
<td>No. 4</td>
<td>45 to 75</td>
</tr>
<tr>
<td>No. 40</td>
<td>55 to 80</td>
</tr>
</tbody>
</table>

2. Obtain prior permission from Project Manager for use of additives to meet above requirements.

2.04 ASPHALT SEAL CURE

A. Cutback Asphalt: MC30 conforming to requirements of Section 02742 - Prime Coat.

B. Emulsified Petroleum Resin: EPR-1 Prime conforming to requirements of Section 02742 - Prime Coat.
2.05 MATERIAL MIX

A. Design mix for minimum average compressive strength of 200 psi at 48 hours using TxDOT Tex-120-E unconfined compressive strength testing procedures. Provide minimum cement content of 1 1/2 sacks, weighing 94 pounds each, per ton of mix.

B. Increase cement content when average compressive strength of tests on field samples fall below 200 psi. Refer to Part 3 concerning field samples and tests.

C. Mix in stationary pug mill equipped with feeding and metering devices for adding specified quantities of base material, cement, and water into mixer. Dry mix base material and cement sufficiently to prevent cement balls from forming when water is added.

D. Resulting mixture shall be homogeneous and uniform in appearance.

2.06 SOURCE QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Perform testing for unconfined compressive strength by TxDOT Test Method Tex-120-E as follows:

1. Mold three samples each day or for each 300 tons of production.

2. Compressive strength shall be average of three tests for each production lot.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation.
C. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

3.03 PLACEMENT

A. Do not mix and place cement stabilized base when temperature is below 40 degrees F and falling. Place base when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Place material on prepared subgrade in uniform layers to produce thickness indicated on Drawings. Depth of layers shall not exceed 6 inches.

C. Spread with approved spreading machine. Conduct spreading so as to eliminate planes of weakness or pockets of non-uniformly graded material resulting from hauling and dumping operations.

D. Provide construction joints between new material and stabilized base that has been in place 4 hours or longer. Joints shall be approximately vertical. Form joint with temporary header or make vertical cut of previous base immediately before placing subsequent base.

E. Use only one longitudinal joint at center line under main lanes and shoulder unless shown otherwise on Drawings. Do not use longitudinal joints under frontage roads and ramps unless indicated on Drawings.

F. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure firm bond between reinforcement and base.

3.04 COMPACTION

A. Start compaction as soon as possible but not more than 60 minutes from start of moist mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow stabilized base to mix with underlying material.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 2 percent above optimum moisture as determined by ASTM D 698. Mix in with spiked tooth harrow or equal. Reshape surface and lightly scarify to loosen imprints made by equipment.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.
E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers which are sufficiently light to prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

F. Compact to minimum density of 95 percent of maximum dry density at moisture content of treated material between optimum and 2 percent above optimum as determined by ASTM D 1557, unless otherwise indicated on Drawings.

G. Maintain surface to required lines and grades throughout operation.

3.05 CURING

A. Moist cure for minimum of 7 days before adding pavement courses. Restrict traffic on base to local property access. Keep subgrade surface damp by sprinkling.

B. If indicated on Drawings, cover base surface with curing membrane as soon as finishing operation is complete. Apply with approved self-propelled pressure distributor at following rates, or as indicated on Drawings:
   1. MC30: 0.1 gallon per square yard.
   2. EPR-1 Prime: 0.15 gallon per square yard.

C. Do not use cutback asphalt during period of April 16 to September 15.

3.06 TOLERANCES

A. Smooth and conform completed surface to typical section and established lines and grades.

B. Top surface of base course: Plus or minus 1 1/4 inch in cross section, or in 16 foot length.

3.07 FIELD QUALITY CONTROL

A. Perform testing under provisions of Section 01454 - Testing Laboratory Services.

B. Take minimum of one core at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Request additional cores in vicinity of cores indicating nonconforming in-place depths at no extra cost to City. When average of tests fall below required depth, place additional material and compact at no additional cost to City.

D. Perform compaction testing in accordance with ASTM D 698 or ASTM D 2922 and ASTM D 3017 at randomly selected locations. Remove and replace areas that do not conform to compaction requirements at no additional cost to City.
E. Fill cores and density test sections with new compacted cement stabilized base.

3.08 NONCONFORMING BASE COURSE

A. Remove and replace areas of base course found deficient in thickness by more than 10 percent, or that fail compressive strength tests, with cement-stabilized base of thickness shown on Drawings.

B. Replace nonconforming base course sections at no additional cost to City.

3.09 UNIT PRICE ADJUSTMENT

A. Make unit price adjustments for in-place depth determined by cores as follows:

1. Adjusted unit price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price.

2. Apply adjustment to lower limit of 90 percent and upper limit of 100 percent of unit price.

3.10 PROTECTION

A. Maintain stabilized base in good condition until completion of Work. Repair defects immediately by replacing base to full depth.

B. Protect asphalt membrane, when used, from being picked up by traffic. Membrane may remain in place when proposed surface courses or other base courses are to be applied.
Section 02713

RECYCLED CRUSHED CONCRETE BASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Recycled crushed concrete base (RCCB) course.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. Payment for RCCB is on per ton basis furnished and compacted in place.
   2. Payment for RCCB for transitions and base repairs, if required, is on a per ton basis.
   3. No separate payment will be made for RCCB for temporary driveway, temporary detour pavement, temporary road shoulders and etc. Include payment in unit price for related work.
   4. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES

C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils.
D. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.
E. TxDOT Tex-113-E - Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials.
F. TxDOT Tex-115-E - Field Method for Determining In-place Density of Soils and Base Materials.
G. TxDOT Tex-120-E - Soil-Cement Testing.
1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit representative samples of crushed concrete for testing.

C. Submit weight tickets, certified by supplier, for each delivery of recycled crushed concrete, gravel, and soil binder.

D. Submit manufacturer's description and characteristics for pug mill and associated equipment, mixer trucks, spreading and compaction equipment for approval.

1.05 TESTS

A. Follow Section 01454 - Testing Laboratory Services.

B. Test and analyze aggregate and binder products following TxDOT Tex-110-E.

1.06 DELIVERY, STORAGE AND HANDLING

A. Provide materials from stockpiles that are protected during storage from contaminates detrimental to concrete base.

B. Load material from same area of stockpile to maintain uniformity of each successive delivery to Project site.

C. Store cement in weatherproof enclosures. Protect from ground dampness.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Provide RCCB with following performance:

1. Minimum 7 percent cement.

2. Minimum compressive strength: 650 psi at 14 days following TxDOT Tex-120-E.

3. Prepare concrete product in on-site or off-site pug mill, or in on-site or off-site portable concrete mixer.

B. Preliminary Design: Prepare preliminary mix with minimum cement to crushed concrete ratios of 5 percent by dry mass of materials.
1. Designate source of concrete for crushing. Follow Section 01454 - Testing Laboratory Services for tests of concrete from source.

2. Results of laboratory and compression tests will be used by Project Manager to select final mix design.

2.02 PORTLAND CEMENT

A. ASTM C 150 Type I, II, or III; bulk or sacked.

2.03 WATER

A. Potable.

2.04 AGGREGATE

A. Recycled Crushed Concrete: Material retained on No. 40 Sieve, and durable coarse particles of crusher-run reclaimed cured Portland cement concrete, obtained from approved source. Organic material is prohibited. The crushed concrete shall be substantially free of foreign matter including but not limited to asphalt, base, and dirt.

B. Soil Binder (classified below): Meeting following requirements when tested following TxDOT Tex-106-E:

1. Maximum liquid limit: 35

2. Maximum plasticity index: 10

C. Mixed Aggregate and Soil Binder: Grading following TxDOT Tex-101-E and Tex-110-E within following limits:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Crushed Concrete Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 3/4 inch</td>
<td>0 to 10</td>
</tr>
<tr>
<td>No. 4</td>
<td>45 to 75</td>
</tr>
<tr>
<td>No. 40</td>
<td>55 to 80; classified as Soil Binder</td>
</tr>
</tbody>
</table>

2. Bank sand may be added to mix at pug mill.

2.05 ASPHALTIC SEAL CURE

A. Acquire written approval from Project Manager before curing and before proceeding with curing.

B. Use following as option to curing by sprinkling:
1. Cut-back asphalt: MC30 following Section 02742 - Prime Coat.

2. Emulsified petroleum resin: EPR-1 Prime following Section 02742 - Prime Coat.

2.06 MATERIAL MIX

A. Design mix for minimum compressive strength of 650 psi at 14 days following TxDOT Tex-120-E unconfined compressive strength.

B. Cement Ratio: Follow Paragraph 2.01A. Increase cement content in two percent steps up to 9 percent maximum when compressive strength of design mix samples fail TxDOT Tex-120E test.

2.07 MIXING EQUIPMENT

A. Mix following Paragraph 2.01A, with metering devices adding specified quantities of crushed concrete, cement, and water into mixer. Dry mix crushed concrete and cement prior to adding water. Produce homogeneous and uniformly mixed product.

2.08 SOURCE QUALITY CONTROL

A. Test following Section 01454 - Testing Laboratory Services.

B. When directed by Project Manager, test for unconfined compressive strength following Test Method TxDOT Tex-120-E as follows:

1. Mold minimum of three samples each day or for each 500 tons of production or one for each day.

2. Compressive strength: average of 3 specimens for each sample lot.

PART 3 EXECUTION

3.01 EXAMINATION

A. Follow Section 01452 - Inspection Services.

B. Verify buried utility work is complete.

C. Verify lime treatment of base is complete.

D. Verify subgrade is ready to support imposed loads.
E. Verify flatwork, foundations, projecting reinforcement and similar Work interfacing with base is in place.

F. Verify lines and grades are correct.

3.02 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02330 - Embankment and Section 02315 - Roadway Excavation, or Section 02336 - Lime Stabilized Subgrade and Section 02337 - Lime-Fly Ash Stabilized Subgrade and Section 02338 - Portland Cement Stabilized Subgrade.

C. Correct subgrade deviations in excess of plus or minus 1/4 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course for efficient operations.

E. Have sufficient products and equipment on hand to expeditiously apply base.

3.03 MIXING

A. Maintain moisture content of between optimum and 5 percent above optimum.

3.04 PLACEMENT

A. Place mixture with approved spreading equipment. Spread to eliminate planes of weakness or pockets of nonuniformly graded material resulting from hauling and dumping operations.

B. Provide approximately vertical construction joints between fresh base and base-in-place 4 hours or longer. Form joint with temporary header or make vertical cut of in-place base immediately before placing fresh base.

C. Make cold joints at center line of head-to-head parking stalls.

D. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Provide proper bond between reinforcement and base.

E. Transverse and longitudinal joints shall be vertical.

F. Unless noted otherwise, place recycled crushed concrete base in courses not to exceed 8 inches in depth. All courses shall be placed on same working day unless approved by Project Manager. Construction joints between new base and base previously placed shall be wetted and coated with dry cement prior to addition of new base.
G. Complete finishing operations within period of 6 hours after cement is added to base materials.

3.05 COMPACTATION

A. Start compaction maximum 3 hours after start of mixing. Compact loose mixture with approved tamping rollers until entire depth is uniformly compacted. Do not allow base to mix with underlying material.

1. Do not rework uncompacted material that has set up for more than 30 minutes.

2. Complete placement and compaction work within 6 hours from start of moist mixing.

B. Correct irregularities or weak spots immediately by replacing material and recompacting.

C. Apply water to maintain moisture between optimum and 5 percent above optimum moisture.

D. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

E. Finish by blading surface to final grade after compacting final course. Seal with approved pneumatic tired rollers or flat wheel rollers which are sufficiently light to prevent surface hair line cracking.

F. Compact to minimum density of 95 percent of dry density, following TxDOT Tex-113-E, at moisture content of treated material between optimum and 5 percent above optimum.

G. Test roadway base course compaction in accordance with TxDOT Tex-115-E.

H. Maintain surface to required lines and grades throughout operation.

3.06 CURING

A. Moist cure for minimum of 72 hours before adding pavement courses.

B. Use sprinkling or, at option, apply following curing membrane as soon as initial set begins, using approved light-weight self-propelled pressure distributor:

1. MC30: 0.1 gallon per square yard.

2. EPR-1 Prime: 0.15 gallon of asphalt residual per square yard.

C. Do not use cut-back asphalt during period of April 16 through September 15.

3.07 TOLERANCES
A. Completed Surface: Smooth and conform to typical section and established lines and grades.

B. Top Surface of Base Course: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.08 FIELD QUALITY CONTROL

A. Test following Section 01454 - Testing Laboratory Services.

B. Perform compaction tests following TxDOT Tex-113-E at randomly selected locations. Remove and replace areas failing compaction requirements at no additional cost to City.

3.09 PROTECTION

A. Maintain base in proper condition until surface is placed. Surface must be placed within 14 days after final mixing and compaction unless otherwise approved by Project Manager. Repair unacceptable base course immediately by replacing base to full depth.

B. Curing membrane may remain in place at areas where surface courses or other base courses are applied.

C. Prevent construction traffic on base for minimum 3 days. Light vehicles, used to maintain proper cure, are permitted on base after initial set or as permitted by Project Manager.

END OF SECTION
Section 02714

FLEXIBLE BASE COURSE FOR TEMPORARY DRIVEWAYS

PART 1    G E N E R A L

1.01 SECTION INCLUDES

A. Foundation course of crushed concrete or stone.

1.02 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. Measurement for flexible base course payment is on each driveway basis. To maintain access or temporary driveway, separate measurement will be made for each different type of driveway (residential, commercial, or custom properties) or as identified on the construction drawings.

2. Payment limits for temporary driveways are based upon the width of the driveway access (not to exceed 12-feet for residential, 24-feet for commercial, or custom dimensioned properties) and the length from permanent or temporary roadway to the remaining permanent driveway or street right-of-way, as necessary to maintain access to properties.

3. No separate payment will be made for flexible base course for temporary roads, detour pavements, and shoulder under this Section unless it is included as an extra unit bid and as approved for payment by the project manager. Flexible base course for temporary driveways or access if included under the extra unit bid item is on a cubic yard basis.

4. Temporary driveways will be paid only once per driveway location shown to be replaced on the drawing and payment shall be made based upon actual installation.

5. Refer to Section 01270 - Payment Procedures for unit price procedures.

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

1.03 REFERENCES
A. ASTM D 1556 - Density of Soil in Place by the Sand-Cone Method.


C. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

D. ASTM D 361 - Test Method for Water Content of Soils and Rock in Place by Nuclear Methods (shallow depth).


G. TxDOT Tex-101-E - Preparation of Soil and Flexible Base Materials for Testing.

H. TxDOT Tex-110-E - Determination of Particle Size Analysis of Soils.

1.04 SUBMITTALS

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

B. Submit samples of flexible base course and soil binder for testing.

1.05 TESTS

A. Tests and analysis of soil materials will be performed in accordance with ASTM C 131, ASTM D 698, ASTM D 4318, Tex-101-E, and Tex-110-E under provisions of Section 01454 - Testing Laboratory Services.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide materials from stockpiles that are protected during storage from contaminates that would be detrimental to the flexible base course.

B. Load materials from same area of stockpile to maintain uniformity of each successive delivery to the project site.

PART 2 PRODUCTS

2.01 MATERIALS
A. Crushed Stone or Concrete: Material retained on the No. 40 sieve meeting the following requirements:

1. Durable particles of crusher-run broken limestone, crushed concrete, crushed sandstone, or granite obtained from an approved source.

B. Soil Binder: Material passing the No. 40 sieve meeting the following requirements when tested in accordance with ASTM D 4318:

1. Maximum Liquid Limit: 40
2. Maximum Plasticity Index: 12
3. Maximum Lineal Shrinkage: 7 (when calculated from volumetric shrinkage at liquid limit).

C. Mixed Materials shall meet the following requirements:

1. Minimum compressive strength of 35 psi at 0 psi lateral pressure and 175 psi at 15 psi lateral pressure using triaxial testing procedures.
2. Grading in accordance with Tex-101-E and Tex-110-E within the following limits:

<table>
<thead>
<tr>
<th>Sieve</th>
<th>Percent Retained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/4 inch</td>
<td>0 to 10</td>
</tr>
<tr>
<td>No. 4</td>
<td>45 to 75</td>
</tr>
<tr>
<td>No. 40</td>
<td>60 to 85</td>
</tr>
</tbody>
</table>
PART 3    EXE C U T I O N

3.01    EXAMINATION

A. Verify compacted subgrade is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02    PREPARATION

A. Complete backfill of new utilities below future grade.

B. Prepare subgrade in accordance with requirements of Section 02315 - Roadway Excavation or Sections 02336 - Lime Stabilized Subgrade and 02337 - Lime/Fly-ash Stabilized Subgrade.

C. Correct subgrade deviations in excess of plus or minus 1/2 inch in cross section, or in 16 foot length by loosening, adding or removing material, reshaping and recompacting by sprinkling and rolling.

D. Prepare sufficient subgrade in advance of base course operations.

3.03    PLACEMENT

A. Spread and shape in lifts to compacted thickness not to exceed 6 inches in depth. Complete spreading, shaping, and compacting on same day material is deposited.

B. Place base so that projecting reinforcing steel from curbs remain at approximate center of base. Secure a firm bond between reinforcement and base.

C. Start rolling operations as soon as possible after placement. Use sheepfoot, steel, or pneumatic rollers as approved. Roll longitudinally with subgrade starting from sides. Overlap successive strips by one-half width of each rear wheel.

D. Maintain moisture between optimum and 3 percent above optimum moisture.

E. Compact to 95 percent of Proctor density in accordance with ASTM D 698, unless otherwise indicated on the Drawings.

F. Finish to grade and compact lift before placing successive lift.

G. Maintain shape by grading throughout operation.

H. Provide total thickness indicated on Drawings.

3.04    TOLERANCES
A. Completed surface shall be smooth and conform to typical section and established lines and grades.

3.05 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. Compaction Testing will be performed in accordance with ASTM D 698 or ASTM D 2922 and ASTM 3017 at a random location near each depth determination core. Rework and recompact areas that do not conform to compaction requirements.

3.06 PROTECTION

A. Sprinkle to prevent excessive loss of moisture.

B. Restrict construction traffic on finished base to equipment required to complete the work.

END OF SECTION
PART 1  GENERAL

1.01 SECTION INCLUDES

A. Surface course of compacted mixture of coarse and fine aggregates and asphaltic binder.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for hot-mix asphalt concrete pavement is on a per ton basis. Separate pay items are used for each different required thickness of pavement.

2. Payment for hot-mix asphalt concrete pavement includes payment for associated work performed in accordance with Section 02743 - Tack Coat.

3. Payment for pavement repair or pavement replacement for utility projects is on a square yard basis and includes surface and base materials in accordance with Section 02951.

4. Payment for temporary detour pavement or temporary roadway and shoulder is on a square yard basis and includes surface and base materials, associated grading, maintenance and removal as well as restoration of ditches.

5. Payment for speed humps is on linear foot basis, and includes milling of existing pavement, tack coat, and placement and compaction of asphalt. Measurement of speed hump is along length of 12 foot wide speed hump, measured transverse to centerline of road. Separate payment is made for thermoplastic markings applied to speed hump.

6. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 REFERENCES


C. TxDOT Tex-106-E - Calculating the Plasticity Index of Soils
E. TxDOT Tex-200-F - Sieve Analysis of Fine and Course Aggregates.
F. TxDOT Tex-203-F - Sand Equivalent Test.
G. TxDOT Tex-204-F - Design of Bituminous Mixtures.
H. TxDOT Tex 206-F - Compacting Test Specimens of Bituminous Mixtures.
I. TxDOT Tex-207-F - Determining Density of Compacted Bituminous Mixtures.
J TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.
K. TxDOT Tex-217-F - Determining Deleterious Material and Decantation Test for Coarse Aggregates.
L. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.
M. TxDOT Tex-530-C - Effect of Water on Bituminous Paving Mixtures.
N. TxDOT Tex-531-C - Prediction of Moisture Induced Damage to Bituminous Paving Materials Using Molded Specimens.

1.04 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.
B. Submit certificates that asphalt materials and aggregates meet requirements of Paragraph 2.01, Materials.
C. Submit proposed design mix and test data for surface course.
D. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Coarse Aggregate:
1. Use gravel, crushed stone, or combination thereof, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic or other injurious matter occurring either free or as coating on aggregate. Use aggregate conforming to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

2. Aggregate by weight shall not contain more than 1.0 percent by weight of fine dust, clay-like particles, or silt when tested in accordance with Tex-217-F, Part II.

B. Fine Aggregate: Sand, stone screenings or combination of both passing No. 10 sieve. Use aggregate conforming to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by TxDOT Tex-106-E. Sand equivalent shall have minimum value of 45 when tested by TxDOT Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with TxDOT Tex-200-F. Use type specified on Drawings:

<table>
<thead>
<tr>
<th>SIEVE SIZE</th>
<th>PERCENT PASSING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Course Surface (TxDOT Type C)</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3/4 “</td>
<td>95 to 100</td>
</tr>
<tr>
<td>1/2”</td>
<td>-</td>
</tr>
<tr>
<td>3/8”</td>
<td>70.0-85.0</td>
</tr>
<tr>
<td>#4</td>
<td>43 to 63</td>
</tr>
<tr>
<td>#8</td>
<td>32.0-44.0</td>
</tr>
<tr>
<td>#30</td>
<td>14.0-28.0</td>
</tr>
<tr>
<td># 50</td>
<td>7.0-21.0</td>
</tr>
<tr>
<td>#200</td>
<td>2.0-7.0</td>
</tr>
<tr>
<td>VMA % minimum</td>
<td>14.0</td>
</tr>
</tbody>
</table>

* 2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.

D. Asphalt Binder: Moisture-free homogeneous material which will not foam when heated to 347 F, meeting the following requirements.
<table>
<thead>
<tr>
<th>PERFORMANCE GRADED BINDER</th>
<th>PERFORMANCE GRADE (PG64-22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average 7-day Maximum Pavement Design Temperature, C</td>
<td>&lt; 64</td>
</tr>
<tr>
<td>Minimum Pavement Design Temperature, C</td>
<td>&gt; -22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORIGINAL BINDER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash Point Temperature, T48; Minimum C</td>
</tr>
<tr>
<td>Viscosity, ASTM D 4402; Maximum, 3Pa*s (3000 cP) Test Temperature, C</td>
</tr>
<tr>
<td>Dynamic Shear, TP5; G*/sin[ ], Minimum, 1.00 kPa Test Temperature @ 10 rad/sec., C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROLLING THIN FILM OVEN (T240) OR THIN FILM OVEN (T179) RESIDUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass Loss, Maximum, %</td>
</tr>
<tr>
<td>Dynamic Shear, TP5; G*/sin[ ], Minimum, 2.20 kPa Test Temperature @ 10 rad/sec., C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRESSURE AGING VESSEL RESIDUE (PP1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAV Aging Temperature, C</td>
</tr>
<tr>
<td>Dynamic Shear, TP5; G*/sin[ ], Minimum, 5000 kPa Test Temperature @ 10 rad/sec., C</td>
</tr>
<tr>
<td>Physical hardening</td>
</tr>
<tr>
<td>Creep Stiffness, TP1; S, Maximum, 300 Mpa -value, Minimum, 0.300 Test Temperature @ 60 sec., C</td>
</tr>
<tr>
<td>Direct Tension, TP3; Failure Strain, Minimum, 1.0% Test Temperature @ 1.0 mm/min, C</td>
</tr>
</tbody>
</table>
E. Anti-stripping Agent:

1. Evaluate mixture of aggregate, asphalt, and additives proposed for use for moisture susceptibility and requirement for anti-stripping agents. To substantiate mix design, produce and test trial mixtures using proposed project materials and equipment prior to placement. Test for susceptibility to moisture and trial mixture may be waived by Project Manager when similar designs using same material have previously proven satisfactory.

2. Liquid Anti-stripping Agent. Use anti-stripping agent with uniform liquid with no evidence of crystallization, settling, or separation of components. Submit sample of anti-stripping agent proposed for use and manufacturer's product data, including recommended dosage range, handling and storage, and application instructions.

F. Pavement markings for speed humps: Conform to requirements of Section 02767 - Thermoplastic Pavement Markings.

2.02 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuous mixtures meeting specifications. With exception of a drum mix plant, plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors.

B. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device
2. Dryer
3. Screens
4. Aggregate weight box and batching scales
5. Mixer
6. Asphalt storage and heating devices
7. Asphalt measuring devices
8. Truck scales

C. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix. Provide one cold feed bin per stockpile.
2.03 MIXES

A. Employ certified testing laboratory to prepare design mixes. Test in accordance with TxDOT Tex-126-E or Tex-204-F, Tex-206-F, Tex-208-F, Tex-530-C and Tex-531-C.

B. Density, Stability and Air Void Requirements:

<table>
<thead>
<tr>
<th>Percent Density</th>
<th>Percent Optimum</th>
<th>HVEEM Stability Percent Not Less Than</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>Max.</td>
<td>94.5</td>
</tr>
<tr>
<td>94.5</td>
<td>97.5</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35</td>
</tr>
</tbody>
</table>

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted base course is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Tack Coat: Conform to requirements of Section 02743 - Tack Coat. Where mixture will adhere to surface on which it is to be placed without use of tack coat, tack coat may be eliminated when approved by Project Manager.

B. Prepare subgrade in accordance with requirements of Section 02711 - Hot Mix Asphalt Base Course, Section 02712 - Cement Stabilized Base Course, or Section 02713 - Recycled Crushed Concrete Base Course.

C. Prepare subgrade in advance of asphalt concrete paving operation.

D. Perform pavement repair and resurfacing as indicated in Section 02951 - Pavement Repair and Resurfacing.

E. Do not use cutback asphalt.

F. Milling of pavement for speed humps: Mill pavement (concrete or asphalt) to depth of one inch and width between 18 and 24 inches around entire perimeter of proposed hump, as shown in detail for speed hump design.
3.03 PLACEMENT

A. Do not place asphalt pavement less than 2 inches thick when surface temperature taken in shade and away from artificial heat is below 50 F and falling. Asphalt may be placed when temperature is above 40 F and rising.

B. Haul prepared and heated asphaltic concrete mixture to project in tight vehicles previously cleaned of foreign material. Mixture temperature shall be between 250 F and 325 F when laid.

C. Spread material into place with approved mechanical spreading and finishing machine of screening or tamping type.

D. Surface Course Material: Surface course 2 inches or less in thickness may be spread in one lift. Spread lifts in such a manner that, when compacted, finished course will be smooth, of uniform density, and will be to section, line and grade as shown. Place construction joints on surface courses to coincide with lane lines or as directed by Project Manager.

E. Joints: Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

F. When new asphalt is laid against existing or old asphalt, saw cut existing or old asphalt to full depth to provide straight smooth joint.

G. In smaller restricted areas where use of paver is impractical spread material by hand. Compact asphalt by mechanical means. Carefully place materials to avoid segregation of mix. Do not broadcast material. Remove lumps that do not break down readily.

3.04 COMPACTION

A. Construct test strip to identify correct type, number, and sequence of rollers necessary to obtain specified in-place density or air-voids when directed by the Project Manager. Prepare test strip at least 1,000 feet in length, comparable to placement and compaction conditions for Project.

B. Begin rolling while pavement is still hot and as soon as it will bear roller without shoving, displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water or petroleum by-products.

C. Compact surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing a minimum of 8 tons. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length.
Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mat temperature drops below 185°F.

D. Use tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.

E. Along walls, curbs, headers and similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

F. Compact binder course and surface course to a minimum density of 91 percent of maximum possible density of voidless mixture composed of same materials in like proportions.

3.05 TOLERANCES

A. Furnish templates for checking surface in finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/8 inch.

B. Completed surface, when tested with 10 foot straightedge laid parallel to center line of pavement, shall show no deviation in excess of 1/8 inch in 10 feet. Correct surface not meeting this requirement.

C. Dimensions of speed humps shall conform to details for speed hump design and speed hump height tolerances.

3.06 QUALITY CONTROL

A. Testing will be performed under provisions of Section 01454 - Testing Laboratory Services.

B. For in-place depth and density, take minimum of one core at random locations for each 1000 feet of single lane pavement. On a 2-lane pavement, take samples at random every 500 feet from alternating lanes. Take cores for parking lots every 500 square yards of base to determine in-place depth and density. If cul-de sac or streets are less than 500 feet, minimum of 2 cores (one per lane) will be procured. On small projects, take a minimum of two cores for each day’s placement. For first days placement and prior to coring, minimum of 5 nuclear gauge readings will be performed at each core location to establish correlation between nuclear gauge (wet density reading) and core (bulk density). This process will continue for each day’s placement until engineer determines that a good bias has been established for that nuclear gauge.

C. Determine in-place density in accordance with TxDOT Tex-207-F and Tex-227-F from cores or sections. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Project Manager. Average densities for each street placed in a single day to determine compliance.
D. Contractor may request three additional cores in vicinity of cores indicating nonconforming in-place depths or density at no additional cost to City. In-place depth and density at these locations shall be average of four cores.

E. Fill cores and density test sections with new compacted asphaltic concrete.

F. Speed humps: Measure dimensions of completed speed hump, before applying pavement markings, at locations shown on Speed Hump Height Measurement Worksheet. Complete one worksheet for each speed hump, and send completed worksheets to City of Houston, Department of Public Works and Engineering, Traffic Management and Maintenance Branch, P.O. Box 1562, Houston, Texas, 77251-1562.

3.07 NONCONFORMING PAVEMENT

A. Recompact and retest nonconforming street sections not meeting surface test requirements or having unacceptable surface texture. Patch asphalt pavement sections in accordance with procedures established by Asphalt Institute. Retesting is at no cost to the City.

B. Remove and replace areas of asphalt surface found deficient in thickness by more than 10 percent. Use new asphaltic surface of thickness shown on Drawings. Remove and replace areas of asphalt surface found deficient in average density.

C. Replace speed humps which do not conform to requirements of details, or which are rejected by Project Manager.

3.08 PROTECTION

A. Do not open pavement to traffic until completion of rolling and temperature has cooled to set asphaltic concrete surface, or as shown on Drawings.

B. Maintain asphalt pavement in good condition until completion of Work.

C. Repair defects immediately by replacing asphalt pavement to full depth.

3.09 PAVEMENT MARKINGS FOR SPEED HUMPS

A. Apply pavement markings to speed humps in conformance with dimensions shown on detail for speed hump design.

END OF SECTION
PART 1  GENERAL

1.01  SECTION INCLUDES

A. Prime coat for asphalt concrete paving

1.02  MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for prime coat under this Section. Include payment in unit price for material being primed.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03  SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed prime coat.

C. Submit report of recent calibration of distributor.

PART 2  PRODUCTS

2.01  CUTBACK ASPHALT

A. Provide moisture-free homogeneous material which will not foam when heated to 347 degrees F and which meets following requirements:

B. Asphalt material for prime coat shall be MC-30 or MC-70 and shall meet following requirements:
### CITY OF HOUSTON
### STANDARD SPECIFICATION
### PRIME COAT

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>TYPE - GRADE</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MC-30</td>
<td>MC-70</td>
<td>MC-30</td>
<td>MC-70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIN.</td>
<td>MAX.</td>
<td>MIN.</td>
<td>MAX.</td>
<td></td>
</tr>
<tr>
<td>Water, Percent</td>
<td>---</td>
<td>0.2</td>
<td>---</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Flash Point, T.O.C., °F</td>
<td>100</td>
<td>---</td>
<td>100</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Kinematic Viscosity at 140°F, cst</td>
<td>30</td>
<td>60</td>
<td>70</td>
<td>140</td>
<td></td>
</tr>
</tbody>
</table>

1. Distillate shall be as follows, expressed as percent by volume of total distillate to 680 degrees F:

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>TYPE-GRADE</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MC-30</td>
<td>MC-70</td>
<td>MC-30</td>
<td>MC-70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIN.</td>
<td>MAX.</td>
<td>MIN.</td>
<td>MAX.</td>
<td></td>
</tr>
<tr>
<td>to 437°F</td>
<td>---</td>
<td>25</td>
<td>---</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>to 500°F</td>
<td>40</td>
<td>70</td>
<td>20</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>to 600°F</td>
<td>75</td>
<td>93</td>
<td>65</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Residue from 680°F Distillation, Volume, Percent</td>
<td>50</td>
<td>---</td>
<td>55</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

2. Tests on Distillation Residue:

<table>
<thead>
<tr>
<th>TEST</th>
<th>TYPE-GRADE</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MC-30</td>
<td>MC-70</td>
<td>MC-30</td>
<td>MC-70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MIN.</td>
<td>MAX.</td>
<td>MIN.</td>
<td>MAX.</td>
<td></td>
</tr>
<tr>
<td>Penetration at 77°F, 100g, 5 sec.</td>
<td>120</td>
<td>250</td>
<td>120</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Ductility at 77°F, 5 cm/min. cms</td>
<td>100*</td>
<td>---</td>
<td>100*</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Solubility in Trichloroethylene, %</td>
<td>99</td>
<td>---</td>
<td>99</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Spot Test</td>
<td>All Negative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* If penetration of residue is more than 200 and ductility at 77 degrees F is less than 100 cm, material will be acceptable when its ductility at 60 degrees F is more than 100.

2.02 EMULSIFIED PETROLEUM RESIN
A. EPR-1 Prime: Slow curing emulsion of petroleum resin and asphalt cement conforming to following requirements:

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>MIN.</th>
<th>MAX.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fural Viscosity at 77°F, Sec</td>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td>Residue by Evaporation, % by Weight</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>-</td>
<td>0.1</td>
</tr>
<tr>
<td>Particle Charge Test</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Tests on Distillation Residue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash Point, COC (F)</td>
<td>400</td>
<td>-</td>
</tr>
<tr>
<td>Kinematic Viscosity @ 140 F (cst)</td>
<td>190</td>
<td>350</td>
</tr>
</tbody>
</table>

B. For use, EPR-1 may be diluted with water up to maximum three parts water to one part EPR-1 in order to achieve desired concentration of residual resin/asphalt to facilitate application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify base is ready to support imposed loads.

B. Verify lines and grades are correct.

3.02 PREPARATION

A. Thoroughly clean base course surface of loose material by brooming prior to application of tack coat.

B. Prepare sufficient base in advance of paving for efficient operations.

3.03 APPLICATION, BASIC

A. Apply prime coat with approved type of self-propelled pressure distributor. Distribute prime coat evenly and smoothly under pressure necessary for proper distribution.

B. Keep storage tanks, piping, retorts, booster tanks, and distributors used in handling asphalt materials clean and in good operating condition. Conduct operations so asphalt material does not become contaminated.

C. If yield of asphaltic material appears to be in error, recalibrate distributor prior to continuing Work.
D. Maintain surface until Work is accepted by City.

3.04 APPLICATION, CUTBACK ASPHALT

A. Do not use cutback asphalt during period of April 16 through September 15.

B. Do not place prime coat when air temperature is below 60 degrees F and falling. Materials may be placed when air temperature taken in shade and away from artificial heat is above 50 degrees F and rising.

C. Distribute at rate of 0.25 to 0.35 gallons per square yard.

D. Equipment shall accurately determine temperature of asphaltic material in heating equipment and in distributor, for determining rate of application, and for obtaining uniformity at junction of two distributor loads. Maintain in accurate working order, including recording thermometer at storage heating unit.

E. Base temperature of application on temperature-viscosity relationship that will permit application of asphalt with viscosity of 100 to 125 centistokes. Maintain asphalt within 15 degrees F of temperature required to meet viscosity. Selected temperature shall be within following range.

<table>
<thead>
<tr>
<th>Prime Coat Type</th>
<th>Minimum (EF)</th>
<th>Maximum (EF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC-30</td>
<td>70</td>
<td>150</td>
</tr>
<tr>
<td>MC-70</td>
<td>125</td>
<td>175</td>
</tr>
</tbody>
</table>

F. Do not allow temperature of MC-30 to exceed 175 degrees F.

G. Do not allow temperature of MC-70 to exceed 200 degrees F.

3.05 APPLICATION, EMULSIFIED PETROLEUM RESIN

A. Do not place prime coat when air temperature is below 36 degrees F and falling.

B. Distribute at rate of 0.15 to 0.25 gallons per square yard.

3.06 PROTECTION

A. Prevent traffic or placement of subsequent courses over freshly applied prime coat until authorized by Project Manager.

END OF SECTION
PART 1    G E N E R A L

1.01    SECTION INCLUDES

A. Tack coat for asphalt concrete paving.

1.02    MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for tack coat under this Section. Include payment in unit price for asphalitic pavements.

2. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03    REFERENCES

A. ASTM D 244 - Standard Test Methods for Emulsified Asphalts.

1.04    SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit product data for proposed tack coat.

C. Submit report of recent calibration of distributor.

PART 2    P R O D U C T S

2.01    EMULSION

A. Provide homogeneous material which shows no separation of asphalt after mixing and meets viscosity requirements within 30 days after delivery.

B. Emulsion material for tack coat.
1. Emulsified asphalt: SS-1 or SS-1h meeting following criteria:

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>SS-1</th>
<th>SS-1h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN.</td>
<td>MAX.</td>
</tr>
<tr>
<td>Furol Viscosity at 77°F, sec.</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>60</td>
<td>--</td>
</tr>
<tr>
<td>Oil Portion of Distillate, %</td>
<td>--</td>
<td>1/2</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>--</td>
<td>0.10</td>
</tr>
<tr>
<td>Miscibility (Standard Test)</td>
<td></td>
<td>Passing</td>
</tr>
<tr>
<td>Cement Mixing, %</td>
<td>--</td>
<td>2.0</td>
</tr>
<tr>
<td>Storage Stability, 1 Day, %</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>Test on Residue:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penetration at 77°F, 100g, 5 sec.</td>
<td>120</td>
<td>160</td>
</tr>
<tr>
<td>Solubility in Trichloroethylene, %</td>
<td>97.5</td>
<td>--</td>
</tr>
<tr>
<td>Ductility at 77°F, 5 cm/min., cms</td>
<td>100</td>
<td>--</td>
</tr>
</tbody>
</table>

2. Polymer Modified Emulsion, SS-1P, for use where thin overlays (less than or equal to 2 inches) are placed on collector or arterial streets and for speed humps, especially over existing Portland cement concrete pavement.

<table>
<thead>
<tr>
<th>PROPERTIES</th>
<th>SS-1P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN.</td>
</tr>
<tr>
<td>Furol Viscosity at 77 F, sec.</td>
<td>30</td>
</tr>
<tr>
<td>Residue by Distillation, %</td>
<td>60</td>
</tr>
<tr>
<td>Oil Portion of Distillate, %</td>
<td>--</td>
</tr>
<tr>
<td>Sieve Test, %</td>
<td>--</td>
</tr>
<tr>
<td>Miscibility (Standard Test)</td>
<td></td>
</tr>
<tr>
<td>Cement Mixing, %</td>
<td>--</td>
</tr>
<tr>
<td>Storage Stability, 1 Day, %</td>
<td>--</td>
</tr>
<tr>
<td>Test on Residue:</td>
<td></td>
</tr>
<tr>
<td>Penetration at 77°F, 100g, 5 sec.; Solubility in Trichloroethylene, %</td>
<td>100</td>
</tr>
<tr>
<td>Ductility at 77°F, 5 cm/min., cms; Viscosity at 140 F, poises</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>1300</td>
</tr>
</tbody>
</table>

3. For emulsions used for tack coats during period of April 16 through September 15,
volatile organic compound solvents (VOC) shall not exceed 12 percent by weight when tested in accordance with ASTM D 244.

PART 3   E X E C U T I O N

3.01   EXAMINATION
   A. Verify compacted base is ready to support imposed loads.
   B. Verify lines and grades are correct.

3.02   PREPARATION
   A. Thoroughly clean base course or concrete surface of loose material by brooming prior to tack coat application.

3.03   APPLICATION
   A. Apply tack coat uniformly by use of approved distributor at rate not to exceed 0.05 gallons per square yard of surface depending on texture of underlying surface. Select an application rate that will provide appropriate asphalt residual.
   B. Paint contact surfaces of curbs, structures, and joints with thin uniform coat of tack coat.

3.04   PROTECTION
   A. Prevent traffic or placement of subsequent courses over freshly applied tack coat until authorized by Project Manager.

END OF SECTION
Part 1 - General

1.01 Section Includes

A. Seeding, fertilizing, mulching, and maintenance of areas indicated on Drawings.

1.02 Measurement and Payment

A. Unit Prices.

1. Payment for hydro mulch seeding is on an acre basis, within limits of construction if shown on the drawings.

2. No payment will be made for hydro mulch seeding under this Section if limits of constructions are not shown on the drawings. Include payment in Section 01740 – Site Restoration.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 Submittals

A. Conform to requirements of Section 01330 - Submittal Procedures.

B. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.

C. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

Part 2 - Products

2.01 Materials

A. Topsoil: Conform to material requirements of Section 02911 - Topsoil.
B. Seed: Conform to U.S. Department of Agriculture rules and regulations of Federal Seed Act and Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.

2. Bermuda: Extra-fancy, treated, lawn type common bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.

3. Wet, moldy, or otherwise damaged seed will not be accepted.

4. Seed requirements, application rates, and planting dates are:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>APPLICATION RATE</th>
<th>PLANTING DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hullled Common Bermuda Grass 98/88</td>
<td>40</td>
<td>Jan 1 to Mar 31</td>
</tr>
<tr>
<td>Unhulled Common Bermuda Grass 98/88</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Hullled Common Bermuda Grass 98/88</td>
<td>40</td>
<td>Apr 1 to Sep 30</td>
</tr>
<tr>
<td>Unhulled Common Bermuda Grass 98/88</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Annual Rye Grass (Gulf)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

C. Fertilizer: Dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers which bear manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of following elements:

1. Nitrogen: 10 Percent
2. Phosphoric Acid: 20 Percent
3. Potash: 10 Percent

D. Mulch:

1. Virgin wood cellulose fibers from whole wood chips having minimum of 20 percent fibers 0.42 inches in length and 0.01 inches in diameter.

2. Cellulose fibers manufactured from recycled newspaper and meeting same fiber content and size as for cellulose fibers from wood chips.

02921-2
01/01/2011
3. Dye mulch green for coverage verification purposes.

E. Soil Stabilizer: "Terra Tack 1" or approved equal.

F. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

PART 3  E X E C U T I O N

3.01 PREPARATION

A. Place and compact topsoil in accordance with requirements of Section 02911 - Topsoil.

B. Dispose of Objectionable and Waste Materials in accordance with Section 01576 - Waste Material Disposal.

3.02 APPLICATION

A. Seed: Apply uniformly at rates given in Paragraph 2.01 B for type of seed and planting date.

B. Fertilizer: Apply uniformly at rate of 500 pounds per acre.

C. Mulch: Apply uniformly at rate of 50 pounds per 1000 square feet.

D. Soil Stabilizer: Apply uniformly at rate of 40 pounds per acre.

E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydro mulching.

F. Sod: Lay single row of sod along perimeter where top soil and pavement intersect. Apply in conformance to Section 02922 - Sodding.

G. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Project Manager approval before resuming operations.

3.03 MAINTENANCE

A. Maintain grassed areas minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in fall, continue maintenance following spring until acceptable lawn is established.

B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.

C. Repair areas damaged by erosion by regrading, rolling and replanting.
D. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydro mulch.

E. Mow grass when height reaches 3 1/2 inches or greater on average before final acceptance. Mow to height of 2 1/2 inches.

END OF SECTION
Section 02922

SODDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Restoration of existing lawn areas disturbed by construction shall be by installation of new sod.

B. Planting of sod within areas designated on Drawings for purpose of surface stabilization, channel stabilization or vegetation buffer strips.

C. Sod is defined as blocks, squares, strips of turfgrass, and adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.

D. Lawn is defined as ground covered with fine textured grass kept neatly mowed.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for sodding is on square yard basis.

2. For utility construction, no separate payment will be made for sodding. Include payment in section 01740 under site restoration.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

1.03 SUBMITTALS

A. Conform to requirements of Section 01330 - Submittal Procedures.

1.04 QUALITY ASSURANCE

A. Sod only when weather and soil conditions are deemed by Project Manager to be suitable for proper placement.

B. Water and fertilize new sod.

C. Guarantee sod to be growing 30 days after substantial completion.
D. Maintenance Period:

1. Begin maintenance immediately after each section of grass sod is installed and continue for 30 day period from date of substantial completion.

2. Resod unacceptable areas.

3. Water, fertilize, control disease and insect pests, mow, edge, replace unacceptable materials, and perform other procedures consistent with good horticultural practice to ensure normal, vigorous and healthy growth. Install disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.

E. Notify Project Manager 10 days before end of maintenance period for inspection.

PART 2 PRODUCTS

2.01 SOD

A. Species: Bermuda (Cynodon Dactylon), Buffalo (Buchloe Dactyloides), or St. Augustine (Stenotaphrum Secundatum) Gulf Coast variety to match existing sod.

B. Contents: 95 percent permanent grass suitable to climate in which it is to be placed; not more than 5 percent weeds and undesirable grasses; good texture, free from obnoxious grasses, roots, stones and foreign materials.

C. Size: 12 inch wide strips, uniformly 2 inches thick with clean-cut edges.

D. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.

2.02 FERTILIZER

A. Available nutrient percentage by weight: 12 percent nitrogen, 4 percent phosphoric acid, and 8 percent potash; or 15 percent nitrogen, 5 percent phosphoric acid, and 10 percent potash.

2.03 WEED AND INSECT TREATMENT

A. Provide acceptable treatment to protect sod from weed and insect infestation. Submit treatment method to Project Manager for approval. Install insect and disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.
2.04 WATER

A. Potable, available on-site through Contractor's water trucks. Contractor may use City of Houston hydrants when water use is measured through Contractor's meter. Do not use private resident's water.

2.05 BANK SAND

A. Free of clay lumps, roots, grass, salt or other foreign material.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that soil placement and compaction have been satisfactorily completed. Verify that soil is within allowable range of moisture content.

B. Top soil shall be free of weeds and foreign material immediately before sodding.

C. Do not start work until conditions are satisfactory. Do not start work during inclement or impending inclement weather.

D. Rake areas to be sodded smooth, free from unsightly variations, bumps, ridges or depressions.

E. Spread 2 inch layer of bank sand over areas to be sodded prior to planting of sod.

F. Apply fertilizer at rate of 25 pounds per 1000 square feet. Apply after raking soil surface and not more than 48 hours prior to laying sod. Mix thoroughly into upper 2 inches of soil. Lightly water to aid in dissipation of fertilizer.

3.02 APPLICATION

A. Full Sodding: Lay sod with closely fitted joints leaving no voids and with ends of sod strips staggered. Lay sod within 24 hours of harvesting.

B. On slopes 2:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.

C. Prior to placing sod, on slopes 3:1 or where indicated, place Hold/Gro or Roll Lite or equal over topsoil. Securely anchor in place with posts sunk firmly into ground at maximum 16 feet on center along pitch of slope and equal to width of wire mesh horizontally across slopes.

D. After sod is laid, irrigate thoroughly to secure 6-inch minimum penetration into soil below sod.
E. Tamp and roll sod with approved equipment to eliminate minor irregularities and to form close contact with soil bed immediately after planting and watering. Submit type of tamping and rolling equipment to be used to Project Manager for approval, prior to construction.

3.03 MAINTENANCE

A. Watering:

1. Water lawn areas once a day with minimum 1/2 inch water for first 3 weeks after area is sodded.

2. After 3 week period, water twice a week with 3/4 inch of water each time unless comparable amount has been provided by rain.

3. Make weekly inspections to determine moisture content of soil unless soil is in frozen condition.

4. Water in afternoon or at night to enable soil to absorb maximum amount of water with minimum evaporation.

B. Mowing:

1. Mow sod at intervals which will keep grass height from exceeding 3 1/2 inches.

2. Set mower blades at 2 1/2 inches.

3. Do not remove more than one-half of grass leaf surface.

4. Mow sodded areas requiring mowing within 1 month after installation with light-weight rotary type mower. Mow sod only when dry and not in saturated or soft condition.

5. Remove grass clippings during or immediately after mowing.

C. Fertilizer and Pest Control:

1. Evenly spread fertilizer composite at rate of 40 pounds per 5000 square feet or as recommended by manufacturer. Do not place fertilizer until 2 weeks after placement of sod.

2. Restore bare or thin areas by topdressing with mix of 50 percent sharp sand and 50 percent sphagnum peat moss.

3. Apply mixture 1/4 to 1/2 inch thick.
4. Treat areas of heavy weed and insect infestation as recommended by treatment manufacturer.

D. Restrict all traffic from sodded areas until sod is established or for minimum 10 days during growing season. Use wood lath and plastic tape to cordon sodded areas. Maintain tape and lath throughout for minimum 30 days during growing season.

3.04 CLEANUP

A. During course of planting, remove excess and waste materials; keep lawn areas clean and take precautions to avoid damage to existing structures, plants, grass, and streets.

B. Remove barriers, signs, and other Contractor material and equipment from project site at termination of establishment period.

C. Dispose of unused materials and rubbish in accordance with Section 01576 - Waste Material Disposal.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repairing and replacing streets, highways, and other pavements as required per street cut ordinance that have been cut, broken, or damaged due to utility excavation.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for pavement repair and replacement for utility projects is on a square yard basis and includes surface and base materials as required per street cut ordinance.

2. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits in accordance with the street cut ordinance or otherwise shown on drawings.

3. Refer to Section 01270 - Measurement and Payment for other 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.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subgrade:

1. Provide backfill material as required by applicable excavation and fill sections (Sections 02315 through 02319) and Section 02330 - Embankment.

2. Provide material for stabilization as required by applicable portions of Section 02336 - Lime Stabilized Subgrade, Section 02337 - Lime/Fly-Ash Stabilized Subgrade, and Section 02338 - Portland Cement Stabilized Subgrade.

B. Base: Provide base material as required by applicable portions of Section 02711 - Hot Mix Asphaltic Base Course, Section 02712 - Cement Stabilized Base Course, and Section 02713 - Crushed Concrete Base Course.
C. Pavement: Provide paving materials as required by applicable portions of Section 02741 - Asphaltic Concrete Pavement, Section 02751 - Concrete Paving, Section 02754 - Concrete Driveways, and Section 02771 - Curb, Curb and Gutter, and Headers, and Section 02775 - Concrete Sidewalks.

PART 3 EXECUTION

3.01 PREPARATION

A. Notify City prior to commencement of excavation in pavement for which an Excavation in Public Way permits has been obtained. Follow directions contained in the permit.

B. Conform to requirement of Section 02221 - Removing Existing Pavements and Structures, for removals.

C. Saw cut pavement 18 inches wider than width of trench needed to install utilities unless otherwise indicated on Drawings.

D. When removing pavement to existing deformed metal strip (i.e. dummy joint), saw cut pavement minimum 2 inches deep on opposite side of deformed metal strip. Place saw joint far enough behind deformed metal strip to obtain continuously straight joint. Remove damaged portion of deformed metal strip as required to provide proper joint. Saw cut and remove metal strip before placement of new concrete pavement.

E. Protect edges of existing pavement to remain from damage during removals, utility placement, backfill, and paving operations. For concrete pavement, protect undisturbed subgrade that is to remain to support replacement slab.

F. Dowel in existing pavement where no reinforcement is found or is broken due to construction activities. Unless otherwise directed by Project Manager, provide No. 6 bars 24 inches long, drilled and embedded 8 inches into center of existing slab with 'PO-ROC’ epoxy grout or approved equal. Space dowels to match new pavement reinforcement spacing.

G. Provide transitional paving and earthwork as required to tie proposed pavement to existing pavement when unable to dowel new pavement into existing pavement.

3.02 INSTALLATION

A. Parking Areas, Service Drives, Driveways, and Sidewalks: Replace with material equal to or better than existing or as indicated on Drawings. Conform to applicable requirements of sections referenced in Paragraph 2.01, Materials.
B. Street Pavements and Curbs, Curbs and Gutters: Replace subgrade, base, and surface course with like materials or as indicated on Drawings and City of Houston Standard Detail 02951.01. Curbs and curbs and gutters shall match existing. Conform to requirements of sections referenced in Paragraph 2.01, Materials.

C. For concrete pavement, install size and length of reinforcing steel and pavement thickness indicated on Drawings and City of Houston Standard Detail 02751.01. Place types and spacing of joints to match existing or as indicated on Drawings.

D. Where existing pavement consists of concrete pavement with asphaltic surfacing, resurface with minimum 2 inch depth asphaltic pavement.

E. Repair state highway and county crossings in accordance with TxDOT permit or county requirements as appropriate and within 1 week after utility work is installed.

3.03 WASTE MATERIAL DISPOSAL

A. Dispose of waste material in accordance with requirements of Section 01576 - Waste Material Disposal.

3.04 PROTECTION

A. Maintain pavement in good condition until completion of Work.

B. Replace pavement damaged by Contractor's operations at no cost to City.

END OF SECTION
Section 02960

MILLING PAVEMENT

PART 1    G E N E R A L

1.01 SECTION INCLUDES

A. Milling of existing asphalt or concrete pavement surface as required for installation of speed humps or pavement overlay.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for removing existing pavement surface by milling is on a square yard basis. Separate pay items and measurements will be made for milling of asphalt surface or milling of concrete surface as applicable.

2. No separate payment under this section for milling associated with installation of speed humps. Payment for installation of speed humps including cost for milling of existing asphalt or concrete pavement shall be per Section 02741.

3. Refer to Section 01270 - Measurement and Payment for unit price procedures.

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

PART 2    P R O D U C T S

2.01 EQUIPMENT

A. For milling and installing of speed humps, the contractor shall use an appropriate type of milling machine to remove the existing asphalt or concrete surface as shown. The milling machine shall be capable of milling a minimum 18 inch wide path and also shall be able to turn in tight corners.

B. The teeth of the machine shall be capable of milling concrete or asphalt as appropriate. The equipment for removing the pavement surface shall be a power operated planing machine with a minimum six-foot cutting width. For detail work and for cutting widths less than six feet, equipment with less than six-foot cutting widths will be allowed. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment self-propelled
with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of cutting four inches of asphaltic concrete pavement, one inch of portland cement concrete pavement, or a combination of two inches of asphaltic concrete pavement and one half inch portland concrete pavement in one continuous operation.

C. The equipment shall be equipped with an approved automatic dual longitudinal grade control system and a transverse control system unless otherwise directed by the project manager. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including stringline, ski, mobile stringline, or matching shoe. The transverse controls shall have an automatic system for controlling cross slope at a given rate.

D. The grade reference used by the Contractor may be of any type approved by the project manager. Control points shall be established for the finished profile. These points shall be set at intervals not to exceed 50 feet. The Contractor shall set the grade reference from the control points. The grade reference shall have sufficient support so that the maximum deflection shall not exceed 1/16 inch between supports.

E. The machine shall have a manual system providing for uniformly varying the depth of cut while the machine is in motion, thereby making it possible to cut flush to all inlets, manholes, or other obstructions within the paved area. The speed of the machine shall be variable in order to leave the desired grid pattern.

F. The machine shall be equipped with integral loading and reclaiming devices to immediately remove material being cut from the surface of the roadway and discharge the cuttings into a truck, all in one operation. The machine shall be equipped with devices to control dust created by the cutting action.

G. Various machines may be permitted to make trail runs to demonstrate the capabilities of that machine. Any machine that is incapable of meeting the requirements of this Section, in the opinion of the project manager, will not be permitted.

H. A street sweeper equipped with a water tank, spray assembly to control dust, a pick-up broom, a gutter broom, and a dirt hopper shall be provided by the Contractor. The street sweeper shall be capable of removing cuttings and debris from the planed pavement. Other sweeping equipment may be provided in lieu of the street sweeper when approved by the project manager in writing.
I. The Contractor shall provide any other equipment and personnel necessary for proper operation of the planing machine, to minimize dust and to remove cuttings.

PART 3 EXECUTION

3.01 PREPARATION

A. The Contractor shall not mill roadway more than 7 calendar days prior to construction.

B. If Contractor does not install speed hump in the specified time, the City, without notice to the Contractor, may effect repairs to the milled area and deduct the cost of the expense incurred by the City for repair work from currently due or future invoiced amounts.

3.02 MILLING

A. The existing pavement to within 1 foot of the face of the curb shall be removed for a depth of one inch or otherwise designated or shown on drawing for milling of the existing pavement.

B. The pavement surface shall be removed for the length, depth and width and to the typical section shown on drawings. The planed surface shall provide a satisfactory riding surface free from gouges, continuous longitudinal grooves, ridges, oil film and other imperfections of workmanship and shall have a uniform textured appearance.

C. When removing an asphaltic concrete pavement from an underlying portland cement concrete pavement, all of the asphaltic concrete pavement shall be removed, leaving a uniform surface of portland cement concrete, unless otherwise directed by the project manager.

D. Any vertical or near vertical longitudinal face exceeding 1 ½ inches in height in the pavement surface open to traffic at the end of a work period shall be sloped a minimum of 1:1. Transverse faces that are present at the end of a work period shall be tapered in a manner acceptable to the project manager.

E. Loose portland cement concrete material from the operation shall be disposed of at sites obtained by the Contractor or otherwise approved by the project manager. All materials removed under this contract become the property of the Contractor. Contractor shall legally dispose of all such removed materials.
F. Pavement that is not removed by the planing machine adjacent to steep curbs, inlets, manholes or other obstructions shall be removed by other methods acceptable to the project manager.

G. The pavement and curb surfaces shall be swept with a street sweeper or other sweeping equipment to remove all debris leaving a clean and presentable condition.

H. Milling is required along the outside perimeter of the hump to the depth of one inch on both concrete and asphalt pavement. Mill the existing pavement to within one foot of the curb face.

3.03 PROTECTION

A. Damage to water valve, water meters, manholes, curbs or other improvements shall be repaired or replaced at no additional cost to the City.

3.04 SURFACE TEXTURE AND TESTS

A. In areas where traffic will be permitted, the texture product shall be a grid pattern or any other pattern with discontinuous longitudinal striations that will provide, in the opinion of the project manager, a satisfactory temporary riding surface.

B. The surface of the pavement, after planing, shall be ready for HMAC overlay and shall be true to the established line, grade and cross section. The pavement surface, when tested with a 10-foot straightedge placed parallel to the centerline of the roadway or tested by other equivalent or acceptable means, shall not have any deviation greater than 1/8 inch in 10 feet. The deviations shall be measured from the top of the texture. Any point in the surface not meeting this requirement shall be corrected as directed by the project manager at the Contractor’s expense.

END OF SECTION