

**CITY OF WARWICK, RHODE ISLAND
WARWICK SEWER AUTHORITY
BAYSIDE SEWER SYSTEM PRESSURE SEWER
CONTRACT 86B
ADDENDUM NO. 7**

February 7, 2020

The following information is provided as part of the Contract Documents as Addendum No. 7.

The project bid date has been changed.

The Warwick Sewer Authority will receive Bids until 1:00 p.m. prevailing time on the 21st day of February 2020 at the office of the Warwick Sewer Authority, 125 Arthur W. Devine Boulevard, Warwick Rhode Island.

CONTRACT SPECIFICATIONS

1. Delete Section 00010 - Table of Contents and replace with the enclosed Section 00010 – Table of Contents (Addendum No. 7). The document includes additional changes and all prior addenda changes.

2. Delete Section 00300 Bid Forms (Addendum No. 5) and replace with the enclosed Section 00300 (Addendum No. 7). The document includes additional changes and all prior addenda changes.

The Bid Forms have been modified to provide an Alternate. The following describes the Base Bid and Alternate 1.

Base Bid

Service connections will be installed by trenchless technologies within all areas where the mainline sewer is designated to be installed by trenchless technologies. Service connections will be installed by open-cut methods to the property line within all areas where the mainline sewer is designated to be installed by open-cut methods.

Alternate 1

All service connections for the project will be installed by trenchless technologies.

3. Delete Section 01025 Measurement and Payment and replace with the enclosed Section 01025 (Addendum No. 7). The document includes additional changes and all prior addenda changes.

4. Delete Section 05500 Sanitary Sewer - Open Excavation and replace with the enclosed Section 05500 Sanitary Sewer (Addendum No. 7). The document includes additional changes and all prior addenda changes.
5. Delete Section 05610 Sanitary Sewer – Trenchless Technologies and replace with the enclosed Section 05610 Sanitary Sewer (Addendum No. 7). The document includes additional changes and all prior addenda changes.
6. Add Section 05810 Auger Boring – Trenchless Installation (Addendum No. 7).
7. Add Section 05811 Pilot Tube – Trenchless Installation (Addendum No. 7).
8. Delete Section 05812 Horizontal Directional Drilling – and replace with the enclosed Section 05812 Horizontal Directional Drilling (Addendum No. 7). The document includes additional changes and all prior addenda changes.

CONTRACT PLANS

1. Plan Sheet No. 58, Details – 1, Delete and replace with the attached Plan.
2. Plan Sheet No. 63, Details – 6, Delete and replace with the attached Plan.

CLARIFICATIONS

1. The statements provided in prior addendums shall be deleted and revised as follows.

Delete

Addendum 4

Comment 20: On the Details Page 3, in the notes it states that the minimum bury depth for water pipe is 5'. Is it also 5' for installing the pipe for sewer force main?

Response 20: The minimum depth for installing sewer force main is 5 feet. However, force main placement must meet the requirements for "PLACEMENT OF SEWERS" provided on Sheet 57 of 75.

Addendum 5

2. Sewer service connections to dwellings shall be terminated at the locations indicated on the plan or as directed by the WSA at a depth of 6 +/- feet. Contractor shall stake the termination point for location by the WSA. All work to install the service connection shall be performed within the roadway. Work on private property will not be permitted without permission of the Warwick Sewer Authority.

Add

1. *The minimum depth for installing mainline sewer pressure main is 5 feet. The preferred minimum depth for installing service connections is 5 feet. The depth for service connections may vary as required to facilitate trenchless operations and to avoid utilities as approved by the Engineer. Sewer force main placement should generally conform to the requirements for "PLACEMENT OF SEWERS" provided on Sheet No. 57 of 75. Variations will be reviewed on a case by case basis.*
 2. *Sewer service connections to dwellings shall be terminated at the locations indicated on the plan or as directed by the Engineer. Contractor shall stake the termination point for location by the Engineer. All work to install the service connection shall be performed within the City right-of-way, reference Detail Sheet No. 6. Work on private property will not be permitted without permission of the Warwick Sewer Authority.*
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2. The Contract Documents include trenchless technologies for the installation of low pressure sewer mains, laterals and services and are not meant to be exclusive. Trenchless methods are to be determined by the Contractor based on Contractor's means and methods that will meet the performance requirements and conditions as shown on the drawings and specified herein.

SECTION 00010

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WARWICK SEWER AUTHORITY
CONTRACT NO. 86B
BAYSIDE SEWER SYSTEM
PRESSURE SEWERS

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APPENDICIES

Appendix A Geotechnical Report & Boring Logs
 Appendix B R.I. Coastal Resources Management Council Permit
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END OF SECTION

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SECTION 00300

BID FORMS

TO: WARWICK SEWER AUTHORITY
125 Arthur W. Devine Boulevard Warwick, RI 02886
BID FOR: Contract No. 86B – Bayside Sewer System, Pressure Sewers

The undersigned BIDDER, having read and examined the Specifications and associated Contract Documents for the above-designated Work, does hereby propose to perform the Work and provide the services set forth in this Bid. All prices stated herein are firm and shall not be subject to escalation provided this Bid is accepted within one hundred twenty (120) days after the time set for receipt of Bids.

The BIDDER, in compliance with the Invitation for Bid for Contract No. 86B Bayside Sewer System in the City of Warwick, Rhode Island, having examined the Drawings and Specifications with related documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of materials and labor, hereby proposes to furnish all labor, materials, supplies, supervision and anything else required or necessary in order to construct the Project in accordance with the Contract Documents within 730 calendar days from the “Notice to Proceed” and in accordance with the prices stated in the Schedule of Bid Items.

This Base Bid is accordingly submitted in the sum of

_____ Dollars
(Written in Words)
(\$ _____)
(Numerical)

The Alternate 1 Bid is accordingly submitted in the sum of

_____ Dollars
(Written in Words)
(\$ _____)
(Numerical)

The Total of the Base Bid and Alternate 1 Bid are accordingly submitted in the sum of

_____ Dollars
(Written in Words)
(\$ _____)
(Numerical)

for the Contract No. 86B Bayside Sewer System. These prices cover all costs of performing the Work required under the Contract Documents of which this Bid is a part.

BIDDER hereby agrees to commence work under this Contract on a date to be specified in a written "Notice to Proceed" by the Warwick Sewer Authority, and to fully complete the project within **730** calendar days of said notice, or as otherwise mutually agreed upon by the Warwick Sewer Authority and BIDDER. BIDDER further agrees to pay as liquidated damages, the sum of \$2,500.00 for each consecutive calendar Day thereafter until the Project is completed.

Upon receipt of written notice of the acceptance of this Bid, BIDDER shall execute the formal Contract attached within ten (10) calendar Days, and deliver surety Bonds and insurance certificates as required in the General Conditions. In the event the Contract and Bond are not executed within the time set forth above, the Bid Security attached in the sum of (10% of the Base Bid Price and Alternate 1 Bid)

_____ Dollars

(Written in Words)

(\$ _____)

(Numerical)

shall become the property of the Warwick Sewer Authority as liquidated damages for the delay and additional expense to the Warwick Sewer Authority caused thereby.

BIDDER acknowledges receipt of the following addenda:

- Addendum No. 1 December 23, 2020**
- Addendum No. 2 January 8, 2020**
- Addendum No. 3 January 14, 2020**
- Addendum No. 4 January 15, 2020**
- Addendum No. 5 January 24, 2020**
- Addendum No. 6 January 29, 2020**
- Addendum No. 7 February 7, 2020**

The undersigned hereby declares that the following list states any and all variations from and exceptions to the requirements of the Contract Documents and that, otherwise, it is the intent of this bid that the Work will be performed in strict accordance with the Contract Documents. If the BIDDER takes no exceptions, he/she shall write "None" in the space provided.

(Add additional pages as required)

The Owner reserves the right to reject any BID which includes variations from and exceptions to the requirements of the Contract Documents.

A.1 SCHEDULE OF BID ITEMS

SCHEDULE OF PRICES

Addendum No. 7

Item No.	Approx. Quantity	Unit Measure	Items w/Unit Bid Prices Written in Words	Unit Bid \$ Price	Amount \$ Bid
The Bidder agrees to perform all the construction work described in the CONTRACT DOCUMENTS, for the following unit and lump sum prices. BIDS shall include applicable fees.					
1	1	L.S.	Site Preparation and Mobilization		
			At _____	Per L.S. _____	_____
2	400	C.Y.	Rock Excavation (Open Cut Excavation)		
			At _____	Per C.Y. _____	_____
3	300	C.Y.	Rock Excavation (Trenchless - Open Cut Excavation)		
			At _____	Per C.Y. _____	_____
4	400	L.F.	Rock Excavation (Trenchless - Drilling - All Diameters)		
			At _____	Per L.F. _____	_____
5	1,050	C.Y.	Earth Excavation (Test Pits - Utilities)		
			At _____	Per C.Y. _____	_____
6	500	C.Y.	Earth Excavation - Unsuitable Materials		
			At _____	Per C.Y. _____	_____
7	150	DAYS	Earth Excavation - Archeological Investigations		
			At _____	Per Days. _____	_____
8	250	C.Y.	Additional Selected Material		
			At _____	Per C.Y. _____	_____
9	15	TON	Calcium Chloride		
			At _____	Per TON _____	_____
10	1,000	C.Y.	Additional Gravel Borrow		
			At _____	Per C.Y. _____	_____
11	10,250	L.F.	1 1/4" Pipe Open Cut Excavation - Service		
			At _____	Per L.F. _____	_____
12	10,500	L.F.	2" Pipe - Open Cut Excavation - Lateral		
			At _____	Per L.F. _____	_____
13	9,810	L.F.	3" Pipe - Open Cut Excavation - Lateral		
			At _____	Per L.F. _____	_____

SCHEDULE OF PRICES

Addendum No. 7

Item No.	Approx. Quantity	Unit Measure	Items w/Unit Bid Prices Written in Words	Unit Bid \$ Price	Amount \$ Bid
14	2,500	L.F.	4" Pipe - Open Cut Excavation - Lateral		
			At _____ Per L.F. _____		
15	1,120	L.F.	6" Pipe - Open Cut Excavation - Lateral		
			At _____ Per L.F. _____		
16	37,800	L.F.	1 1/4" Trenchless - Service		
			At _____ Per L.F. _____		
17	13,100	L.F.	2" Trenchless - Lateral		
			At _____ Per L.F. _____		
18	12,750	L.F.	3" Trenchless - Lateral		
			At _____ Per L.F. _____		
19	100	L.F.	4" Trenchless - Lateral		
			At _____ Per L.F. _____		
20	2,450	L.F.	6" Trenchless - Lateral		
			At _____ Per L.F. _____		
21	1,425	L.F.	8" Trenchless - Lateral		
			At _____ Per L.F. _____		
22	45	L.F.	16" Ductile Iron Gravity Sewer		
			At _____ Per L.F. _____		
23	1	EA.	Sewer Manhole (Gravity)		
			At _____ Per EA. _____		
24	26	EA.	Pressure Sewer Manhole - Open Cut Excavation - Main End Manhole		
			At _____ Per EA. _____		
25	28	EA.	Pressure Sewer Manhole - Open Cut Excavation - Junction / Intersection Cleanout		
			At _____ Per EA. _____		
26	20	EA.	Pressure Sewer Manhole - Open Cut Excavation - Bend Cleanout		
			At _____ Per EA. _____		
27	15	EA.	Pressure Sewer Manhole - Open Cut Excavation - Straight Cleanout		
			At _____ Per EA. _____		

SCHEDULE OF PRICES

Addendum No. 7

Item No.	Approx. Quantity	Unit Measure	Items w/Unit Bid Prices Written in Words	Unit Bid \$ Price	Amount \$ Bid
28	39	EA.	Trenchless - Type A - End Cleanout		
			At _____ Per EA. _____		
29	2	EA.	Trenchless - Type B - In Line Cleanout		
			At _____ Per EA. _____		
30	30	EA.	Trenchless - Type C - 3 Way / 4 Way Intersection Connection		
			At _____ Per EA. _____		
31	540	EA.	Trenchless - Type D - Service Connection		
			At _____ Per EA. _____		
32	10	EA.	Air Release Sewer Manhole (All Sizes)		
			At _____ Per EA. _____		
33	36,000	S.Y.	Remove Bituminous Surface by Cold Planing (Gutters)		
			At _____ Per S.Y. _____		
34	34,200	L.F.	2" Bituminous Pavement Patch Linear, HMA CL 9.5		
			At _____ Per L.F. _____		
35	5,250	S.Y.	2" Bituminous Pavement Patch, HMA CL 9.5		
			At _____ Per S.Y. _____		
36	15,450	TON	1-1/2" Permanent Pavement Overlay, HMA CL 9.5		
			At _____ Per TON _____		
37	1,500	TON	2" Permanent Pavement Overlay (Tidewater Drive), HMA		
			At _____ Per TON _____		
38	1,000	TON	2-1/2" Driveways & Sidewalks HMA CL 9.5 Surface Course		
			At _____ Per TON _____		
39	3,200	L.F.	Bituminous Berm RI STD 7.5.1.		
			At _____ Per L.F. _____		
40	13,340	L.F.	Saw-cutting Bituminous Concrete Driveways		
			At _____ Per L.F. _____		
41	25,920	L.F.	Saw-cutting Operation / Reception Pits / Trenchless Service		
			At _____ Per L.F. _____		

SCHEDULE OF PRICES

Addendum No. 7

Item No.	Approx. Quantity	Unit Measure	Items w/Unit Bid Prices Written in Words	Unit Bid \$ Price	Amount \$ Bid
42	200	C.Y.	Controlled Low Strength Concrete Material		
			At _____ Per C.Y. _____		
43	200	C.Y.	Miscellaneous Concrete		
			At _____ Per C.Y. _____		
44	2,700	L.F.	8" Compost Filter Sock		
			At _____ Per L.F. _____		
45	330	EA.	Silt Sack Protection		
			At _____ Per EA. _____		
46	500	S.Y.	4" Loam and Seed		
			At _____ Per S.Y. _____		
47	10	EA.	Precast Drainage Structures - All Depths		
			At _____ Per EA. _____		
48	500	L.F.	Remove and Dispose Drainage Pipe - All Sizes		
			At _____ Per L.F. _____		
49	10	EA.	Remove and Dispose Existing Drainage Structures - All Sizes		
			At _____ Per EA. _____		
50	400	L.F.	12" RCP Drainage Pipe		
			At _____ Per L.F. _____		
51	400	L.F.	12" D.I. Drainage Pipe		
			At _____ Per L.F. _____		
52	100	L.F.	18" RCP Drainage Pipe		
			At _____ Per L.F. _____		
53	100	L.F.	18" D.I. Drainage Pipe		
			At _____ Per L.F. _____		
54	200	L.F.	Remove and Reset Drainage Pipe - 12-inches or less - All Types		
			At _____ Per L.F. _____		
55	100	L.F.	Remove and Reset 18-inch Drainage Pipe - All Types		
			At _____ Per L.F. _____		

SCHEDULE OF PRICES

Addendum No. 7

Item No.	Approx. Quantity	Unit Measure	Items w/Unit Bid Prices Written in Words	Unit Bid \$ Price	Amount \$ Bid
56	50	L.F.	Remove and Reset 24-inch Drainage Pipe - All Types		
			At _____ Per L.F. _____		
57	28	EA.	Isolate and Reactivate Water Mains - Less Than 40 Feet		
			At _____ Per EA. _____		
58	28	EA.	Isolate and Reactivate Water Mains - 40 to 80 Feet		
			At _____ Per EA. _____		
59	1	Allowance	Overhead Utility House Services - Disconnect & Reactivate - All Types		
			At Two hundred thousand dollars	\$200,000	\$200,000
60	500	L.F.	6" PVC Water Pipe (Sewer Conflicts)		
			At _____ Per L.F. _____		
61	500	L.F.	8" PVC Water Pipe (Sewer Conflicts)		
			At _____ Per L.F. _____		
62	40	EA.	Water Service Connections		
			At _____ Per EA. _____		
63	8	EA.	6" Water Gate Valve		
			At _____ Per EA. _____		
64	8	EA.	8" Water Gate Valve		
			At _____ Per EA. _____		
65	1	EA.	Tapping Sleeve and Valve - All Sizes		
			At _____ Per EA. _____		
66	2	EA.	Fire Hydrants		
			At _____ Per EA. _____		
67	1	L.S.	Construction Road Signs		
			At _____ Per L.S. _____		
68	1	L.S.	Traffic Barrels w/Type A or Type C Light		
			At _____ Per L.S. _____		
69	1	L.S.	Traffic Barricades		
			At _____ Per L.S. _____		

SCHEDULE OF PRICES

Addendum No. 7

Item No.	Approx. Quantity	Unit Measure	Items w/Unit Bid Prices Written in Words	Unit Bid \$ Price	Amount \$ Bid
70	1	L.S.	Vibration Monitoring		
	At _____			Per L.S. _____	_____
70A	1	L.S.	Pre-Construction Survey		
	At _____			Per L.S. _____	_____
70B	1	L.S.	Post-Construction Survey		
	At _____			Per L.S. _____	_____
71	1	Allowance	Miscellaneous Utility Work (Allowance)		
	At	Two hundred thousand dollars		\$200,000	\$200,000
72	1	Allowance	Asbestos Containing Materials (Allowance)		
	At	One hundred thousand dollars		\$100,000	\$100,000
73	1	Allowance	Gas Main Relocation (Allowance)		
	At	One hundred thousand dollars		\$100,000	\$100,000
74	1	Allowance	Soil Compaction Testing (Allowance)		
	At	Twenty thousand dollars		\$20,000	\$20,000
75	1	Allowance	Tree Trimming (Allowance)		
	At	Twenty Five thousand dollars		\$25,000	\$25,000
76	1	Allowance	Police Protection Paid by Warwick Sewer Authority		
				\$0	\$0
77	950	EA.	Utility Location by Vacuum Excavator		
	At _____			Per Each _____	_____

TOTAL OF BASE BID (ITEMS 1 THROUGH 77): \$ _____
 (Figures)

The BIDDER agrees to perform the Work described in the Specifications and shown on the Drawings for the following lump sum or unit prices. All prices must be given in numerical figures and must be typewritten or printed legibly.

Due to the length and nature of this request, only the Total Bid Price will be read aloud at the Bid Opening. The prices for the individual items will not be read aloud, but following the Bid Opening, a Bid Abstract will be prepared, and it will be made available to all interested parties upon request.

TOTAL BASE BID PRICE (In Figures):

\$ _____

TOTAL ALTERNATE 1 (In Figures):

\$ _____

TOTAL BASE BID AND ALTERNATE 1 (In Figures):

\$ _____

Note: In case of error in the extension of prices, the unit price will govern.

The BIDDER warrants that it has available or under its control, labor, equipment, materials, and resources of the character and in the amount required to complete the proposed Work within the specified time.

A.2 ALTERNATES

The Warwick Sewer Authority reserves the right to include one or more alternates identified herein to/from the scope of the project; provided, however, that said alternates shall only be selected by the Warwick Sewer Authority in the order in which they are listed. Bidders are required to submit a bid price for each and every alternate. Failure to submit a bid price for each and every alternate will result in the entire proposal being deemed to be nonresponsive to the solicitation.

Alternates are listed in numerical sequence in order of Warwick Sewer Authority's priority. In determining the lowest responsive bid the awarding authority shall consider alternates in descending numerical sequence such that no individual alternate shall be considered until every alternate preceding it on the list has been added to the base bid price.

Bidder understands that the Warwick Sewer Authority reserves the right to reject any and all bids, and to waive any irregularities in the bidding and accept the bid, with or without alternates, as deemed to be in the best interest of the Warwick Sewer Authority.

The following describes the Base Bid and Alternate 1.

Base Bid

Sewer service connections will be installed by trenchless technologies within all areas where the mainline sewer is designated to be installed by trenchless technologies. Service connections will be installed by open-cut methods to the property line within all other areas where the mainline sewer is designated to be installed by open-cut methods.

Alternate 1

All service connections for the project will be installed by trenchless technologies.

A.3 **EXTRA WORK**

Payment for extra work, if any performed, shall be in accordance with Section 00700 – General Conditions of the Contract Documents, and shall be computed in one of the following methods:

- A. A lump sum agreed upon by the Contractor, the Warwick Sewer Authority, and the Engineer.
- B. The unit price proposed by the Contractor.
- C. Actual costs as defined by Section 00700 – General Conditions.

A.4 **ENGINEER'S ESTIMATE OF QUANTITIES**

Quantities are provided for informational purposes only for use by the BIDDERS in developing a total Bid price. BIDDERS are advised to develop their own material takeoff quantities from the Contract Documents.

A.5 **DECLARATION AND SIGNATURES**

The undersigned hereby declares that, in regard to all conditions affecting the Work to be done and the labor and materials required, this Bid is based on its investigations and findings, and the WARWICK SEWER AUTHORITY, their officers, agents and employees of the WARWICK SEWER AUTHORITY shall not in any manner be held responsible for the accuracy of, or be bound by, any estimates, borings, indications of borings, soils, rock, water, or underground conditions relative to the proposed Work indicated in this or in the other Contract Documents; that no warranty or representation has been made by the WARWICK SEWER AUTHORITY, its officers, agents and employees as to subsurface soil or rock conditions, groundwater conditions, or other underground and similar conditions.

A.6 BIDDER CONTRACTOR QUALIFICATIONS

The Bidder shall meet the minimum qualification requirements provided below.

A.6.1 Required Bidder Qualification Statement

The Bidder shall state below what works of a similar character to that of the proposed contract it has performed, and provide such references as will enable the Owner to judge its experience, skill, and business standing.

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, add separate sheets.

1. Name of Bidder.
2. Permanent Main Office address.
3. When organized?
4. Where incorporated?
5. Is bidder registered with the Secretary of the State to do business in Rhode Island?
6. For how many years has your firm engaged in the contracting business under its present name? Also state names and dates of previous firm names, if any.
7. Contracts on hand. (Schedule these, showing gross amount of each contract and the approximate anticipated dates of completion.)
8. General character of work performed by your company.
9. Have you ever failed to complete any work awarded you in the scheduled contract time, including approved time extensions? ___(Yes) ___(No).

If so, where and why?

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10. Have you ever defaulted on a contract? ___(Yes) ___(No).

If so, where and why?

11. Have you ever had liquidated damages assessed on a contract? ____ (Yes) ____ (No).

If so, where and why?

12. List the more important contracts recently executed by your company, stating approximate cost for each, and the month and year completed.

13. List your major equipment available for this contract.

14. List your key personnel such as Project Superintendent and foreman available for this contract.

15. With what banks do you conduct business?

Do you grant the Engineer permission to contact this (these) institutions? ___(Yes) ___(No)

NOTE: Bidders may be required to furnish their latest financial statement as part of the award process.

Projects of Similar Size and Complexity Demonstrating BIDDER possess Minimum BIDDER Qualifications

Project 1

Project Name: _____

Project Location: _____

Year Completed: _____

Construction Cost: _____

Owner and Contact Information: _____

Engineer and Contact Information: _____

Reference Contact Information: _____

Scope of Work: _____

Projects of Similar Size and Complexity Demonstrating BIDDER possess Minimum BIDDER Qualifications

Project 2

Project Name: _____

Project Location: _____

Year Completed: _____

Construction Cost: _____

Owner and Contact Information: _____

Engineer and Contact Information: _____

Reference Contact Information: _____

Scope of Work: _____

A.6.2 DIRECTIONAL DRILLING CONTRACTOR

The BIDDER or BIDDER's subcontractor shall either be chosen from the prequalified subcontractor list below or be qualified by meeting the minimum qualification requirements provided below.

Prequalified Subcontractor List

00300- 15

1. Directional Technologies, Inc. 77 N. Plains Industrial Road Wallingford, CT 06492 1-877-788-4479
2. S.J. Louis Construction 1351 Broadway St. W., PO Box 459 Rockville, MN 56369 (320) 253-9291

DIRECTIONAL DRILLING QUALIFICATIONS

I. Submission Requirements

In order to conduct a reasonable and efficient evaluation of the contractor, the WSA requires that firms prepare qualification statements which are clear and concise, and which follow the format outlined below.

1. **Cover Letter.** The respondent shall include a cover letter, signed by an individual authorized to submit information for the contractor. In the cover letter, the contractor must:
 - a. Certify that the information contained in the submittal is true and accurate.
 - b. Certify that the personnel for the horizontal directional drilling operations listed in their submittal will be directly involved with the project for its duration.
 - c. Disclose if the contractor or any member of its team is currently debarred from doing business with any governmental agency or is a party to any pending or current litigation which would adversely affect performance on the project.
 - d. Disclose if the firm or any member of the firm has filed for protection of US Bankruptcy court in the last 7 years. If yes, then describe the circumstances and evidence of the firm's ability to complete the project.
2. **Firm Background.** The HDD Contractor must be an established business with the experience, equipment and qualified personnel in the area of trenchless technology/horizontal directional drilling. Provide a general description of the firm, services provided, office locations, number and type of personnel involved in the providing the services offered, years in business. The firm must have a **minimum of 10 years providing horizontal directional drilling services.**
3. **Equipment, Condition, Size and Capacity.** The HDD Contractor must demonstrate they possess the necessary directional drilling and ancillary equipment of adequate size, capacity and condition to execute the project with consideration of existing /subsurface conditions. The Contractor shall provide a listing of the following:
 - a. Make, model, serial number, year manufactured, rated torque and thrust/pull capacity of HDD equipment owned or proposed to be acquired / rented by the Contractor.
 - b. Make, model, serial number, year manufactured, rated torque and thrust/pull capacity of HDD equipment of choice for use on this project.
 - c. Type, manufacturer, model and accuracy of tool detection/location/guidance systems.
 - d. Means for recording and information to be recorded detailing drilling history for as-built drawings and documentation.
4. **Personnel.** The HDD Contractor shall provide information on the capabilities and experience of the management, project staff, and field personnel anticipated to be assigned to the project (i.e. Project Manager, Site Superintendent, Crew Foreman, Directional Drilling Equipment Operators and other relevant staff). The Superintendent, Crew Foreman and directional drilling equipment operator(s) shall have **at least 3 years of experience using directional drilling**

equipment/installation techniques on at least 5 projects similar in size, scope and setting to the project described above. Provide a resume for each showing their name, title, including a detailed description of their role and job responsibilities, education, construction experience, years with the firm and a list of all the projects completed that they have had direct/indirect experience on similar projects of size and scope.

5. **Project Experience.** The HDD contractor must include a record of experience on 5 projects of similar size, scope and setting completed in the last 10 years. For each project, provide information on:
 - a. The project name and client
 - b. Description of the project
 - c. Scope of services provided
 - d. Pipe diameters, pipe material and lengths
 - e. HDD technology used
 - f. Problems encountered and how they were resolved
 - g. Any claims and how they were resolved.
 - h. The original and final contract sum
 - i. Start and completion dates
 - j. The owners name, address, telephone number and contact for project

6. **References.** Provide reference information for the following:
 - a. Project References
 - Provide the following reference information for each project listed under the project experience section.
 - Project Name
 - Name, address, telephone, and email of Owner
 - Name, address, telephone, and email of Owner's representative or Engineer
 - Name of Contact person, title, telephone and email for each

7. **Financial Stability.** The contractor must submit proof of their financial stability. This will include an audited financial statement for the most recent completed year, information demonstrating available bonding and a letter from the firm's banking institution indicating their line of credit available to cover project cash flow. The surety/bonding company must be licensed to do business in the State of Rhode Island. Any and all financial information requested and/or submitted shall be maintained as confidential upon request.

8. **Safety Record.** Provide a 3-year history of the Contractor's worker's compensation experience modifier rating and documentation from their insurance carrier supporting the rating history provided.

9. **Insurance.** The Contractor should demonstrate that they maintain adequate insurance coverage and provide evidence of such coverages.

BIDDER certifies that materials and means and methods used to construct above projects are similar in nature to the Work of this Contract.

Respectfully submitted,

_____ Date _____
Name of Company*

By _____
(Signature) (Printed or Typed)

Title _____

Business Address _____

SEAL

(Seal if Bid is by a Corporation)

*Note: Insert BIDDER'S name. If a corporation, give the state of incorporation, using the phrase "A corporation organized under the laws of _____, composed of officers as follows:

Further, be advised that _____, who serves as _____ of this company, is duly authorized to enter into any resulting contract with the OWNER.

President

Vice President

Secretary

Treasurer

END OF SECTION

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.1 MEASUREMENT AND PAYMENT

- A. All Work performed as described in these Contract Documents will be paid for under one or more of the items listed in the Schedule of Bid Items. All other activities required in connection with performance of the Work, including all Work required under Division 1 – General Requirements, whether described in the Contract Documents or mandated by applicable codes, permits and laws, will not be separately paid for unless specifically provided for in the form of general bid, but will be considered incidental to performance of the overall Project and deemed to be included in the various bid items listed in the Schedule of Bid Items.
- B. Each unit or lump sum price stated in the Schedule of Bid Items shall constitute full compensation as herein specified for each item of Work completed in accordance with the Drawings and Specifications.
- C. Contractor shall make its own estimate of the quantities necessary to complete the Work.
- D. The payment items listed herein and in the Schedule of Bid Items are intended to provide full payment for the Work shown on the Drawings and specified herein. Any Work called for or inferred in the documents but not listed as a payment item shall be considered incidental to the overall Project.
- E. It is the intent of these Specifications to provide all labor, equipment, materials, supplies, temporary facilities, incidentals, and appurtenances to satisfactorily complete the Work of this Contract.
- F. Partial payment for lump sum items will be made based upon the percentage of Work complete in accordance with the schedule of values as estimated by Contractor and verified and approved by Engineer under each individual item to date. Partial payment for unit price items will be made based upon the Contractor's estimated quantity completed to date, and verified by Engineer, for items listed in the schedule of values.
- G. Contractor shall coordinate all quantity surveys with the Engineer, so that Engineer may conduct its own quantity survey for verification purposes. Discrepancies in the quantities estimated by Contractor and Engineer shall be resolved prior to modifying the site surface.
- H. Allowances have been included on the Bid Price Form for work that cannot be sufficiently quantified and must be completed by a specific third party, the services of which are arranged and provided by the Contractor. Measurement for these services will be the invoice amounts paid by the Contractor for work authorized and directed by the Engineer. No Contractor markup will be

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applied to these costs. Payment will constitute full compensation for work and costs associated with reimbursable payments to third parties.

1.2 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

- A. The methods of measurement and basis of payment for the Payment Items listed above are specified in the following section.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
1	Site Preparation and Mobilization	Lump Sum

Measurement: The work of this section shall be measured on a lump sum basis. The work consists of the performance of actions that are required to clear and prepare the site for subsequent construction operations and those efforts necessary for the movement of Contractor's personnel and equipment to the project site and for the establishment of all the Contractor's field offices, buildings, and facilities required for the performance of the Contract, and other incidentals not paid elsewhere in the contract.

Payment: Site Preparation and Mobilization will be paid for at the contract lump sum price listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment and other incidentals required to establish site preparation, Contractor's facilities at the site and at the conclusion of the contract, for complete removal thereof.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
2	Rock Excavation (Open Cut Excavation)	Cubic Yard (CY)

Measurement: Rock excavation for open cut trench installation will be measured on a volume basis as computed from the area in its original position. The volume will be determined by differencing the area to be excavated from its original position before excavation is begun to the design subgrade after excavation is completed. Rock excavation for open cut excavations will consist of the removal of intact bedrock and boulders or detached bedrock fragments which have a minimum volume of 1 cubic yard.

Payment: The accepted quantity of Rock excavation for open cut trench removal will be paid for at the contract unit price per cubic yard as listed in the Proposal. The payable quantity will be the number of cubic yards of ledge rock or boulders drilled and mechanically split, or split by hand, as measured before excavation, that would have been removed if the excavation had been made everywhere to a depth of 6 inches below the underside of the pipe or masonry and to a width of 27 inches greater than the outside dimensions of said pipe or masonry on each side. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including excavation within the prescribe limits of the work, formation of embankments, grading, compaction, disposal of surplus materials, preparation of subgrade, and all other incidentals required to finish the work complete and accepted by the Engineer.

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<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
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3	Rock Excavation (Trenchless - Open Cut Excavation)	Cubic Yard (CY)
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Measurement: Rock excavation to facilitate trenchless technologies will be measured on a volume basis as computed from the area in its original position. Trenchless technology rock excavation will include excavations for operation and reception pits, and for rock removal required to retrieve or facilitate drilling runs using open cut excavation. Rock excavation for trenchless open cut excavations will consist of the removal of intact bedrock and boulders or detached bedrock fragments which have a minimum volume of 1 cubic yard.

Payment: The accepted quantity of Rock Excavation for trenchless open cut removal will be paid for at the contract unit price per cubic yard as listed in the Proposal. The payable quantity will be the number of cubic yards of ledge rock or boulders drilled and mechanically split, or split by hand, as measured before excavation, that would have been removed if the excavation had been made everywhere. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including excavation within the prescribed limits of the work, formation of embankments, grading, removal of bituminous pavement, compaction, disposal of surplus materials, preparation of subgrade, and all other incidentals required to finish the work complete and accepted by the Engineer.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
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4	Rock Excavation (Trenchless – Drilling – All Diameters)	Linear Foot (LF)
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Measurement: Rock excavation to facilitate drilling through boulders or ledge rock encountered during operations will be measured in linear feet of continuous run.

Payment: The accepted quantity for rock drilling via trenchless technologies will be paid for at the contract unit price per linear foot for all pipe size diameters as listed in the Proposal. The linear foot price shall be the additional premium cost to facilitate drilling through boulders or ledge rock. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including all other incidentals required to finish the work complete and accepted by the Engineer.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
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5	Earth Excavation (Test Pits - Utilities)	Cubic Yard (CY)
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Measurement: Earth excavation performed to locate existing utilities or to determine subsurface soil conditions will be measured on a volume basis as computed from the area in its original position. The volume will be determined by differencing the area to be excavated from its original position before excavation is begun to the design subgrade after excavation is completed.

Payment: The accepted quantity of Earth Excavation for test pits for utility exploration will be paid for at the contract unit price per cubic yard as listed in the Proposal. The payable quantity will be the number of cubic yards of material excavated. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including excavation within the prescribe limits of the work, backfill of material, grading, compaction, disposal of surplus materials, preparation of subgrade, and all other incidentals required to finish the work complete and accepted by the Engineer.

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<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
6	Earth Excavation (Unsuitable Materials)	Cubic Yard (CY)

Measurement: Earth excavation performed to remove unsuitable soils which due to their consolidation properties, degree of saturation, gradation, organic content or other deleterious characteristics will not provide a stable subgrade or foundation or cannot be placed and compacted as backfill will be measured on a volume basis as computed from the area in its original position. The volume will be determined by differencing the area to be excavated from its original position before excavation is begun to the design subgrade after excavation is completed.

Payment: The accepted quantity of Earth Excavation to remove unsuitable soil will be paid for at the contract unit price per cubic yard as listed in the Proposal. The payable quantity will be the number of cubic yards of material excavated. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including excavation within the prescribe limits of the work, dewatering, disposal of materials, preparation of subgrade, and all other incidentals required to finish the work complete and accepted by the Engineer. Backfill to replace unsuitable materials will be paid for separately.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
7	Earth Excavation (Archeological Investigations)	Days

Measurement: Earth excavation for archeological investigations will be measured on a day rate for work performed. The work will include providing a backhoe with a flat blade bucket, dump truck, backhoe operator, dump truck, driver, and laborer. Earth excavations for archeological investigation will be performed as required to facilitate the placement of additional operation or reception pits, to support additional excavation within areas not previously approved by archeological investigations.

Payment: The accepted quantity of Earth Excavation for archeological investigations will be paid for at the contract unit price per day as listed in the Proposal. The payable quantity will be the number of days work is performed. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, saw-cutting bituminous pavement, including excavation within the prescribe limits of the work, disposal of bituminous pavement and materials, preparation of subgrade, and all other incidentals required to finish the work complete and accepted by the Engineer.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
8	Additional Select Material	Cubic Yard (CY)

Measurement: Additional select material will be measured by the number of cubic yards actually placed. Additional select material shall be placed as directed by the Engineer as needed to facilitate construction operations. The material will be commercial grade crushed stone or filter stone in accordance the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction. All stone shall be suitably graded from the smallest to the largest particles; it shall be clean, hard, durable and free from dust, loam, clay or organic matter.

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Payment: The accepted quantity of additional select material will be paid for at the contract unit price per cubic yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, and all other incidentals, including trimming and fine grading required to finish the work, and complete and accepted by the Owner. Selected material required to fill unauthorized excavations will not be paid for separately, but will be provided at the Contractor's expense.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
9	Calcium Chloride Dust Control	Tons (TON)

Measurement: Calcium Chloride for Dust Control will be measured by the number of tons actually applied as directed by the Owner and as needed to conform to the soil erosion and sediment control plan. The material shall conform to the latest ASTM Specifications. The Owner may allow the weights as printed on the shipping contained to constitute the official measure, otherwise the contractor shall provide scales to weight the material at no additional cost to the Owner.

Payment: The accepted quantity of calcium chloride for dust control will be paid for at the contract unit price per ton as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment, and all other incidentals, required to finish the work, complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
10	Additional Gravel Borrow	Cubic Yard (CY)

Measurement: Additional gravel borrow material will be measured by the number of cubic yards actually placed. Additional gravel borrow material shall be placed as directed by the Engineer as needed to facilitate construction operations.

Payment: The accepted quantity of additional select material will be paid for at the contract unit price per cubic yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, and all other incidentals, including trimming and fine grading required to finish the work, and complete and accepted by the Owner. Gravel borrow used as a subbase course for temporary and permanent pavement patch and for pipe bedding will not be paid for separately, but is included for payment under the appropriate pipe and pavement items.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
11, 12, 13, 14, 15	Pressure Sewer Pipe (All Sizes) Laterals – Open Cut Excavation	Linear Foot (LF)

Measurement: Pressure sewer pipe installed by open cut excavations of the various types and sizes indicated on the Plans will be measured in linear feet of continuous runs of such sewers actually installed in accordance with the Plans and/or as directed by the Owner. Deductions will not be made for the pipe length, inside diameter, of manholes.

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Payment: The accepted quantity for pressure sewer pipe, laterals and services, installed by open cut excavation will be paid for at the contract unit price per linear foot for the various pipe sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the pipe complete and in place. The work will include furnishing all pipes, plugs, excavation, dewatering, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing a bedding materials, geo-textile filter fabric; laying, setting and jointing all pipes and fittings, making all connections to existing pipes and manholes, for rebuilding inverts of existing manholes as may be required, including adapters for all leakage testing, for backfilling and compacting backfill material, for disposal of all excess excavated materials, for replacing or rebuilding driveways, walks, sidewalks, curbs, walls, and any other impacted structures, including shrubs, fences, sprinkler systems, existing grassed areas and other surface material; for furnishing, placing, and removing all temporary timber sheeting and bracing, trench boxes and or steel plates; for providing temporary bracing at existing utility poles, for removing and resetting existing mailboxes; for removing abandoned water and gas main pipe, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
16, 17, 18, 19, 20 & 21	Pressure Sewer Pipe (All Sizes) Laterals and Services – Trenchless	Linear Foot (LF)

Measurement: Pressure sewer pipe installed by trenchless technologies of the various types and sizes indicated on the Plans will be measured in linear feet of continuous runs of such sewers actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantity for pressure sewer pipe, laterals and services, installed by trenchless technologies will be paid for at the contract unit price per linear foot for the various pipe sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the pipe complete and in place. The work will include furnishing all pipes, plugs, installing and jointing all pipes and fittings, making all connections to existing pipes and manholes, disposal of all excess excavated materials, for replacing or rebuilding driveways, walks, sidewalks, curbs, walls, and any other impacted structures, including shrubs, fences, sprinkler systems, existing grassed areas and other surface material; for providing temporary bracing at existing utility poles, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
22	16-Inch Ductile Iron Gravity Sewer Pipe Laterals - Open Cut Excavation	Linear Foot (LF)

Measurement: Gravity sewer pipe installed by open cut excavation as indicated on the Plans will be measured in linear feet of continuous runs of such sewers actually installed in accordance with the Plans and/or as directed by the Owner. Deductions will not be made for the pipe length, inside diameter, of manholes.

Payment: The accepted quantity for gravity sewer pipe installed by open cut excavation will be paid for at the contract unit price per linear foot for the various pipe sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the pipe complete and in place. The work will include furnishing all pipes, plugs, excavation, dewatering, compaction, saw-cut of bituminous and concrete pavements, furnishing

and placing a bedding materials, geo-textile filter fabric; laying, setting and jointing all pipes and fittings, making all connections to existing pipes and manholes, for rebuilding inverts of existing manholes as may be required, including adapters for all leakage testing, for backfilling and compacting backfill material, for disposal of all excess excavated materials, for replacing or rebuilding driveways, walks, sidewalks, curbs, walls, and any other impacted structures, including shrubs, fences, sprinkler systems, existing grassed areas and other surface material; for furnishing, placing, and removing all temporary timber sheeting and bracing, trench boxes and or steel plates; for providing temporary bracing at existing utility poles, for removing and resetting existing mailboxes; for removing abandoned water and gas main pipe, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
23, 24, 25, 26 & 27	Sewer Manholes (Open Cut Excavation) (Gravity and Pressure Sewer)	Each (EA)

Measurement: Sewer Manholes installed by open cut excavation of the various types and sizes all indicated on the Plans will be measured by the number of such structures actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of sewer manholes installed by open cut excavation will be paid for at the contract unit price per each such structure as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the manholes complete and in place. The work will include furnishing all excavation, dewatering, earth supports systems, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing bedding materials, geo-textile filter fabric; making all connections to existing pipes, constructing brick inverts, manholes frames and covers (all types), valves, fittings, adapters, leakage tests, temporary bracing at existing utility poles, removing abandoned water and gas main pipe, joint sealant, non-shrink grout, concrete, manhole steps, rubber boots, waterproofing, and all other incidentals. No extra payment will be made for the various type of manhole frames and covers.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
28, 29, 30 & 31	Valve, Cleanout, & Junctions Connections (Trenchless Technologies, Types A, B, C, & D)	Each (EA)

Measurement: The various types of valve, cleanout and junction connection types installed by open cut excavation within the designated operation and reception pits all indicated on the Plans will be measured by the number of each such configurations actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of each type of valve, cleanout and junction connection installed by open cut excavation within the designated operation and reception pits will be paid for at the contract unit price per each such type as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the manholes complete and in place. The work will include furnishing all excavation, dewatering, earth supports systems, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing bedding materials, making all connections to existing pipes, concrete, frames and covers, curb boxes, covers, risers, valves, fittings, caps, adapters, temporary bracing at existing utility poles, joint sealant, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
32	Air Release Manhole and Valve (Open Cut Excavation)	Each (EA)

Measurement: Air Release Manholes and Valves installed by open cut excavation with a trench or designated operation or reception pits of the various types and sizes all indicated on the Plans will be measured by the number of such structures actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of air release manholes and valves installed by open cut excavation will be paid for at the contract unit price per each such structure as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the manholes complete and in place. The work will include furnishing all excavation, dewatering, earth supports systems, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing bedding materials, geo-textile filter fabric; making all connections to existing pipes, constructing brick inverts, manholes frames and covers (all types), air release valves, fittings, adapters, leakage tests, temporary bracing at existing utility poles, removing abandoned water and gas main pipe, joint sealant, non-shrink grout, concrete, manhole steps, rubber boots, waterproofing, and all other incidentals. No extra payment will be made for the various type of manhole frames and covers.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
33	Remove Bituminous Pavement Surface Gutters by Cold Planing / Milling	Square Yard (SY)

Measurement: Removing bituminous pavement within the roadway gutters by cold planning will be measured by the number of square yards of said pavement actually removed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of removing bituminous pavement surface from roadway gutters by cold planning will be paid for at the contract unit price per square yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment, removal and disposal of millings, sweep pavement immediately following operations, all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
34	2-Inch Depth Bituminous Pavement Patch Linear HMA CL 9.5 - Open Cut Excavation Trenches	Linear Foot (LF)

Measurement: Bituminous pavement patch for sewer pipe installed by open cut trench excavations as indicated on the Plans will be measured in linear feet of continuous runs of such 2-inch depth installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of bituminous pavement patch will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and includes sawcut and tack coating the pavement edge, 12-inches of compacted gravel borrow base, 2-inch of bituminous pavement (HMA CL 9.5), temporary stripping, all other incidentals required to finish the work complete and accepted by the Owner.

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<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
35	2-Inch Depth Bituminous Pavement Patch HMA CL 9.5 – Operating and Reception Pits	Square Yard (SY)

Measurement: Bituminous pavement patch open cut operation and reception pits for trenchless technologies as indicated on the Plans will be measured in square yard of such 2-inch depth installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of bituminous pavement patch will be paid for at the contract unit price per square yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and includes sawcut and tack coating the pavement edge, 12-inches of compacted gravel borrow base, 2-inch of bituminous pavement (HMA CL 9.5), temporary stripping, all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
36, 37 & 38	Bituminous Pavement Surface Course HMA CL 9.5 1-1/2" Permanent Pavement Overlay 2" Permanent Pavement Overlay - Tidewater Drive 2-1/2" Driveways and Sidewalks Surface Course	Ton (TON)

Measurement: Bituminous pavement for permanent surface course overlay will be measured by the number of tons based on certified delivery slips actually placed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of bituminous pavement for permanent surface course will be paid for at the contract unit price per ton as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including sweeping and cleaning, tack coat, removal and disposal of broken or loose pavement, saw-cutting of street pavements, saw-cutting side streets, cut and match areas existing roadways, filling of potholes or depressions, adjusting of all utility frames, covers, and roadway boxes, temporary bituminous wedges, hauling, spreading, shaping, rolling and compaction of bituminous concrete material for leveling courses and new pavement, pavement markings; and for furnishing all labor, materials, and equipment and for all other incidental required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
39	Bituminous Berm Rhode Island Standard No. 7.5.1	Linear Foot (LF)

Measurement: Bituminous berm will be measured in linear feet of continuous runs installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of bituminous berm will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including forming, shaping, rolling and compaction of

bituminous berm and for all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
40	Saw-cutting Bituminous Driveways	Linear Foot (LF)

Measurement: Saw-cutting operation and bituminous driveways will be measured in linear feet of continuous runs completed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of saw-cutting bituminous driveways will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and for all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
41	Saw-cutting Operation / Reception Pits	Linear Feet (L.F.)

Measurement: Saw-cutting bituminous at operation and reception pits will be measured per each operation/reception pit sawcut completed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of saw-cutting operation / reception pits will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for saw-cutting all four sides of each pit and for all labor, materials, and equipment and for all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
42	Controlled Low Strength Material	Cubic Yard (CY)

Measurement: Controlled low strength material, flowable fill, will be measured by the number of cubic yards actually placed. Controlled low strength material shall be placed as directed by the Engineer as needed to facilitate construction operations.

Payment: The accepted quantity of controlled low strength material will be paid for at the contract unit price per cubic yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, and all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
43	Miscellaneous Concrete	Cubic Yard (CY)

Measurement: Concrete will be measured by the number of cubic yards actually placed. Concrete shall be placed as directed by the Engineer as needed to facilitate construction operations.

Payment: The accepted quantity of concrete will be paid for at the contract unit price per cubic yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, and all other incidentals complete and accepted by the Owner.

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<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
44	8" Compost Filter Sock	Linear Foot (LF)

Measurement: Compost Filter Sock will be measured in linear feet of continuous runs completed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of compost filter sock will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including continuous maintenance throughout construction and removal upon completion of work, and for all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
45	Silt Sack Inlet Protection	Each (EA)

Measurement: Silt Sack Inlet Protection will be measured per each unit installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of silt sacks will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including continuous maintenance throughout construction, cleaning and removal upon completion of work, and for all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
46	4-Inch Loam and Seed	Square Yard (SY)

Measurement: 4-Inch Loam and seed will be measured in square yards installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of loam and seed will be paid for at the contract unit price per square yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including placing of loam, seed, and fertilizer, for watering all newly seeded and all other incidentals required to finish the work complete and accepted by the Owner. Payment for loam and seed for areas disturbed by the Contractor, outside of normal work limits during construction of this project will be paid by the Contractor.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
47	Precast Drainage Structure	Each (EA)

Measurement: Precast Drainage Structures of the various types and sizes all indicated on the Plans will be measured by the number of such structures actually installed in accordance with the Plans and/or as directed by the Owner.

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Payment: The accepted quantities of drainage manholes installed by will be paid for at the contract unit price per each such structure as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the structures complete and in place. The work will include furnishing all excavation, dewatering, earth supports systems, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing bedding materials, geo-textile filter fabric; making all connections to existing pipes, constructing brick inverts, manholes frames and covers (all types), temporary bracing at existing utility poles, removing abandoned water and gas main pipe, joint sealant, non-shrink grout, concrete, manhole steps, waterproofing, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
48	Remove and Dispose Drainage Pipe – All Sizes	Linear Foot (LF)

Measurement: Removal of drainage pipe will be measured in linear feet of continuous runs completed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantity removal and dispose drainage pipe will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including legal disposal of all pipe and excess materials and for all other incidentals required to finish the work complete and accepted by the Owner.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
49	Remove and Dispose Existing Drainage Structures – All Sizes	Each (EA)

Measurement: Remove and dispose existing drainage structures of the various types and sizes will be measured by the number of such structures actually removed and disposed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of remove and dispose drainage structures will be paid for at the contract unit price per each such structure as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the structures complete and in place. The work will include all excavation, dewatering, earth supports systems, compaction, saw-cut of bituminous and concrete pavements, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
50, 51, 52 & 53	Storm Drainage Pipe 12" Reinforced Concrete Pipe 12" Ductile Iron Pipe 18" Reinforced Drainage Pipe 18" Ductile Iron Pipe	Linear Foot (LF)

Measurement: Drainage pipe will be measured in linear feet of continuous runs of such pipe actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantity for drainage pipe will be paid for at the contract unit price per linear foot for the various pipe type and sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the pipe

complete and in place. The work will include furnishing all pipes, plugs, excavation, dewatering, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing of bedding materials; laying, setting and jointing all pipes and fittings, making all connections to existing pipes and manholes, for rebuilding inverts of existing manholes as may be required, for backfilling and compacting backfill material, for disposal of all excess excavated materials, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
54, 55 & 56	Remove and Reset Storm Drainage Pipe (All Types) 12" Pipe or Less, 18" and 24"	Linear Foot (LF)

Measurement: Remove and reset storm drainage pipe will be measured in linear feet of continuous runs of such pipe actually removed and reset in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantity for remove and reset storm drainage pipe (all types) will be paid for at the contract unit price per linear foot for the various pipe types and sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to remove and reset pipe complete and in place. The work will include furnishing all pipes, plugs, excavation, dewatering, compaction, saw-cut of bituminous and concrete pavements, furnishing and placing of bedding materials; laying, setting and jointing all pipes and fittings, making all connections to existing pipes and manholes, for backfilling and compacting backfill material, for disposal of all excess excavated materials, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
57 & 58	Isolate, Remove, Replace & Reactivate Water Mains Less than 40 Feet of Water Pipe (6" and 8" Ductile Iron and PVC) 40 to 80 Feet of Water Pipe (6" and 8" Ductile Iron and PVC)	Each (EA)

Measurement: Isolate, remove, replace and reactivate water mains of the various types and sizes will be measured by the number of such operations made to facilitate sewer pipe installation in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of remove, replace, and reactivate water mains will be paid for at the contract unit price per each such structure as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment include furnishing all pipes, fittings, restraints, earth support, dewatering, excavation, backfill, compaction, saw-cut of bituminous pavements, bedding materials; laying, setting and jointing all pipes and fittings, disinfection, re-activation of the water system and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
59	Overhead Utility House Services (Disconnect & Re-activate)	Allowance

This allowance is for the temporary disconnect and reactivation of overhead utilities to facilitate trenchless technologies. The Contractor shall include in the Contract Sum this allowance stated as listed in the Proposal. The items covered by allowances shall be supplied for such amounts and by such

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persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection. Unless otherwise provided in the Contract Documents, allowances shall cover the cost to the Contractor’s materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances. The Contractor shall submit invoice from National Grid or other overhead service providers for payment without surcharge or markup.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
60 & 61	6” PVC Water Pipe (Sewer Conflicts) 8” PVC Water Pipe (Sewer Conflicts)	Linear Foot (LF)

Measurement: Water main installed will be measured in linear feet of continuous runs of such pipe actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantity for water pipe installed will be paid for at the contract unit price per linear foot for the various pipe sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the pipe complete and in place. The work will include furnishing all pipes, fitting, restraints, excavation, backfill, dewatering, compaction, earth support systems, saw-cut of bituminous pavements, bedding materials; laying, setting and jointing all pipes and fittings, making all connections to existing pipes, leakage testing, for backfilling and compacting backfill material, for disposal of all excess excavated materials, for replacing or rebuilding driveways, walks, sidewalks, curbs, walls, and any other impacted structures, including shrubs, fences, sprinkler systems, existing grassed areas and other surface material; for furnishing, placing, and removing all temporary timber sheeting and bracing, trench boxes and or steel plates; for providing temporary bracing at existing utility poles, for removing and resetting existing mailboxes; for removing abandoned water and gas main pipe, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
62	Water Service Connections (House Services)	Each (EA)

Measurement: Water service connections will be measured by the number of service connections installed from the water main to the property line in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of water service connections will be paid for at the contract unit price per each service installed as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment include furnishing all pipes, fittings, tapping new mains, saddles, corporation stops, curb stops, cast iron curb boxes and extension rods, removal and disposal of existing curb stops and boxes; reconnecting the new service pipe to the existing service; providing miscellaneous fittings and unions; and other materials required for installing the services complete, earth support systems, dewatering, excavation, backfill, compaction, saw-cut of bituminous pavements, bedding materials; laying, setting and jointing all pipes and fittings, disinfection, re-activation of the water service and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
63 & 64	6" and 8" Water - Gate Valves	Each (EA)

Measurement: Gate Valves will be measured by the number of gate valve of various sizes installed on the water main in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of gate valves will be paid for at the contract unit price per each installed as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment include furnishing all valves, fittings, cast iron curb boxes and extension rods, restraints, removal and disposal of existing valves and other materials, earth support systems, dewatering, excavation, backfill, compaction, saw-cut of bituminous pavements, bedding materials; laying, setting and jointing all connections and fittings, disinfection, re-activation of the water service and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
65	Tapping Sleeve and Valve – All Sizes	Each (EA)

Measurement: Tapping Sleeves and Valves will be measured by the number of various types and sizes installed on the water main in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of tapping sleeves and valves will be paid for at the contract unit price per each installed as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment include furnishing all valves, fittings, cast iron curb boxes and extension rods, restraints, removal and disposal of existing valves and other materials, earth support systems, dewatering, excavation, backfill, compaction, saw-cut of bituminous pavements, bedding materials; laying, setting and jointing all connections and fittings, disinfection, re-activation of the water service and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
66	Fire Hydrants	Each (EA)

Measurement: Hydrants will be measured by the number installed on the water main in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of hydrants will be paid for at the contract unit price per each installed as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment include furnishing all valves, fittings, cast iron curb boxes and extension rods, restraints, removal and disposal of existing valves, hydrants, and other materials, concrete, earth support systems, dewatering, excavation, backfill, compaction, saw-cut of bituminous pavements, bedding materials; laying, setting and jointing all connections and fittings, disinfection, re-activation of the water service and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
67, 68 & 69	Traffic Control Devices Construction Road Signs Traffic Barrels w/Type A or Type C Light Traffic Barricades	Lump Sum (LS)

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Measurement: The work of this section shall be measured on a lump sum basis. The payable quantity will be for devices in place including but not limited to construction road signs, traffic barrels w/ type A or type C lights, and traffic barricades.

Payment: Traffic control devices including construction road signs, traffic barrels w/Type A or Type C lights, and traffic barricades will be paid for at the contract lump sum price listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment including daily maintenance, moving, and resetting of all traffic control equipment and devices and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
70	Vibration Monitoring	Lump Sum (LS)

Measurement: The work of this section shall be measured on a lump sum basis. The payable quantity will be for providing vibration monitoring throughout construction of the project as defined by the Contract Documents.

Payment: Vibration monitoring will be paid for at the contract lump sum price listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, and reports and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
70A	Pre-Construction Survey	Lump Sum (LS)

Measurement: The work of this section shall be measured on a lump sum basis. The payable quantity will be for providing pre-construction surveys throughout the project area prior to performing work as defined by the Contract Documents.

Payment: Pre-construction surveys will be paid for at the contract lump sum price listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, and reports and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
70B	Post-Construction Survey	Lump Sum (LS)

Measurement: The work of this section shall be measured on a lump sum basis. The payable quantity will be for providing post-construction surveys throughout the project area upon completion of work as defined by the Contract Documents.

Payment: Post-construction surveys will be paid for at the contract lump sum price listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, and reports and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
71 & 72	Miscellaneous Utility Work Asbestos Containing Materials	Allowances

The Contractor shall include in the Contract Sum all allowances stated as listed in the Proposal. The items covered by allowances shall be supplied for such amounts and by such persons or entities

as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection. Unless otherwise provided in the Contract Documents, allowances shall cover the cost to the Contractor’s materials and equipment, delivery, unloading and handling, labor, installation costs, overhead, profit and other expenses.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
73, 74 & 75	Gas Main Relocation Soil Compaction Testing Tree Trimming	Allowances

The Contractor shall include in the Contract Sum all allowances stated as listed in the Proposal. The items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection. Unless otherwise provided in the Contract Documents, allowances shall cover the cost to the Contractor’s materials and equipment delivered at the site and all required taxes, less applicable trade discounts. Contractor’s costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
76	Police Protection	None

Measurement: None.

Payment: Payment for police protection will be paid directly by the Warwick Sewer Authority. The Contractor will be responsible for coordinating police protection with the Police Department and the Owner. The Warwick Police Department will invoice the WSA directly without charge to the Contractor. The Owner’s representative will review and approve all related police invoices.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
77	Utility Location Investigation – (Vacuum Excavator)	Each (EA)

Measurement: Earth excavation performed to locate existing utilities by vacuum excavator will be measured per each pit. Utility locations shall be performed by a vacuum excavator. Investigations shall be performed to locate gas and water services and mains, and to locate drainage utilities to maximum depths of 8 feet. Excavation pits shall be performed to ensure trenchless technologies do not conflict with existing utilities.

Payment: The accepted quantity of utility pits for utility exploration will be paid for at the contract unit price per each as listed in the Proposal. The payable quantity will be the number of excavation pits performed. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including excavation within a maximum 30” x 30” pit, sawcut of pavement, excavation, backfill of material, grading, compaction, disposal of surplus materials, preparation of subgrade, placement of 3-inches of bituminous cold patch, and all other incidentals required to finish the work complete and accepted by the Engineer. Any archaeological oversight of the excavation will be performed by the WSA.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
78	Pressure Sewer Pipe 1 ¼" Services Connections – Trenchless (Outside of Archeological Significant Areas / Open Cut Mainline Trench Locations)	Linear Foot (LF)

Measurement: Pressure sewer pipe installed by trenchless technologies of the various types and sizes indicated on the Plans will be measured in linear feet of continuous runs of such sewers actually installed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantity for pressure sewer pipe service connections, installed by trenchless technologies will be paid for at the contract unit price per linear foot for the various pipe sizes as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment to install the pipe complete and in place. The work will include furnishing all pipes, plugs, installing and jointing all pipes and fittings, making all connections to existing pipes and manholes, disposal of all excess excavated materials, for replacing or rebuilding driveways, walks, sidewalks, curbs, walls, and any other impacted structures, including shrubs, fences, sprinkler systems, existing grassed areas and other surface material; for providing temporary bracing at existing utility poles, and all other incidentals.

<u>BID ITEM</u>	<u>DESCRIPTION</u>	<u>PAY UNIT</u>
79	Saw-cutting Trenchless Service Connections (Outside of Archeological Significant Areas / Open Cut Mainline Trench Locations)	Linear Feet (LF)

Measurement: Saw-cutting bituminous at operation and reception pits will be measured per each operation/reception pit sawcut completed in accordance with the Plans and/or as directed by the Owner.

Payment: The accepted quantities of saw-cutting operation / reception pits will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for saw-cutting all four sides of each pit and for all labor, materials, and equipment and for all other incidentals required to finish the work complete and accepted by the Owner.

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SECTION 05500

SANITARY SEWER – OPEN EXCAVATIONS

1.1 SUMMARY

- A. Section Includes:
 - 1. Gravity and Pressure Sewer Laterals
- B. Related Sections:
 - 1. Section 03350 - Excavation and Fill

1.2 SUBMITTALS

- A. Section 01340 – Shop Drawings.
 - 1. Product Data: Data for each type of pipe and pipe accessory specified.
- B. Section 01780 - Procedures for closeout submittals.
 - 1. Project Record Documents: Accurately record the following.
 - a. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with environmental regulatory agencies, utility company requirements and applicable health codes and authority having jurisdiction requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MAIN LINE

- A. Pipe
 - 1. 2", 3",4", 6" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), DR 11 pressure pipe. Shall be manufactured with a green color stripe for sewer pipe identification.
 - 2. Schedule 80 PVC pipe shall be used in Manholes for all pipe sizes of Intersecting Mains, In-Line Main Cleanout and Dead-End Main Cleanout.
- B. Fittings
 - 1. 2", 3",4", 6" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), SDR 11, butt fusion and electro fusion molded pressure fittings.

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2. Schedule 80 PVC fittings shall be used in Manholes for all pipe sizes of Intersecting Mains, In-Line Main Cleanout and Dead-End Main Cleanout.

2.2 SERVICES

A. Pipe

1. 1¼" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), DR 11 pressure pipe. Shall be manufactured with a green color stripe for sewer pipe identification.

B. Fittings

- C. 1¼" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), SDR 11, butt fusion and electro fusion molded pressure fittings.

2.3 INTERSECTING MAINS AND VALVE

A. Pipe

1. Schedule 80 PVC pipe shall be used for all sizes of Intersecting Mains, In-Line Main Cleanout and Dead-End Main Cleanout Manholes.

B. Pipe Joints

1. Stainless Steel Male thread HDPE transition fitting manufactured by Poly-Cam® Series 710HD or approved equal shall be used for 2" Intersecting Mains, In-Line Main Cleanout and Dead-End Main Cleanout connections.

C. Valves

1. Plug Valve manufactured by Henry Pratt company or approved equal shall be used for 3"-8" Intersecting Mains and Valve, 3"-8" In-Line Main Cleanout and Valve and 3"-8" Dead-End Main Cleanout and Valve connections.
2. 2" Schedule 80 PVC 2000 Standard Ball Valve manufactured by True Union shall be used for 2" Intersecting Mains and Valves, 2" In-Line Main Cleanout and Dead-End Main Cleanout connections.

D. Fittings

1. Schedule 80 PVC Cross manufactured by Spears or approved equal shall be used for all sizes of Intersecting Mains where a cross fitting is warranted.
2. Schedule 80 PVC Tee manufactured by Spears or approved equal shall be used for all sizes of Intersecting Mains where a tee fitting is warranted.
3. Schedule 80 PVC One Piece Flange manufactured by Spears or approved equal shall be used for 3"-8" Intersecting Mains and 3"-8" In-Line Main Cleanout and 3"-8" Dead-End Main Cleanout.

E. Adapters

1. Mechanical Joint HDPE Molded Butt Fusion Flange Adapter with Flange & Bolt Kit including Gland and Gasket manufactured by Integrity Fusion Products or approved equal shall be used for 3"-8" Intersecting Mains and 3"-8" In-Line Main Cleanout and 3"-8" Dead-End Main Cleanout.

F. Frame and Covers.

1. Frames and covers shall be as detailed on the Plans.

- G. The Contractor shall submit shop drawings of all proposed materials and substitutions for approval by the Engineer.

2.4 IN-LINE CLEANOUT MANHOLE

A. Fittings

1. 8"x4" Schedule 80 PVC Reducer (socket x socket) manufactured by Spears shall be used for 8" In-Line Main Cleanouts and 8" Dead-End Main Cleanouts.
2. 6"x2" Schedule 80 PVC Reducer (socket x socket) manufactured by Spears shall be used for 6" In-Line Main Cleanouts and 6" Dead-End Main Cleanouts.
3. 4"x2" Schedule 80 PVC Reducer (socket x socket) manufactured by Spears shall be used for 4" & 8" In-Line Main Cleanouts and 4" & 8" Dead-End Main Cleanouts.
4. 3"x2" Schedule 80 PVC Reducer (socket x socket) manufactured by Spears shall be used for 3" In-Line Main Cleanouts and 3" Dead-End Main Cleanouts.
5. 1 5/8" SS Strut Channel Support Assembly with bolted end wall plates (P2941) and 2" SS Riser Pipe Clamp (P1117) including SS bolts, nuts, washers and hardware manufactured by Unistrut or approved equal shall be used for all sizes of In-Line Main Cleanouts and all sizes of Dead-End Main Cleanouts.

B. Adapters

1. 2" SS Camlock Type A Adapter x Female NPT Part # 200-A-SS manufactured by Dixon Valve & Coupling Co. or approved equal shall be used for 2" In-Line Main Cleanouts and 2" Dead-End Main Cleanouts.
2. 2" SS Camlock Type DC Dust Cap Part # 200-DC-SS manufactured by Dixon Valve & Coupling Co. or approved equal shall be used for 2" In-Line Main Cleanouts and 2" Dead-End Main Cleanouts.
3. Schedule 80 PVC Coupling Socket x FIPT manufactured by Spears or approved equal shall be used for 2" In-Line Main Cleanouts and 2" Dead-End Main Cleanouts.
4. Schedule 80 PVC Adapter Socket x MIPT manufactured by Spears or approved equal shall be used for 2" In-Line Main Cleanouts and 2" Dead-End main Cleanouts.

2.5 DEAD END MAIN CLEANOUTS

A. Fittings

1. Schedule 80 PVC 45° Elbow (Socket x Socket) manufactured by Spears or approved equal shall be used for all sizes of Dead-End Main Cleanout.

2.6 HDPE PIPE AND FITTINGS FOR PRESSURE SEWERS

A. Conformance with the following

1. ASTM F2620-06: Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fitting.
2. ASTM D3261: Standard Specification for Butt Heat Fussion Polyethylene Plastic Fittings for Polyethylene Plastic Tubing.
3. ASTM D3350 – Standard Specification for Polyethylene Plastic Pipe and Fitting Materials.
4. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

2.7 QUALITY ASSURANCE

A. Mark pipe and fittings with the following information applied at intervals nor more than 5 feet:

1. Manufacturer's name or trademark
2. Nominal pipe size
3. HDPE Cell Classification

4. Applicable dimension ratio
5. Date and location of manufacturer
6. Applicable standard designation number

2.8 SUBMITTALS

- A. Shop Drawing showing lengths of pipe, fitting and joint details, construction details, tolerances and other information, as required.
- B. Conformance Certificates: Each shipment of pipe and fittings shall be accompanied with the pipe manufacturer's notarized certification that materials meet specification requirements.
- C. Guarantee: The Contractor shall furnish to the Authority a written guarantee signed by the manufacturer of the pipe and pipe fittings which he proposes to furnish, which shall warrant and guarantee that the pipe and pipe fittings meet all requirements of the specifications and that the pipe and fittings shall not fail or be injured as a result of conveying sewage, drainage, industrial wastes or groundwater. The form of guarantee shall in all respects be satisfactory to the Authority.

PART 3 - EXECUTION

3.1 DELIVERY, HANDLING, AND STORAGE

- A. Examine the pipe and fittings for cracks, dents, abrasions or other flaws prior to installation. Mark rejected piping with a yellow crayon and remove from the project within 24 hours.
- B. Avoid damage to pipe from impact, bending, compression or abrasion during handling and storage.
- C. Store pipe on flat surface which provides even support for the pipe barrel and any overhanging. Do not stack pipe higher than 5 feet. Do not store pipe and fittings in direct sunlight.
- D. Use only nylon protected sling to handle pipe. The use of hooks or bare cables will not be permitted.

3.2 CUTTING THE PIPE

- A. Cut the pipe square with saws or pipe cutters designed specifically for the material. Protect the pipe and fittings from serrated holding devices and abrasion.
- B. Bevel the end in accordance with the manufacturer's recommendations. Locate a depth mark with a pencil or crayon to assure the spigot end is inserted to the recommended depth.
- C. Remove burrs and wipe off all dust and dirt from the jointing surfaces.
- D. Perform all jointing operations in accordance with manufacturer's printed instructions. Make copies of manufacturer's printed instructions available to the Authority.

- E. Thoroughly clean and remove all dirt and foreign material from the pipe.
- F. Pipe Warning/Tracking Tape shall be plastic 4-inch wide tape with magnetic tracking wire labeled "Sewer."

3.3 LAYING PIPE

- A. Pipe shall be laid upon a trench bottom prepared as hereinbefore specified in these Specifications. All pipes shall be carefully cleaned just before laying. Extreme care shall be exercised so as not to damage the pipe in handling. Each pipe shall be laid to line and grade and so as to form a tight joint with the next adjoining pipe and to bring the inverts continuous.
- B. Pipe shall be laid in accordance with these Specifications and in accordance with the recommendations of the manufacturer of the pipe.
- C. The Contractor shall secure and reproduce ties and other pipeline appurtenances as required by the Engineer.

3.4 FLEXIBLE COUPLINGS AND ADAPTERS

- A. Flexible couplings and adapters designed to take care of normal expansion and contraction movements of all pipes and to join different kinds of pipes, where shown on the Contract Drawings, shall be furnished and installed. The body and gasket retaining rings of the flexible couplings or adapters shall be cast iron. Gaskets shall be oil resistant and the bolts shall be of high corrosion resistant alloys suitable for underground burial.

3.5 TESTING PRESSURE SEWERS

- A. After the pipes of the pressure main have been laid, secured in place and jointed as hereinbefore specified, the sewers shall be tested for strength at a pressure of 125 pounds per square inch. The pressure for strength test shall be maintained for at least ten minutes by pumping additional water into the pipeline.
- B. The pressure main shall be tested for leakage under a pressure of 75 pounds per square inch. The test for leakage shall last for at least one hour and may be required to last for two hours. The additional water needed to maintain the required pressures shall be accurately measured in a manner approved by the Engineer. The rate of leakage for force main sewer shall not exceed one gallon per day per 1000 linear feet. The Contractor shall repair all leaks discovered under any of the tests required above. The tests shall be made when required by the Engineer. The Contractor shall furnish all apparatus, materials, and labor and the necessary water for making the tests at no additional expense to the Authority.
- C. Before testing pipelines, the Contractor must make certain that the pipelines are securely held and all fittings are secured to prevent movement of the pipelines.
- D. The ends of the sections of force main to be tested shall be tightly closed by flanges or otherwise for the duration of each test. The Contractor shall provide such material, supplies, and equipment as necessary for carrying out the tests.

- E. The Contractor shall make all necessary arrangements for securing the water for test purposes and shall stand the expense of these arrangements and of the water required for leakage tests.

3.6 CLEANING PIPE LINES AND APPURTENANCES

- A. Upon completion of construction, all dirt and other foreign material shall be removed from the pipelines and their appurtenant constructions. No materials shall be left to impede the normal flow through them.

END OF SECTION

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SECTION 05610

SANITARY SEWER – TRENCHLESS TECHNOLOGIES

1.1 SUMMARY

- A. Section Includes:
 1. Gravity and Pressure Sewer Laterals
 2. Service connections
- B. Related Sections:
 1. Section 03350 - Excavation and Fill

1.2 SUBMITTALS

- A. Section 01340 – Shop Drawings.
 1. Product Data: Data for each type of pipe and pipe accessory specified.
- B. Section 01780 - Procedures for closeout submittals.
 1. Project Record Documents: Accurately record the following.
 - a. Actual locations of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - b. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements: Perform work in accordance with environmental regulatory agencies, utility company requirements and applicable health codes and authority having jurisdiction requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Product Requirements: Transport, handle, store, and protect Products.

PART 2 - PRODUCTS

2.1 MAIN LINE

- A. Pipe
 1. 2", 3", 4", 6" & 8" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), DR 11 pressure pipe. Shall be manufactured with a green color stripe for sewer pipe identification.
 2. Schedule 80 PVC pipe shall be used in Manholes for all pipe sizes of Air Release & Vacuum Valves.
- B. Fittings

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1. 2", 3", 4", 6" & 8" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), SDR 11, butt fusion and electro fusion molded pressure fittings.
2. Schedule 80 PVC fittings shall be used in Manholes for all pipe sizes of Air Release & Vacuum Valves.

2.2 SERVICES

A. Pipe

1. 1¼" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), DR 11 pressure pipe. Shall be manufactured in a solid green color for sewer pipe identification.

B. Fittings

1. 1¼" High Density Polyethylene (HDPE), PE4710 resin, Iron Pipe Size (IPS), SDR 11, butt fusion and electro fusion molded pressure fittings.

2.3 AIR RELEASE & VACUUM VALVE SEWER MANHOLE

A. Pipe

1. 2", 3", 4", 6", 8" High Density Polyethylene (HDPE) PE4710, IPS Pressure Pipe shall be used for sewer and service connections.
2. Schedule 80 PVC pipe shall be used for all sizes of Air Release & Vacuum Valve Sewer Manholes.

B. Pipe Joints

1. Stainless steel male thread HDPE transition fitting manufactured by Poly-Cam Series 710HD or approved equal shall be used for 2" Intersecting Mains and Valve Type C, 2" In-Line Main Cleanout and Valve Type B and 2" Dead-End Main Cleanout and Valve Type A.

C. Valves

1. Wastewater Composite Combination Air Valve D-025 manufactured by ARI Flow Control or approved equal shall be used for all sizes of Air Release & Vacuum Valve Sewer Manholes.
2. 2" Schedule 80 PVC 2000 Standard Ball Valve manufactured by True Union or approved equal shall be used for all sizes of Air Release & Vacuum Valve Sewer Manholes.

D. Fittings

1. 8"x8"x2" Schedule 80 PVC Tee shall be used for 8" Air Release & Vacuum Valve Sewer Manholes.
2. 6"x6"x2" Schedule 80 PVC Tee shall be used for 6" Air Release & Vacuum Valve Sewer Manholes.
3. 4"x4"x2" Schedule 80 PVC Tee shall be used for 4" Air Release & Vacuum Valve Sewer Manholes.
4. 3"x3"x2" Schedule 80 PVC Tee shall be used for 3" Air Release & Vacuum Valve Sewer Manholes.
5. 2" Schedule 80 PVC Tee shall be used for 2" Air Release & Vacuum Valve Sewer Manholes.
6. 8" Schedule 80 PVC One Piece Socket Flange manufactured by Spears or approved equal shall be used for 8" Air Release & Vacuum Valve Sewer Manholes.
7. 6" Schedule 80 PVC One Piece Socket Flange manufactured by Spears or approved equal shall be used for 6" Air Release & Vacuum Valve Sewer Manholes.
8. 4" Schedule 80 PVC One Piece Socket Flange manufactured by Spears or approved equal shall be used for 4" Air Release & Vacuum Valve Sewer Manholes.

9. 3" Schedule 80 PVC One Piece Socket Flange manufactured by Spears or approved equal shall be used for 3" Air Release & Vacuum Valve Sewer Manholes.
10. 1 5/8" SS Strut Channel Support Assembly with bolted end wall plates (P2941) and 2" SS Riser Pipe Clamp (P1117) including SS bolts, nuts, washers & hardware manufactured by Unistrut or approved equal shall be used for all sizes of Air Release & Vacuum Valve Sewer Manholes all sizes of Dead-End Main Cleanouts.

E. Adapters

1. Molded Butt Fusion Flange Adapter and stainless-steel Backup Ring - IPS manufactured by Integrity Fusion Products or approved equal shall be used for 3" – 8" Air Release & Vacuum Valve Sewer Manholes.
2. Fusion CF101 Carbon Filter Manhole Insert System manufactured by Fusion Environmental Solutions or approved equal shall be used for all sizes of Air Release & Vacuum Valve Sewer Manholes.
3. Polypropylene Camlock Type A Adapter x Female NPT Part #PPA200 manufactured by Dixon Valve & Coupling Co. or approved equal shall be used for 2" Air Release & Vacuum Valve Sewer Manholes.
4. Schedule 80 PVC Coupling Socket x FIPT manufactured by Spears or approved equal shall be used for 2" Air Release & Vacuum Valve Sewer Manholes.
5. Polypropylene Camlock Type D Coupler x Female NPT Part #PPD200 manufactured by Dixon Valve & Coupling Co. or approved equal shall be used for 2" Air Release & Vacuum Valve Sewer Manholes.
6. Schedule 80 PVC Adapter Socket x MIPT manufactured by Spears or approved equal shall be used for 2" Air Release & Vacuum Valve Sewer Manholes.

F. Manhole Frame, Cover & Boxes

1. 2006A1PT ZPT Assembly Product # 00200686W01 manufactured by East Jordan Group or approved equal shall be used for all sizes of Dead-End Main Cleanout and Valve Type A, In-Line Main Cleanout and Valve Type B, Intersecting Mains and Valve Type C, and Air Release & Vacuum Valve Sewer Manhole.
2. Valve Box Cover Product #06800006 manufactured by East Jordan Group or approved equal shall be used for all sizes of Dead-End Main Cleanout and Valve Type A, In-Line Main Cleanout and Valve Type B, Intersecting Mains and Valve Type C, and Services and Valves Type D.
3. Valve Box Top 8555 Product # 85557026U manufactured by East Jordan Group or approved equal shall be used for all sizes of Dead-End Main Cleanout and Valve Type A, In-Line Main Cleanout and Valve Type B, Intersecting Mains and Valve Type C, and Services and Valves Type D.
4. Valve Box Bottom 8555 Product # 85556036U manufactured by East Jordan Group or approved equal shall be used for all sizes of Dead-End Main Cleanout and Valve Type A, In-Line Main Cleanout and Valve Type B, Intersecting Mains and Valve Type C, and Services and Valves Type D.
5. Cleanout Box and Lid Assembly 1578Z Product #00157811C02 manufactured by East Jordan Iron Works or approved equal shall be used for all sizes of Dead-End Main Cleanout and Valve Type A, In-Line Main Cleanout and Valve Type B, Intersecting Mains and Valve Type C, and Services and Valves Type D.

2.4 SERVICE AND VALVE TYPE D

A. Valves

1. 1¼" Polyethylene Ball Valve manufactured by Integrity Fusion Products or approved equal shall be used for all sizes of Service and Valve Type D.

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B. Fittings

1. 8"x2" Butt Fusion HDPE Reducing Tee shall be used for Service on 8" Main and Valve Type D and In-Line Main Cleanout and Valve Type B.
2. 6"x2" Butt Fusion HDPE Reducing Tee shall be used for Service on 6" Main and Valve Type D and In-Line Main Cleanout and Valve Type B.
3. 4"x2" Butt Fusion HDPE Reducing Tee shall be used for Service on 4" Main and Valve Type D and In-Line Main Cleanout and Valve Type B.
4. 3"x2" Butt Fusion HDPE Reducing Tee shall be used for Service on 3" Main and Valve Type D and In-Line Main Cleanout and Valve Type B.
5. 2"x2" Butt Fusion HDPE Tee shall be used for Service on 2" Main and Valve Type D and In-Line Main Cleanout and Valve Type B.
6. 2"x1/4" Butt Fusion Reducer shall be used for All Services on all Mains and Valve Type D.

C. Adapters

1. SDR 11 Electrofusion Coupler IPS Series manufactured by Integrity Fusion Products or approved equal shall be used for 1 1/4" Service and Valve Type D.

2.5 INTERSECTING MAINS AND VALVE TYPE C

A. Valve

1. Plug Valve manufactured by Henry Pratt company or approved equal shall be used for 3"-8" Intersecting Mains and Valve Type C, 3"-8" In-Line Main Cleanout and Valve Type B and 3"-8" Dead-End Main Cleanout and Valve Type A.
2. Polyethylene Ball Valve manufactured by Integrity Fusion Products or approved equal shall be used for 2" Intersecting Mains and Valve Type C, 2" In-Line Main Cleanout and Valve Type B and 2" Dead-End Main Cleanout and Valve Type A.

B. Fittings

1. 8"x8" Butt Fusion Tee manufactured by Integrity Fusion Products or approved equal shall be used for 8" Intersecting Mains and Valve Type C.
2. 6"x6" Butt Fusion Tee manufactured by Integrity Fusion Products or approved equal shall be used for 6" Intersecting Mains and Valve Type C.
3. 4"x4" Butt Fusion Tee manufactured by Integrity Fusion Products or approved equal shall be used for 4" Intersecting Mains and Valve Type C.
4. 3"x3" Butt Fusion Tee manufactured by Integrity Fusion Products or approved equal shall be used for 3" Intersecting Mains and Valve Type C.
5. 2"x2" Butt Fusion Tee shall be used for 2" Intersecting Mains and Valve Type C.
6. Molded Cross Tees shall be used for all sizes of Intersecting Mains where a cross fitting is warranted.
7. SDR 11 – Epoxy Coated DI Backup Ring – IPS manufactured by Integrity Fusion Products or approved equal shall be used for 3"-8" Intersecting Mains and Valve Type C.
8. 2" Electrofusion Coupling manufactured by Integrity Fusion Products or approved equal shall be used for 2" Intersecting Mains and Valve Type C, 2" In-Line Main Cleanout and Valve Type B and 2" Dead-End Main Cleanout and Valve Type A.

C. Adapters

1. 8" HDPE Mechanical Joint HDPE Flange Adapter with Flange & Bolt Kit manufactured by Integrity Fusion Products or approved equal shall be used for 8" Intersecting Mains and Valve Type C, 8" In-Line Main Cleanout and Valve Type B and 8" Dead-End Main Cleanout and Valve Type A.

2. 6" HDPE Mechanical Joint HDPE Flange Adapter with Flange & Bolt Kit manufactured by Integrity Fusion Products or approved equal shall be used for 6" Intersecting Mains and Valve Type C, 6" In-Line Main Cleanout and Valve Type B and 6" Dead-End Main Cleanout and Valve Type A.
3. 4" HDPE Mechanical Joint HDPE Flange Adapter with Flange & Bolt Kit manufactured by Integrity Fusion Products or approved equal shall be used for 4" Intersecting Mains and Valve Type C, 4" In-Line Main Cleanout and Valve Type B and 4" Dead-End Main Cleanout and Valve Type A.
4. 3" HDPE Mechanical Joint HDPE Flange Adapter with Flange & Bolt Kit manufactured by Integrity Fusion Products or approved equal shall be used for 3" Intersecting Mains and Valve Type C, 3" In-Line Main Cleanout and Valve Type B and 3" Dead-End Main Cleanout and Valve Type A.
5. SS Transition HDPE x Male NPT manufactured by Poly-Cam or approved equal shall be used for 2" Intersecting Mains and Valve Type C, 2" In-Line Main Cleanout and Valve Type B and 2" Dead End Main Cleanout and Valve Type A.
6. SS FIPT Cleanout Cap shall be used for 2" Intersecting Mains and Valve Type C and 2" In-Line Main Cleanout and Valve Type B.

2.6 DEAD-END MAIN CLEANOUT AND VALVE TYPE A

A. Fittings

1. 8" Butt Fusion 45° Elbow manufactured by Integrity Fusion Products or approved equal shall be used for 8" Dead-End Main Cleanout and Valve Type A.
2. 6" Butt Fusion 45° Elbow manufactured by Integrity Fusion Products or approved equal shall be used for 6" Dead-End Main Cleanout and Valve Type A.
3. 4" Butt Fusion 45° Elbow manufactured by Integrity Fusion Products or approved equal shall be used for 4" Dead-End Main Cleanout and Valve Type A.
4. 3" Butt Fusion 45° Elbow manufactured by Integrity Fusion Products or approved equal shall be used for 3" Dead-End Main Cleanout and Valve Type A.
5. 2" Butt Fusion 45° Elbow manufactured by Integrity Fusion Products or approved equal shall be used for 2" Dead-End Main Cleanout and Valve Type A.
6. 8"x4" Butt Fusion Reducer manufactured by Integrity Fusion Products or approved equal shall be used for 8" Dead-End Main Cleanouts and Valve Type A.
7. 6"x4" Butt Fusion Reducer manufactured by Integrity Fusion Products or approved equal shall be used for 6" Dead-End Main Cleanouts and Valve Type A.
8. 4"x2" Butt Fusion Reducer manufactured by Integrity Fusion Products or approved equal shall be used for 8", 6" & 4" Dead-End Main Cleanouts and Valve Type A.
9. 3"x2" Butt Fusion Reducer manufactured by Integrity Fusion Products or approved equal shall be used for 3" Dead-End Main Cleanouts and Valve Type A.

B. Adapters

1. Dixon / Boss-Lock™ Type A Adapter x Female NPT Part # 200-A-SS manufactured by Dixon Valve & Coupling Co. or approved equal shall be used for all sizes of Dead-End Main Cleanout & Valve Type A.
2. Dixon Type DC Dust Cap Part # 200-DC-SS manufactured by Dixon Valve & Coupling Co. or approved equal shall be used for all sizes of Dead-End Main Cleanout & Valve Type A.

2.7 HDPE PIPE AND FITTINGS FOR PRESSURE SEWERS

A. Conformance with the following

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1. ASTM F2620-06: Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fitting.
2. ASTM D3261: Standard Specification for Butt Heat Fusion Polyethylene Plastic Fittings for Polyethylene Plastic Tubing.
3. ASTM D3350 – Standard Specification for Polyethylene Plastic Pipe and Fitting Materials.
4. ASTM F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.

2.8 QUALITY ASSURANCE

- A. Mark pipe and fittings with the following information applied at intervals not more than 5 feet:
1. Manufacturer's name or trademark
 2. Nominal pipe size
 3. HDPE Cell Classification
 4. Applicable dimension ratio
 5. Date and location of manufacturer
 6. Applicable standard designation number

2.9 SUBMITTALS

- A. Shop Drawing showing lengths of pipe, fitting and joint details, construction details, tolerances and other information, as required.
- B. Conformance Certificates: Each shipment of pipe and fittings shall be accompanied with the pipe manufacturer's notarized certification that materials meet specification requirements.
- C. Guarantee: The Contractor shall furnish to the Authority a written guarantee signed by the manufacturer of the pipe and pipe fittings which he proposes to furnish, which shall warrant and guarantee that the pipe and pipe fittings meet all requirements of the specifications and that the pipe and fittings shall not fail or be injured as a result of conveying sewage, drainage, industrial wastes or groundwater. The form of guarantee shall in all respects be satisfactory to the Authority.

PART 3 - EXECUTION

3.1 DELIVERY, HANDLING, AND STORAGE

- A. Examine the pipe and fittings for cracks, dents, abrasions or other flaws prior to installation. Mark rejected piping with a yellow crayon and remove from the project within 24 hours.
- B. Avoid damage to pipe from impact, bending, compression or abrasion during handling and storage.
- C. Store pipe on flat surface which provides even support for the pipe barrel and overhanging. Do not stack pipe higher than 5 feet. Do not store pipe and fittings in direct sunlight.
- D. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and direct rays of the sun.

- E. Use only nylon protected sling to handle pipe. The use of hooks or bare cables will not be permitted.

3.2 CUTTING THE PIPE

- A. Cut the pipe square with saws or pipe cutters designed specifically for the material. Protect the pipe and fittings from serrated holding devices and abrasion.
- B. Bevel the end in accordance with the manufacturer's recommendations. Locate a depth mark with a pencil or crayon to assure the spigot end is inserted to the recommended depth.
- C. Remove burrs and wipe off all dust and dirt from the jointing surfaces.
- D. Perform all jointing operations in accordance with manufacturer's printed instructions. Make copies of manufacturer's printed instructions available to the Authority.

3.3 LAYING PIPE

- A. Pipe shall be direction drilled reference Section 05812

3.4 TESTING PRESSURE SEWERS

- A. After the pipes of the pressure main have been laid, secured in place and jointed as hereinbefore specified, the sewers shall be tested for strength at a pressure of 125 pounds per square inch. The pressure for strength test shall be maintained for at least ten minutes by pumping additional water into the pipeline.
- B. The pressure main shall be tested for leakage under a pressure of 75 pounds per square inch. The test for leakage shall last for at least one hour and may be required to last for two hours. The additional water needed to maintain the required pressures shall be accurately measured in a manner approved by the Engineer. The rate of leakage for force main sewer shall not exceed one gallon per day per 1000 linear feet. The Contractor shall repair all leaks discovered under any of the tests required above. The tests shall be made when required by the Engineer. The Contractor shall furnish all apparatus, materials, and labor and the necessary water for making the tests at no additional expense to the Authority.
- C. The ends of the sections of pressure main to be tested shall be tightly closed by flanges or otherwise for the duration of each test. The Contractor shall provide such material, supplies, and equipment as necessary for carrying out the tests.
- D. The Contractor shall make all necessary arrangements for securing the water for test purposes and shall stand the expense of these arrangements and of the water required for leakage tests.

3.5 SEWER SERVICE CONNECTIONS

- A. Sewer service connections shall be constructed of HDPE Iron Pipe.
- B. Pipe for service connections shall be directionally drilled with an appropriate cap or plug provided at the end. The end location of all service connections shall be staked and approved by the Owner prior to

installation. After installation the stake shall be adjusted if necessary and location record by GPS, and a minimum of 3 field ties.

3.6 CLEANING PIPE LINES AND APPURTENANCES

- A. Upon completion of construction, all dirt and other foreign material shall be removed from the pipelines and their appurtenant constructions. No materials shall be left to impede the normal flow through them.

END OF SECTION

SECTION 05810

AUGER BORING – TRENCHLESS INSTALLATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

- A. This section covers installation of the 1-1/4-inch HDPE sewer lateral pipe by auger boring. The contractor may also elect to install main line by using auger boring if it is appropriate to their means and methods and compatible with ground conditions.
- B. The Contractor shall furnish all materials and equipment necessary for installation of a welded steel pipe as shown on the Contract Drawings and is responsible for selecting their means and methods for completing the installation of the steel casing pipe in compliance with the specifications.
- C. Auger boring shall include fabrication, transportation, testing, installation, and launch of the auger boring equipment; installation and use of all other auger boring excavation equipment; the excavation, handling, removal, and disposal of all materials encountered in the trenchless installation; installation of welded steel pipe where shown in the drawings or specified in the contract documents; collecting and conveying all construction water; provision of all temporary drainage, ventilation, lighting, and wiring; safety; and all appurtenant work necessary to complete the work in accordance with the Contract Documents.
- D. The excavated diameter of the bore shall be determined by the Contractor based on its selected construction means, methods and equipment, subject to the limitations as shown on the Contract Drawings or stated elsewhere in the Specifications. Excavate the bore to the selected size; to the line and grade to allow the steel pipes to be placed to the line indicated on the Drawings; and to within the tolerances specified herein.
- E. Launch and reception pits for drilling operations shall only be located within predetermined pits shown on the plans or within the predetermined trench line on Tidewater Drive. These pits shall be created using a flat blade on a backhoe. Reception pits on homeowner properties for lateral connections will not be allowed. If auger boring is selected by Contractor for lateral installation, a steel casing shall be installed from the launch pit, the auger shall be removed from the casing from within the launch pit, the lateral shall be installed inside the steel casing, and the annular space between the lateral and steel casing may be backfill grouted.

1.2 RELATED SECTIONS

- A. Section 05610 – Sanitary Sewers Trenchless Technologies
- B. Section 05813 - Geotechnical Instrumentation and Monitoring

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1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. A139 - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe.
- B. Occupational Safety and Health Administration (OSHA): Particular attention is called to Subpart S of the OSHA Standards (29 CFR 1926/1920), published as U.S. Department of Labor Publication 2207, Revised October 1, 1979. Second revision dated August 1, 1989. See Federal Register dated June 30, 1993 for revised standard and commentary.

1.4 QUALITY ASSURANCE

- A. Perform auger boring work using qualified personnel. The Auger Boring Contracting Company (Firm), Auger Boring Superintendent and Operators shall have a minimum of 5 years of auger boring experience and have successfully completed at least 3 previous auger boring projects within the past 5 years.
- B. Provide access to Engineer and furnish all necessary assistance and cooperation to aid the Engineer in observations, measurements, data, and sample collection, including, but not limited to the following:
 - 1. The Engineer shall have full access to the launch and reception pits prior to, during and following all auger boring operations. This shall include, but not be limited to, visual inspection of installed pipes, and verification of line and grade. Provide safe access in accordance with all safety regulations.
 - 2. The Engineer shall have full access to the bentonite lubrication plant prior to, during, and following all auger boring operations. This shall include, but not be limited to, full access to visually inspect storage and mixing tanks, lubricant pressures and pumping rates, and amount and type of lubricants on site.
- C. Immediately notify the Engineer within 24 hours, in writing, if the Contractor believes the conditions encountered are materially and significantly different than those represented within the Contract Documents.
- D. The Contractor's surveyor responsible for line-and-grade control shall be a Licensed Surveyor registered in the State of Rhode Island who has prior experience in similar projects.
- E. Allowable Ground Surface Settlement or Heave: The Contractor shall repair any settlement or heave resulting from auger boring in accordance with applicable regulations.
- F. The Contractor shall immediately notify the City, in writing, if any problems that would cause a schedule delay or a change to the submitted process/procedure are encountered with equipment or materials.

- G. Launch and Reception pits will be constructed at locations indicated on the drawings and shall conform to all safety requirements and job site constraints. Thrust blocks and foundation pads shall be designed and constructed to withstand the anticipated construction loads. The launch pit foundation must be able to support the tracks, permitting forward and backward movement of the auger boring machine without vertical movement. Launch or reception pits on homeowner properties for lateral connections will not be allowed.
- H. Proper construction of the foundation often requires the use of crushed stone or concrete. Thrust blocks must be square with the alignment of the bore and must be designed to distribute forces over sufficient area so that the allowable compressive strength of the soil is not exceeded with a factor of safety no less than 2.0.
- I. Contact one call center (Rhode Island 911) to mark all utilities 72 hours prior (excluding weekends and holidays) to excavation.

1.5 SUBMITTALS

- A. All submittals shall be made at least 30 days prior to the start of auger boring. Auger boring construction shall not start until all submittals have been reviewed and returned with the designation “no exceptions taken.”
- B. All submittals requiring any civil or structural design shall be signed and stamped by a professional civil or structural engineer registered in the State of Rhode Island.
- C. Qualifications:
 - 1. Provide the name and qualifications of the project superintendent and machine operators, each having a minimum of five years of experience with the type of equipment proposed for the work and have worked on at least 5 previous auger boring projects within the past 10 years.
 - 2. Provide the name and qualifications of the surveyor proposed for the Work. Surveyor shall have a minimum of three years of experience with similar construction.
- D. Submit information describing the auger boring equipment and methods 30 days prior to pit excavation. Also include:
 - 1. Schedule for auger bore work identifying all major construction activities as independent items. The schedule will be required prior to construction and updates shall be provided daily.
 - 2. Material Safety Data Sheets (SDS) for pipe lubricants and any other materials proposed that have an associated SDS.
 - 3. Information defining the proposed auger boring system including:
 - Capacity, number, and arrangement of main jacks.
 - Details of thrust ring, controls, pressure gages, and calibration data for jacks indicating pressure vs. load relationship.

- Recommendations from auger boring equipment manufacturer of required anchoring or backstop for the anticipated soil conditions.
4. Material specifications and shop drawings of casing showing the pipe wall thickness, steel grade, or other material, if used, and the maximum allowable axial force. A pipe certification of compliance shall be submitted.
 5. Plan for installation of instrumentation and monitoring points in accordance with Section 05813, Geotechnical Instrumentation and Monitoring.
 6. Safety plan for auger boring operations in accordance with OSHA standards, including provisions for lighting, ventilation, and electrical system safeguards.
 7. Detail of auger-stop arrangement.
 8. Contingency Plans: The following list includes problem scenarios that may be encountered during auger boring operations. This list is not comprehensive and the Contractor shall include others that may be anticipated. The Contractor shall submit contingency plans for dealing with each problem scenario while satisfying the specifications. These plans shall include the observations and measurements required to clearly identify the cause of the problems, and state when Contractor shall implement actions stated in contingency plans.
 - a. Frictional forces reaching the design capacity of the pipe, auger boring equipment, frame, or anchorages. Contractor shall evaluate the use of a lubrication system, if not already implemented, for this scenario.
 - b. Thrust block deforming excessively under loads due to inadequate ground support behind the thrust block.
 - c. Damaged casing pipe or out of compliance casing pipe during installation.
 - d. Dramatic or sudden increase in torque due to large obstruction at heading.
 - e. Excavated volumes significantly exceeding pipe volume installed.
 - f. Evidence of subsidence, heaving or utility movement.
 - g. Line and/or grade exceeding tolerance.
 9. Descriptions of the carrier pipe insertion equipment and methods.
 - a. Plan for assembly of casing spacer and carrier pipes, and insertion procedure into the casing.
 - b. Submit material specifications, manufacturer information, and installation procedures for casing spacers.
 - c. Submit mix design, supplier information, and installation procedures for backfill grouting.

1.6 SAFETY REQUIREMENTS

- A. Perform Work in accordance with the current applicable regulations of federal, state, and local agencies.
- B. Care shall be taken so that the traveling public, integrity of the road surface and the safety of the workers are not endangered.

1.7 LAUNCH AND RECEIVING PIT REQUIREMENTS

- A. The contractor's work plan shall identify the location, size, depth, layout, and ground support design of the launch and receiving pits as well as the spoil storage areas.
- B. The launch pit shall be of adequate size to meet the operational requirements of the auger unit as well as other components indicated on the drawing.
- C. Where open-cut construction subsequently occurs in the pits used for auger boring, such construction shall be in accordance with the relevant specifications and guidelines.
- D. All excavations shall be protected in accordance with the relevant safety regulations and project requirements. Such protection may include the installation of metal sheeting, shoring and/or bracing as required to adequately support the sides, floor and face of the launch and receiving pits, as well as any other excavation. The pits will be dewatered as required.
- E. In no case shall the pits remain open without appropriate lights and safety barricades, fencing or guardrails. Placement of construction equipment shall not be used in lieu of fencing, barricades and/or guardrails. Pits are to be adequately plated over when not in use.
- F. Portable concrete traffic barriers will be placed around the perimeter of the pits, meeting applicable safety standards providing a barrier from the surrounding roadways. Concrete traffic barriers shall be angled in the direction of the traffic flow; do not place barriers perpendicular to on-coming traffic.
- G. A staircase or ladder shall be provided in accordance with the relevant safety regulations and guidelines. A minimum of two means of egress shall be provided.
- H. Pits which have been excavated for auger boring operations shall be backfilled as soon as the pipe installation is completed and all equipment has been removed and appurtenances have been constructed.

1.8 DESIGN CRITERIA

- A. Use auger boring equipment that is compatible with the subsurface conditions provided in the Geotechnical Report.
- B. Support of excavation shall be in accordance with all relevant regulations and safety requirements.
- C. The auger boring equipment shall be equipped to allow the operator to maintain line and grade within the specified tolerances. Contractor shall check line and grade on a regular basis.
- D. Thrust reaction backstop shall support the maximum anticipated load in accordance with equipment manufacturer's recommendations.

- E. Provide banding by welding a steel band around the top $\frac{3}{4}$ circumference of the outside wall of the leading edge of the first steel casing pipe.
- F. The overcut by the cutting head shall not exceed the outside diameter of the pipe by more than 1 inch.
- G. Auger boring or related activities shall not commence until all submittals related to the work have been approved.

1.9 CRITERIA FOR DETERMINING CASING INSTALLATION LOADS

- A. The casing pipe and pipe joints shall be designed and selected to carry the thrust of the jacks in combination with overburden, earth and hydrostatic loads. Selected casing for dry augering shall be selected to withstand action of auger without damage.
- B. The Contractor shall retain the services of a Professional Engineer to determine design stresses, design deflection and factors of safety for design of the casing. This determination is to be included in the design submittals. The following maximum casing pipe stresses and deflection to the casing will be observed:
 - 1. Design stresses in the steel pipe wall shall be limited to 50% of the minimum yield point of the steel or 18,000 psi, whichever is less, when subjected to the design loads.
 - 2. The maximum allowable deflection of steel casing shall not exceed 3% of the casing nominal diameter.
 - 3. For other casing materials, submit and follow the manufacturer's guidelines for maximum allowable stress and deflection.
 - 4. Use H-20 vehicle loading distribution as criteria for truck loading in accordance with the American Association of State Highway and Transportation Officials (AASHTO).

1.10 DEFORMATION AND SETTLEMENT MONITORING

- A. Instrumentation and monitoring shall be as per Section 05813, Geotechnical Instrumentation and Monitoring, and as shown on the Contract Drawings.

PART 2 – PRODUCTS

2.1 EQUIPMENT

- A. Auger Boring Equipment: Provide auger boring equipment capable to sustain any ground, live loads and any other loads, which may be imposed upon it and the casing pipe as well as any loads imposed by the thrust jack and steering mechanisms.

2.2 MATERIALS

- A. Provide non-toxic, biodegradable pipe lubricants consisting of bentonite, polymers, and/or bentonite/polymer mixtures as required to minimize pipe friction.
- B. Steel casing shall:
 - 1. Be new, smooth wall, straight-seam or seamless, carbon steel pipe which conforms to ASTM Specification A139, Grade A.
 - 2. Have minimum yield strength of 36,000 psi.
 - 3. Casing diameter shall be determined by the Contractor based on their means and methods and submitted for review.
 - 4. Have a difference in roundness between the major and the minor outside diameters not exceeding 1% of the specified nominal outside diameter, or ¼ inch, whichever is less.
 - 5. Have an outside circumference which is within 1% of the nominal circumference, or 0.5 inch, whichever is less.
 - 6. Have an allowable straightness deviation in any 10-foot length of 0.125 (1/8) inch or straighter.
- C. At the Contractor's option, PVC or SceptaCon casing may be pushed into the pilot tube bore and left in place as a casing. The service lateral or main line would subsequently be installed within the casing with appropriate casing spacers and backfill grouted with appropriate backfill grout material. Casing spacers and backfill grouting materials and processes shall be submitted and reviewed with a no exceptions taken designation prior to installation.
- D. The Contractor shall select the casing thickness per Section 1.9 of this specification.

PART 3 – EXECUTION

3.1 GENERAL

- A. Auger boring operations shall be in accordance with the auger boring work plan.
- B. Contractor shall be responsible for locating all underground facilities regardless of the City's previous efforts in this regard. Contractor shall be responsible for all losses and repairs occasioned by damage to underground facilities resulting from auger bore operations. Contractor shall undertake the following steps prior to commencing auger bore operations in a location which might contain underground facilities:
 - 1. Contact one call center (Rhode Island 811) 72 hours prior to work to locate utilities for the construction area.
 - 2. Locate all existing lines, cables, or other underground facilities.
 - 3. Install settlement monitoring as shown on the Drawings and as specified.
 - 4. Modify auger bore practices to prevent damage to existing facilities.

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- C. Do not begin auger boring until the following conditions have been met:
 - 1. Submittals have been made and the Engineer has reviewed and returned them with the notation “No Exceptions Taken” or “Make Corrections As Noted.”
 - 2. Excavation of launch and receiving pits has been completed. Adequate sheeting, shoring and bracing for excavations shall comply with all relevant standards and safety regulations, and be placed and maintained to ensure that work proceeds safely and expeditiously. Upon completion of the required work, the sheeting, shoring and bracing shall be removed to the extent possible without damaging the completed work.
 - 3. Utilities subject to potential settlement have been physically located.
- D. Furnish all necessary equipment, power, water, and utilities for the Work, including pipe lubricant mixing and pumping, conveyance and disposal of spoil, and other associated Work consistent with the methods of construction.
- E. Contractor will provide jacks, mounted on a frame, or against a backstop, of capacity suitable for forcing the excavating auger and casing through the soil or rock formation encountered. Jacks shall be operated in such a manner that the pressure applied to the circumference of the casing is evenly distributed
- F. Contractor will provide steerable front section of casing to allow, at minimum, vertical grade adjustments. Provide water level or other means to allow monitoring the grade elevation of the auger casing. Casing to be jacked on guide rails, while properly braced together and directed in the proper line and grade.
- G. Mount guidance system in a manner that isolates it from effects of movement by the any forces due to installation of the pipeline.
- H. Excavate within the easements and rights-of-way, to the lines and grades designated on the Drawings, and utilize methods which include due regard for safety of workers, adjacent structures, utilities and the public.
- I. During construction operations, and until the work pits are backfilled and fill material compacted, traffic barricades and warning lights to safeguard traffic and pedestrians shall be furnished and maintained by the Contractor.
- J. Gasoline powered equipment, if used in jacking and receiving pits, shall comply with OSHA requirements for ventilation and protection of workers in the excavation.

3.2 AUGER BORING

- A. Jack each pipe section forward as the excavation progresses in such a way to provide adequate ground support at all times. Provide a thrust frame capable of developing a uniform distribution of jacking forces around the periphery of the pipe.
- B. Provide a lubrication system if required to prevent pipe binding or stoppage.

- C. Perform auger boring operations in a manner that will maintain the stability of the heading, and minimize loss of ground and settlement of the ground surface. Use of water to facilitate removal of spoil is permitted; however, water jetting or spraying water into or on the heading is not allowed. Prevent over-excavation of the site soils by taking actions as necessary to prevent uncontrolled flow of soils and water into casing pipe.
- D. The leading edge of the pipe shall extend beyond the leading edge of the auger at all times.
- E. During auger boring operations, monitor and report the information including advancement rate per hour, soil conditions encountered, volume of material excavated, maximum thrust force exerted by the machine for each pipe segment and any obstacles encountered in the daily log. Reporting of this information does not relieve the Contractor of its responsibility as stated in these documents, nor does it place on the Engineer responsibility for control and protection of the work.
- F. An auger stop ring shall be used to prevent the auger from proceeding ahead of the casing and over-excavating the soil.
- G. In unconsolidated soil formations, a drilling fluid containing at least 10% of high yield, fully hydrated bentonite shall be used to seal the voids outside the wall of the casing pipe, and to provide lubrication for the installation of the pipe.
- H. Contractor shall repair pipe that has been damaged during installation in place with the approval of the Engineer. The damaged pipe shall not be repaired until a procedure for repair has been submitted and approved. Begin procedure as soon as possible after the pipe damage is discovered to minimize problems caused by not moving the pipe string. Any pipe damaged beyond repair, or where inadequate repairs have been performed shall be removed and replaced by the Contractor at no additional cost to the Town.
- I. Control Line and Grade to the tolerances specified.
 - 1. The final position of the pipe may vary laterally from the design alignment by an amount equal to or lesser than 1% of the installed length of the pipe, but no more than ± 24 inch. The maximum permitted vertical deviation is ± 12 inch. Such variations must be regular and only in one direction. A water level or a similar device shall be used to facilitate vertical control of the pipe.
- J. To the extent possible, the augering operation will be performed without interruptions to minimize the likelihood of the carrier pipe getting stuck in the ground.
- K. After completing Work, provide the Engineer with access to both pipe ends for visual inspection of the line and grade of the completed pipe installation.
- L. Contaminated lubricants shall be disposed of at an approved site licensed to accept this material. Non-contaminated lubricants shall be disposed of at an approved landfill site or an alternate approved site as arranged by the Contractor.

- M. If sinkholes, crevices, or open solution features are encountered during construction (regardless of excavation method being used), repair will have to be made, the specifics of which should be determined on a case-by-case basis by the ENGINEER based on actual conditions.
- N. Any significant crevices or open solution-features exposed in the rock (either in the bottom or sidewall of the excavation) may need to be sealed with concrete prior to placing fill.

3.3 FIELD JOINTS

- A. Connecting adjacent pieces of steel pipe during auger boring operations shall be achieved by continuous butt-welding at the joints for creating a rigid water-tight encasement or by integral press fit connectors, as long as the expected installation loads and the installation design criteria are met or exceeded.
- B. Field butt-welding a square end of a steel pipe to a 30-degree beveled end of steel pipe is acceptable unless otherwise specified.

3.4 CLEANUP, TESTING AND INSPECTION

- A. The Contractor shall remove all construction debris, spoil, oil, grease, and other materials from the installed pipeline. Cleanup will be incidental to the construction. No separate payment shall be made for the cleanup.
- B. Acceptance of the Work:
 - 1. Submit as-built drawings of the installed casing

3.5 INSTALLATION AND GROUTING

- A. Backfill grout for annular space: The service lateral or main line would subsequently be installed within the casing with appropriate casing spacers and backfill grouted with appropriate backfill grout material. Casing spacers and backfill grouting materials and processes shall be submitted and reviewed with a no exceptions taken designation prior to installation.

3.6 OBSTRUCTIONS OR CHANGED CONDITIONS

- A. If an obstruction is encountered which stops the forward progress of the work, the cause of the stoppage shall be determined. When the cause has been determined, the installation method shall be modified to suit the conditions encountered. The contractor will notify the Engineer in writing and will receive an approval in writing for the proposed modifications. Refer to the General Conditions Article 25 for differing site conditions information.

END OF SECTION

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SECTION 05811

PILOT TUBE – TRENCHLESS INSTALLATION

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The work specified in this section includes installation of steel casing pipe by pilot tube trenchless method(s) selected by the *Contractor*, at the locations shown on the Drawings. The work requires furnishing all materials and equipment necessary for installation of the steel casing for the sewer laterals, which will be 1-1/4-inch HDPE pipe, or installation of the main sewer line.
- B. The excavated diameter of the pilot tube shall be determined by the Contractor based on its selected construction means, methods and equipment, subject to the limitations as shown on the Drawings or stated elsewhere in the Specifications. Excavate the pilot tube to the selected size; to the line and grade to allow the steel casing pipes to be placed using pipe jacking methods to the line indicated on the Drawings; and to within the tolerances specified herein.
- C. Launch and reception pits for drilling operations shall only be located within pre-determined pits shown on the plans or within the predetermined trench line on Tidewater Drive. These pits shall be created using a flat blade on a backhoe. Reception pits on homeowner properties for lateral connections will not be allowed.
- D. If pilot tube trenchless installation is selected by Contractor for lateral installation the lateral shall be installed from the launch pit without excavation of a reception pit. In this case, the pilot tube bit and drill string will be pulled back and replaced with a rigid casing, such as steel, PVC, or IPEX SceptaCon, which would be left abandoned in the hole. The drill string will be used as casing for the installation of the 1 ¼ inch HDPE service lateral.

1.2 RELATED SECTIONS

- A. Section 05610 – Sanitary Sewers Trenchless Technologies
- B. Section 05813 – Geotechnical Instrumentation and Monitoring

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. ANSI/AWS D.1.1 – Structural Welding Code
- B. American Society for Testing and Materials (ASTM):
 1. ASTM A36 – Standard Specification for Carbon Structural Steel
 2. ASTM A51 – Standard Specification for Quenched Alloy-Steel Track Bolts
 3. ASTM A139 – Standards Specification for Electric-Fusion (Arc)-Welded Steel Pipe.
 4. ASTM A572 – Standard Specification for High-Strength Low-Alloy Columbian-Vanadium Structural Steel

- C. American Water Works Association (AWWA).
- D. Occupational Safety and Health Administration (OSHA).
- E. American Society of Civil Engineers (ASCE) Pilot Tube and other Guided Boring Methods, 2017.

1.4 SYSTEM DESCRIPTION

- A. Performance Requirements:
 1. The pilot tube trenchless method shall be capable of installing the main sewer line and lateral casings as shown on the Drawings and in the ground types and groundwater conditions described in the Geotechnical Report.

1.5 SUBMITTALS

- A. All submittals are required at least 30 days prior to the start of pilot tube construction, with the exception of construction records submittals and survey data, which are to be submitted as indicated below.
- B. Qualifications: Submit written documentation of company and key personnel experience in accordance with Paragraphs 1.6.A through 1.6.C. Include resume, name, address, telephone numbers and license numbers for surveyor and engineer for approval before starting work. Submit resumes for superintendent(s) and pilot tube equipment operator(s) for approval before starting work.
- C. Submit a detailed description of pilot tube trenchless equipment, including methods and sequencing for installing all crossings shown on the Drawings.
 1. Shop Drawings
 2. Furnish Shop Drawings and calculations for the layout of the of the pressure sewer.
 3. Furnish Shop Drawings and material specifications for the sewer line connection design and materials.
 4. Design calculations demonstrating that the casing pipe is capable of sustaining the maximum stresses to be imposed during jacking. The calculations shall take into account maximum anticipated ground loads (earth, groundwater and surcharge pressure), live loads, jacking forces, eccentric forces due to steering, and any other loads that may be reasonably anticipated. All loads shall be shown and described.
 5. Calculations showing pipe resistance to damage from backfill grouting of carrier pipe.
 6. Calculations showing the hydraulic pressure that is required to develop the maximum allowable jacking force for main jacks and intermediate jacking stations (if used). A description of controls to ensure that the maximum allowed hydraulic pressure will not be exceeded during jacking operations. Calculations demonstrating that the ground behind the backstop (or thrust wall), as well the selected shoring method for the pit walls behind the thrust block, will sustain the maximum forces developed by the main jacks.
 7. Calculations showing anticipated face pressure and side resistance for pilot tube machine and pipe string, including an analysis of intermediate jacking station (if used) placement

and utilization plan.

8. Calculations determining ground settlement curves and ground losses associated with the selected trenchless method along the length of the alignment.
9. Submit material specifications, manufacturer information, and installation procedures for casing spacers.
10. Submit mix design, supplier information, and installation procedures for backfill grouting.

D. Contingency Plan for the Following Scenarios:

1. High Jacking Forces.
2. Damaged Pipe.
3. Obstruction(s).
4. Surface Settlement.
5. Major mechanical breakdown.
6. Stoppage of jacking.
7. Leakage.

E. Daily Records: as per Section 1.7 of this specification.

F. Provide sufficient detail in all submittals to allow the Engineer to judge whether or not the proposed equipment, materials, and procedures will meet the requirements of the Contract Documents. All drawings shall be legible with dimensions accurately shown and clearly marked in English. Drawings and photographs transmitted by a facsimile will not be accepted. The Engineer's review of submitted details and data will be based on consideration of requirements for the completed work, utilities, and the possibility of unnecessary delays in the execution of the work to be constructed under these Contract Documents.

1.6 QUALITY CONTROL

- A. Employ a land surveyor registered in the State of Rhode Island and acceptable to the Engineer.
- B. Employ a professional engineer registered in the State of Rhode Island of the discipline required for specific service on the project
- C. Provide proof that the *Contractor* has completed at least three (3) trenchless projects involving installation of pipes with similar diameters and methodology to that proposed for this work for a distance of 200 feet each and through subsurface and groundwater conditions similar to those expected for this work. This prior experience must have taken place within the past five (5) years.
- D. The *Contractor* shall provide at least seventy-two (72) hours advance written notice to Engineer of the planned inception of the trenchless work. The *Contractor* shall immediately notify the Engineer, in writing, when any problems are encountered with equipment or materials, or if the *Contractor* believes the conditions encountered are materially and significantly different than those represented within the *Agreement* Documents. All work by the *Contractor* shall be done in the presence of the Engineer, unless the Engineer grants prior written approval to perform such work in Engineer's absence.

- E. Contact Dig Safe (811) to mark all utilities 72 hours prior (excluding weekends and holidays) to excavation.
- F. The Engineer and the Owner shall have full access to the all pilot tube trenchless installation equipment, pits, and all other instrumentation prior to, during, and following all pilot tube trenchless installation operations.
- G. The Engineer and the Owner shall have access to all data logs generated by equipment, daily logs to be submitted for each shift, no later than the next working day.

1.7 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work.
 1. Daily Records: The following daily records shall be submitted by the Contractor by noon on the day following the shift for which the data or records were taken, to the on-site Engineer for review.
 2. Jacking Records: The Contractor shall provide complete written jacking records to the Engineer. These records will include, at a minimum, date, time, name of operator, trenchless drive identification, installed pipe number and corresponding length along the drive, rate of advance, jacking forces, cutter head speed and torque. At least seven (7) days prior to the launch of the machine, the Contractor shall submit samples of the jacking logs or records to be used.

PART 2 PRODUCTS

2.1 STEEL CASING

- A. Steel casing shall be designed by the Contractor. For service line installation, the steel casing shall be considered the abandoned drill string through which the HDPE service line will be installed by advancing it from the jacking pit. For the main line, the steel casing shall be a casing pulled into the bore after the pilot tube and any successive reaming passes that may be necessary. In either case, the casing shall be designed per the specifications herein.
- B. Steel Casing Design:
 1. The casing pipe and pipe joints shall be designed and selected to carry the thrust of the jacks in combination with overburden, earth and hydrostatic loads. Selected casing for dry augering shall be selected to withstand action of auger without damage.
- C. Steel Casing Materials:
 1. For pilot tube trenchless installation, steel casing shall be steel pipe specifically designed by the pipe manufacturer for the installation selected by the Contractor as specified below.
 2. The minimum outside diameter and wall thickness for the steel casing shall be in accordance with the Drawings for the specific installation detailed.
 3. Steel pipe shall be new, smooth wall carbon steel pipe which conforms to ASTM A-36; ASTM A 139, Grade A; ASTM A51 5, grade 60; or ASTM A572, grade 42.
 4. Steel pipe shall have a minimum yield strength of 36,000 psi.

5. All steel pipe shall be square cut.
 6. Steel pipe shall have roundness such that the difference between the major and minor outside diameters shall not exceed 0.5 percent of the specified nominal outside diameter or 6mm, whichever is less.
 7. Steel pipe shall have an outside circumference which is within 0.5 percent of the nominal circumference.
 8. Steel Pipe may be connected in lieu of welding with an integral machine press-fit connection; Permalok® or equal.
 9. Coating and linings are not required on the steel casing pipe.
- D. The service lateral or main line would subsequently be installed within the casing with appropriate casing spacers and backfill grouted with appropriate backfill grout material. Casing spacers and backfill grouting materials and processes shall be submitted and reviewed with a no exceptions taken designation prior to installation.

2.2 ALTERNATIVE CASING MATERIALS

- E. At the Contractor's option, PVC or SceptaCon casing may be pushed into the pilot tube bore and left in place as a casing. The service lateral or main line would subsequently be installed within the casing with appropriate casing spacers and backfill grouted with appropriate backfill grout material. Casing spacers and backfill grouting materials and processes shall be submitted and reviewed with a no exceptions taken designation prior to installation.

2.3 EQUIPMENT

- A. Pilot tube equipment shall be used to install the water, sewer and storm lines as shown on the Drawings.
- B. The pilot tube equipment shall be manufactured by one (1) of the following.
1. Akkerman, Inc. of Brownsdale, MN.
 2. The Robbins Company of Solon, OH
 3. Icon Group of East Brunswick, NJ.
 4. Wirth/Soltau Services, Inc. of N. Charleston, SC.
 5. Herrenknecht of Auburn, WA.
 6. Or Approved equal.

PART 3 EXECUTION

3.1 PILOT TUBE INSTALLATION

- A. Set up the pilot tube equipment in the launch pit(s) as shown on the Drawings. Operation for any trenchless installation shall not commence until both the jacking pit and receiving pit (if used) have been completed.
- B. The installation shall be conducted continuously, on a 24-hour basis until completion of the

pilot tube and jacking operation of any single drive has been completed.

- C. The Contractor shall not begin pilot tube installation until the following conditions have been met:
1. All required submittals have been provided, reviewed and accepted.
 2. All notices, permits, licenses are obtained and/or given.
 3. A preconstruction safety conference has been conducted. This conference must be arranged and the Engineer notified of the date at least seven (7) days in advance of the conference.
 4. The location, orientation and grade of the jacking frame or guide rails and entry/exit seals for the planned drive have been surveyed to ensure they are on the proper line and grade and to verify that they are properly supported. Special care shall be taken when setting the guide rails and jacking frame/elements to ensure stability and correctness of the alignment and grade. Guide rails or jacking frame/elements shall be securely attached to the pit supports or concrete working slab, with supplementary braces, piles, concrete, or grout if necessary, to prevent movement or shifting during the work. Guidance system shall be calibrated and verified to start operation with required accuracy.
 5. Site safety representative has prepared a code of safe practices and an emergency plan in accordance with OSHA and other applicable requirements. Provide the Engineer and The Owner with a copy of each prior to starting pipe jacking.
 6. All specified geotechnical and structural instrumentation and monitoring required for the planned drives has been installed, approved, and baselined in accordance with Section 05813 – Geotechnical Instrumentation and Monitoring.
- D. Conduct all operations so as to not create a mud, dust, or noise nuisance in the streets and to adjacent properties. Promptly clean up, remove, and dispose of mud or spoil spillage.
- The Contractor shall survey the location and orientation of the jacking frame guide rails prior to start of jacking operations for each trenchless drive, to ensure they are on the proper line and grade. Results of these surveys shall be submitted to the Engineer prior to beginning jacking operations.
- E. The Contractor shall ensure that the axial forces from the main jacks shall be distributed to the pipe uniformly to prevent damage to the ends of the pipe.
- F. Thrust Blocks: Special care shall be taken when setting the jacking frame guide rails in the jacking pit to ensure correct alignment and grade, and to ensure stability of the frame. If a concrete thrust block is used, concrete or other materials shall have attained the required strength before jacking begins.
- G. Ground surface settlement or heave above the pipeline centerline and within the zone influenced by the pilot tube construction shall be monitored in accordance with SECTION 05813, Geotechnical Instrumentation and Monitoring, and shall be limited to the tolerances as specified. The Contractor shall repair any damage resulting from surface settlement or heave caused by pilot tube installation at no additional fee to the Owner. The Contractor shall pressure grout any voids caused by or encountered during the pilot tube installation.
- H. Install the pilot tube at the line and grade show on the Drawings or as approved in the submittals.

- I. Enlarge the pilot tube to the selected diameter for each main line and service line installation by the trenchless method selected by the Contractor.

3.2 STEEL CASING PIPE INSTALLATION

- A. Methods: The Contractor shall install steel casing using pilot tube methods and equipment as defined and specified in this section and as outlined in the Contractor's Approved Submittal.

- B. Cleaning and Testing:

- 1. Cleaning:
- 2. Upon completion of the Work of this Section, remove all rubbish, trash, and debris resulting from operations. Remove all intrusive materials, oil, and grease.
- 3. Clean and disinfect pipe after removal of bulkheads has been completed.
- 4. Casing shall be visually inspected by the Engineer after completion of the pipe jacking operation. No visible leakage will be allowed. Visible leakage will be repaired per manufacturer's recommendation.

- C. Inspection

- 1. All work done under this section shall be subject to inspection and acceptance by the Engineer.

- D. Repairs

- 1. All damage detected shall be repaired in accordance with the requirements of the Agreement, and the requirements of the pipe and/or joint manufacturer

3.3 SAFETY

- A. The Contractor is responsible for safety on the job site. Methods of construction shall be such as to ensure the safety of the work, Contractor's and other employees on site, and the public. Perform all work in accordance with all current applicable regulations and safety requirements of Federal, State, and local agencies. In the event of conflict, comply with the more stringent requirements.

- B. When personnel are underground, furnish and operate a temporary ventilation system, and air and dust monitoring systems including continuous monitoring of hazardous, toxic, flammable, or explosive gases conforming to the requirements of OSHA. Operate and maintain a ventilation system that provides a sufficient supply of fresh air and maintains an atmosphere free of hazardous, toxic, or flammable gasses in all underground work areas.

- C. All work shall conform to the requirements of OSHA. Gas testing shall be performed accordance with OSHA requirements.

- D. No gasoline-powered equipment shall be permitted in jacking and receiving pits or trenchless drive at any time. Diesel, electrical, hydraulic, and air powered equipment is acceptable, subject to applicable local, State, and Federal regulations.

SECTION 05812

HORIZONTAL DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 DESCRIPTION OF GENERAL REQUIREMENTS

- A. The Contractor shall provide all necessary tools, materials and equipment to successfully complete the installation of directionally drilled piping as specified herein and shown on the drawings. The Contractor shall be responsible for the selection of all tooling including steering and guidance systems, the final constructed product, and for furnishing the qualified labor and supervision necessary for this method of construction.
- B. The Contractor shall furnish all items necessary to perform the horizontal directional drilling operation and construct the pipe to the lines and grade shown on the drawings.
- C. Boring must use techniques of creating or directing a borehole along a predetermined path to a specified target location. This must involve use of mechanical and hydraulic deviation equipment to change the boring course and must use instrumentation to monitor the location and orientation of the boring head assembly along a predetermined course.
- D. Drilling must be accomplished with fluid-assisted mechanical cutting. Boring fluids shall be a mixture of bentonite and water or polymers and additives. Bentonite sealants and water will be used to lubricate and seal the borehole. It is mandatory that minimum pressures and flow rates required to successfully complete the boring operation be used during drilling operation. Maximum allowable pressures shall be calculated and adhered to as not to fracture the sub-grade material around and/or above the bore.
- E. The mobile drilling system shall utilize small diameter fluid jets and/or mechanical cutters to cut and excavate the soil as the head advances forward.
- F. Steering shall be accomplished by the installation of an offset section of drill stem that causes the cutterhead to turn eccentrically about its centerline when it is rotating. When steering adjustments are required, the cutterhead offset section is rotated toward the desired direction of travel and the drill stem is advanced forward without rotation.
- G. Launch and reception pits for drilling operations shall only be located within pre-determined pits shown on the plans or within the predetermined trench line on Tidewater Drive. These pits shall be created using a flat blade on a backhoe. Reception pits on homeowner properties for lateral connections will not be allowed. If HDD is selected by Contractor for lateral installation, laterals must be drilled and installed from the launch pit.

1.2 DESCRIPTION OF ARCHEAOLOGICAL GENERAL REQUIREMENTS

- A. Excavations to facilitate drilling operations shall only be located within the pre-determined pits shown on the plans or within the predetermined trench path along Tidewater Drive.
- B. Excavations to facilitate drilling operations may be placed within areas indicated as "IDENTIFIED FEATURE" on the Plans or within the Archaeological Report with prior approval of Archeologist,

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Engineer and Owner. Contractor shall provide the Archeologist, Engineer, and Owner a minimum 14-day notice for review and approval of such work.

- C. Prior to the start of work, the Engineer and Archeologist and Contractor shall mark the limits of all “CRITICAL IDENTIFIED FEATURES”. Excavations to facilitate drilling operations shall not be performed within these identified areas. All work proposed to be performed within 50 feet of a critical identified feature on the Plans or within the Archaeological Report shall be submitted for approval prior to the start of work for review and approval by the Archeologist, Engineer and Owner.
- D. Contractor shall notify the Archeologist, Engineer, and Owner of any additional excavations which may be required outside of the predetermined pits and trenches to facilitate work. The Engineer and Owner shall review and determine if the excavations are required and necessary to facilitate work. If determined necessary to complete work, the cost for archaeological investigations shall be borne by the Owner. If the excavations are determined to be for the general benefit and convenience of the Contractor, the cost shall be borne the Contractor. Contractor shall provide a minimum 21day notice to the Owner for additional excavations outside of the predetermined pits and trenches.
- E. Prior to work on Mayor Lane, archaeological investigations shall be scheduled and completed.

1.3 DESCRIPTION OF WORK

- A. The Contractor’s bid shall Include all horizontal directional drilling, installation of product pipe, furnishing labor, materials, services, equipment, incidentals, technical services, and all other related work necessary to complete the following:
 1. Field locate and protect all existing utilities.
 2. Submittals included in this specification and elsewhere in the Contract Documents.
 3. Preparation of site including excavation and backfill of access pits and slurry containment pits, removal of vegetation, earthwork, topsoil stripping, excavating, rock excavation, obstruction removal, and grading to obtain required finish contours and elevation.
 4. Drill a horizontal directionally drilled pilot bore and ream borehole as needed to required tolerances.
 5. Contain all drilling mud and ensure no spillage enters any body of water over land or through hydro-fracture.
 6. Monitor horizontal and vertical location of drill path, and ensure the constructed bores follow the design profile and remain within the project’s right-of-way.
 7. Installation of casing pipes and product pipes.
 8. Testing of installed product pipe sections.
 9. Restoration of all affected surfaces to their preconstruction conditions or as outlined in the contract documents.
 10. Removal of all drilling fluids and spoils from the construction area, and transporting them to an approved disposal site.

1.4 RELATED DOCUMENTS AND SECTIONS

- A. The Contract Documents, as defined in Section 01010 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
- B. Related Sections:
 1. Section 03350 - Excavation and Fill

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2. Section 05610 – Sanitary Sewers Trenchless Technologies
3. Section 05813 – Geotechnical Instrumentation and Monitoring

1.5 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.
- B. The following American Water Works Association (AWWA) standards form a part of this specification as referenced:
 1. AWWA C906 Polyethylene Pressure Pipe and Fittings, 4 In. Through 63 In. for Water Distribution and Transmission.
- C. The following American Society for Testing and Materials (ASTM) standards form a part of this specification as referenced:
 1. ASTM F714 Standard Specification for Polyethylene (PE)
 2. ASTM D3350 Plastic Pipe (SDR-PR) Based Outside Diameter. Standard Test Method for Polyethylene Pipe and fitting Materials
 3. ASTM F1962, “Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of PE Pipe or Conduit Under Obstacles, Including River Crossings,”
- D. American Petroleum Institute (API), RP 13B-1, Recommended Practice for Field Testing Water-Based Drilling Fluids.
- E. American Society of Civil Engineers (ASCE), Manual of Practice 108, “Pipeline Design for Installation by Directional Drilling.”
- F. American Association of State Highway and Transportation Officials (AASHTO).
- G. Occupational Safety and Health Administration (OSHA) requirements.

1.6 DEFINITIONS

- A. Contractor's Construction Drawings: Shall be defined as drawings by which the Contractor proposes to construct the referenced item. The submission of these drawings shall be required for the sole purpose of providing sufficient detail to verify that the Contractor's work in progress is in accordance with the intent of the design.
- B. Frac-out: Release of drilling fluid to ground surface, waterways, or utilities as a result of drilling fluid pressure in excess of that pressure required to fracture or permeate the ground.
- C. Horizontal Directional Drilling: A trenchless, steerable installation method of using a drilling machine to bore a small diameter pilot hole. Pilot hole is bored by either controlled fluid jetting or fluid assisted mechanical cutting or combinations thereof. Pilot hole is reamed, as necessary, to accommodate product pipe. Where allowed, product pipe is pulled back into reamed hole by drilling machine. Installed product pipe is cleaned and prepared for testing and operation.
- D. Launch Pit: Excavation for initiating HDD pilot bore where HDD drill rig is positioned.
- E. Reception Pit: Excavation for receiving HDD pilot bore and for initiating product pipe pull back.

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- F. Returns and Spoils: Drilling mud and cuttings collected at the entry and exit pits, as well as any fluid which escapes from the borehole to the surface, or spilled during mixing, handling or hauling operations.

1.7 SUBMITTALS

- A. The Engineer will base the review of submitted details and data on the requirements of the completed work, safety of the work in regards to the public, potential for damage to public or private utilities and other existing structures and facilities, and the potential for unnecessary delay in the execution of the work. Such review shall not be construed to relieve the Contractor in any way of his responsibilities under the contract or of the Contractor's responsibility for construction site safety. Contractor shall not commence work on any items requiring Contractor's construction drawings or other submittals until the drawings and submittals are reviewed and accepted by the Engineer and by the Owner.
- B. The drawings, cut sheets, and descriptions submitted as part of these requirements shall be sufficiently detailed to demonstrate to the Engineer whether the proposed materials and procedures will meet the requirements of this specification and design drawings.
- C. The Contractor shall submit the following items at least twenty-one (21) days before start of construction:
1. List of qualified subcontractors to be used including contact names, addresses, and telephone numbers.
 2. Detailed schedule of Work including:
 - a. Pipe product delivery and fabrication.
 - b. Pipe string connection and testing.
 - c. Drill mobilization and setup.
 - d. Pilot hole drilling/boring and reaming.
 - e. Pipe product pulling.
 - f. Final pipe inspection and testing.
 - g. Record drawing preparation.
 - h. Demobilization and restoration.
 - i. Disposal of excess drilling fluids and drill/bore cuttings and method of transporting drilling fluids and cuttings offsite.
 3. Working plans showing general arrangement of the following:
 - a. Work, storage, staging, and pipe stringing areas.
 - b. Maintenance of traffic and site access during pipe jointing.
 - c. Laydown areas showing locations of drill entry and exit points.
 - d. Drilling fluids mixing/storage tanks
 - e. Slurry recycling plant.
 - f. Drilling equipment.
 - g. Pollution prevention measures.
 - h. Layout profile and supports for pits, conductor casings (if used), and other excavations required to drill and install the pipe.
 4. Detailed working plans and analyses including:
 - a. Plan/profile along pipe drill path plotted at scale no smaller than that used in the design drawings.
 - b. Entry and exit locations and angles.
 - c. Conductor casing size (if used), thickness and alignment with details and dimensions of

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- cutting shoe.
 - d. Bending radii, horizontal and vertical.
 - e. Length of drives
 - f. Depth of cover
 - g. Clearance from existing piles, pipelines, encasements and structures.
 - h. Buoyancy control procedures.
 - i. Pipe stress analysis for the alignment described on the working plans above, indicating adequate factor of safety in accordance with manufacturer's recommendations and standards referenced herein.
5. Provide equipment specifications and manufacturer's operating manuals for the proposed drill rig, recycler, mud motor(s), and any other major equipment to be used during the drilling operations along with the Contractor's previous project experience (with references) with this equipment or equipment with similar size/capacity.
 6. Reaming Head Description, Cutters and Size: Describe reaming procedure and method of monitoring drill fluid viscosity, density and pressure to prevent frac-out and excess ground movements. Submit proposed overcut (i.e., size of largest reamer).
 7. Description and measurements of drill rod and drillhead.
 8. Description of how pilot hole drill will be steered and how position and inclination of bore head will be monitored; include type, operating range, and degree of accuracy of tracking equipment. This submittal shall include a plan for accurately locating drill path during drilling operations and measurement frequency and accuracy of proposed guidance system as stated by manufacturer.
 9. Drilling Fluids:
 - a. Complete list of all drilling fluids, additives, and mixtures to be used along with Material Safety Data Sheets and composition of drilling fluids and additives.
 - b. Describe how drill fluid viscosity, density and pressure will be monitored.
 - c. Describe fluid seal at entry pit conductor casing, if used.
 - d. Planned density and viscosity ranges.
 - e. Describe how drill fluid viscosity, density and pressure will be monitored.
 - f. Target maximum drilling fluid pressure at bore station intervals of fifty feet or less.
 - g. Calculations showing a factor of safety of 1.5 or more against frac-out or heave. In cases where this factor of safety cannot be met, a clean up plan will need to be submitted and returned with no exceptions taken prior to construction.
 10. Drilling Fluids Management Plan:
 - a. Identify water source water for mixing drilling mud.
 - b. Method of slurry containment, including sketches and systems and fluid seal at entry pit conductor casing if used.
 - c. Method of cutting removal and recycling drilling fluid during hole boring and reaming.
 - d. Method of transporting drilling fluids and cuttings offsite, including anticipated total volume and type and frequency of truck traffic.
 - e. Identify approved disposal site for drilling mud and spoils.
 - f. Estimate anticipated daily volume to be held on-site overnight.
 11. Product pipe assembly plans, including, welding/fusing equipment and procedures, lay down, pull guides, and rollers.

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12. Pipe catalog information confirming pipe, fittings, joints, and other materials confirm to requirements of this section.
 13. Drawings of connection details at ends of each directional drill.
 14. Drilling Fluid Management and Contingency Release Plan describing means and methods for:
 - a. Containment, collecting and disposal of drill fluid, spoils and returns during the project.
 - b. Equipment and materials, included site specific Drill Fluid Spill Kit, and procedures to contain and remove inadvertent drill fluid releases, including surface seepage, both on land and in a body of water.
 - c. Monitoring and testing procedures when drilling beneath a waterway.
 - d. Procedure for shutdown of drilling operations once a release has been detected at the surface.
 - e. Procedure for restarting the drilling operations once the release has been contained and both mitigation measures and future release containment at the release location have been established.
 15. Contingency plan for the following potential situations:
 - a. Loss of drilling fluid circulation.
 - b. Obstruction encountered during drilling or reaming.
 - c. Broken drill pipe.
 - d. Collapsed or buckled product pipe.
 - e. HDD fails to advance or fails to respond to steering actions.
 - f. Failure to maintain grade and when alignment derivations are more than allowable limits.
 - g. Installation (pull back) forces reach 80 percent of the manufacturer's maximum allowable force.
 - h. Ground settlement/heave exceeding allowable limits.
 - i. Archeological debris within returns at entry pit.
 16. Fuel and Hydraulic Fluid Containment and Contingency Plan.
 17. Submit material specifications, manufacturer information, and installation procedures for casing spacers.
 18. Submit mix design, supplier information, and installation procedures for backfill grouting.
- D. Informational Submittals:
1. Preconstruction and post construction surveys including photographs, videotapes, field notes, and sketches as specified herein. Submit within one week of development.
 2. Pipe manufacturer's fused jointing and testing instructions. Submit prior to mobilization to the site.
 3. Field Surveys, as required: Plot survey results on drawing with scale no smaller than that used for Enlarged Plan and Profile Drawings in Contract Documents. Show proposed changes to alignment of profile.
 - a. Field survey information from end of each installation and datum for establishing location of installation.
 - b. Entry and exit locations.

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4. Daily drilling log within 24 hours of daily completion, including predrilling field calibration, raw data record (i.e., head position, drilling fluid data, borehole pressure) and location of anomalies or frac-outs as described in Part 3 of this specification.
5. Record Drawings updated at each application for payment and finalized prior to contract closeout. These shall contain the following components:
 - a. Description of tools actually used on installation if they differ from what was contained in approved submittal.
 - b. Tool operators' records including predrilling field calibration, raw data record (head position, fluid data) and location of anomalies or frac-outs.
 - c. Interpretation analysis of raw data, plan and profile, and deviations to original installation plan.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle pipe during loading, transportation, and unloading so as to prevent injury to or abrasion of pipe.
 1. Pipe shall not be dropped from vehicles, nor allow pipe to roll down skids or slopes without proper restraining ropes.
 2. Pipe and fittings shall be handled by wide belly band slings as recommended by pipe manufacturer to avoid damage to pipe. Bare chains shall not be used in contact with pipe
 3. Inspect fabricated materials for damage. Replace materials found to be defective in manufacture or damaged in handling during and after delivery including the furnishing of material and labor required for the replacement of installed products found to be defective.
- B. Storage:
 1. Use suitable pads, strips, skids or blocks for each pipe during transportation and while awaiting installation.
 2. Store and protect pipe at storage area designated on Drawings or other areas approved by Engineer.

1.9 SAFETY AND COMPLIANCE

- A. Safety Requirements:
 1. Perform work in a manner to maximize safety and reduce exposure of men and equipment to hazardous and potentially hazardous conditions, in accordance with applicable safety standards, including OSHA standards.
 2. Whenever there is an emergency or stoppage of work which is likely to endanger the excavation or adjacent structures, operate a full work force for 24 hours a day, including weekends and holidays, without intermission until the emergency or hazardous conditions no longer jeopardize the stability and safety of the work.
 3. The work will be performed in conformance with authorities having jurisdiction, and will conform to all applicable health and safety regulations.
 4. The Contractor shall follow all safety measures recommended by the drill rig manufacturer.
 5. The drill rig shall be equipped with a common grounding system to prevent electrical shock in the event of inadvertent strike of underground electrical cable. The grounding system shall be connected to all pieces of interconnecting machinery; namely, the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats, and any other interconnected equipment, to a common ground.

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6. The drilling rig shall be equipped with an "electrical strike" audible and/or visual warning system that notifies the system operators of an electrical strike.
- B. Air Quality: Conduct directional drilling operations by methods and with equipment, which will positively control dust, fumes, vapors, gases or other atmospheric impurities in accordance with applicable safety requirements.
- C. The contractor shall abide by bylaws and regulations of the State, County, and/or Municipality in which the work is located.
- D. Obtain any and all other permits required for prosecution of the work.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Refer to Section 05610 for HDPE pipe material.

2.2 HDD EQUIPMENT

- A. General: Sized to complete installation of proposed alignment with due consideration of ground conditions, down-hole tools, drilling fluid additives, drilling technologies, size of final product pipe, and length of bore.
- B. Features: The contractor shall be responsible for the directional drilling method and equipment.
- C. The drilling rig shall be sized to complete installation of proposed alignment with due consideration of ground conditions, down-hole tools, drilling fluid additives, drilling practices, size of final product pipe, and length of bore.
- D. The drilling rig shall have a system to monitor and record maximum pullback force during the pullback operation.
- E. The drilling rig shall have an anchorage system to anchor drilling machine to the ground to resist thrust and pull forces during operation.
- F. A swivel shall be used to connect pull section to drill steel to minimize torsional stress imposed on pulled pipe.
- G. Break-aways are to be used on all directional drills to avoid overstressing the pipe. Exceptions will be subjected to approval of the Engineer.
- H. Drill fluid system shall have filters in-line to prevent solids from being pumped into the drill pipe.
- I. Drill fluid system shall have connections between the pump and drill pipe that are relatively leak-free.

2.3 DRILLING FLUID MIXING TANK

- A. Volume of holding tank to supply at least 30 minutes of full pumping capacity.
- B. HDD equipment shall maintain a minimum pumping capacity to provide sufficient quantity of drilling

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fluids exceeding targeted flow volume for all phases of the operation.

- C. Provide in-line flow meter to determine drilling fluid discharge.
- D. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure adequate mixing.
- E. Mixing system shall continually agitate the drilling fluid during drilling operations.

2.4 TRACKING SYSTEM

- A. The steering tool/guidance system shall have orientation sensors to monitor and record pitch, roll, and left/right deviation.
- B. Operating range and degree of accuracy of the proposed tracking system shall be adequate to meet project conditions. Tracking/steering equipment shall allow for continuous monitoring of the drill head along the entire proposed alignment. If a poor contact with the sonde is expected to occur at any section, this shall be communicated to the Engineer prior to commencement of construction.
- C. The tracking system shall be capable of providing horizontal and vertical steering data along the entire drill path for each crossing, for the depths shown on the Project Plans, plus an additional 10 feet.
- D. The tracking system shall be capable of locating the drill within eighteen (18) inches radius inscribed around the drill path, and shall be set up and operated by field personnel trained and experienced with the system.
- E. The downhole annular and pipe drilling fluid pressures shall be measured and recorded throughout the pilot hole drilling. These records shall be maintained and provided daily to the Engineer.
- F. Contractor shall provide two 2-way radios to allow communication between crews. Radios shall be complete with built-in antennas, squelch and volume controls, and rechargeable battery packs. The Contractor shall not commence work until there is a working radio at each entry and exit location of an active drilling operation.

2.5 MUD MOTORS

- A. Mud/Slurry Motors, if used, shall be of adequate power to operate the required drilling devices.

2.6 PIPE ROLLERS

- A. Pipe rollers shall be of sufficient size to fully support the weight of the pipe while being butt-fused, pressure-tested, and/or during pullback operations.
- B. Swivel: Use to connect pull section to drill steel to minimize torsional stress imposed on pulled pipe.
- C. Grounding System shall meet the following requirements, as a minimum:
 1. Common grounding system to prevent electrical shock in the event of a high voltage underground cable strike.
 2. Connects interconnecting machinery including drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats, and other interconnected equipment to a common ground.

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2.7 DRILLING FLUIDS

- A. Drilling fluids, muds, and chemical additives shall be nonhazardous materials composed and used in compliance with applicable, local, state, and Federal environmental regulations.
- B. Do not use oil-based drilling fluids or fluids containing additives that can contaminate soil or groundwater.
- C. Maximum unit weight of drilling fluid with cuttings is 9.5 pounds per gallon (ppg).

2.8 ADVANCED METERING EQUIPMENT (ELECTRIC UTILITY MAINS)

- A. For each pipe material, use only pipe from a single manufacturer. HDPE Pipe: As specified in Section 05610 Sanitary Sewers Trenchless Technologies.

2.9 STEEL CASING (CONDUCTOR CASING) – IF USED

- A. The steel casing pipe shall be a new, smooth wall, carbon steel pipe that conform to ASTM A139, Grade “B”.
- B. Minimum yield strength of 35,000 psi or greater.
- C. Steel casing shall have roundness such that the difference between the major and minor outside diameters shall not exceed 1% of the specified nominal outside diameter, or 0.25”, whichever is less.
- D. Steel casing shall have a minimum allowable straightness deviation in any 10 ft length of 1/8”.
- E. Steel casing pipe diameter shall be determined by the contractor to suit their means and methods. It is expected that the casing pipe will be at least 6-inches larger than the outside diameter of the largest reamer to be used by the contractor.
- F. Minimum steel casing pipe wall thickness shall be 0.5 inch.
- G. The design stress in the pipe wall shall be 50 percent of the minimum yield point of the steel or 18,000 psi, whichever is less, when subjected to the loading conditions during the driving and retrieval operation.
- H. Casing section joints shall be butt-welded, lap welded, or welded using butt straps in the field. Each end of the casing for butt-welding shall be prepared by providing 1/4-inch 45-degree chamfer on the outside edges. Use manufacturer’s specified welding wire or rod.

2.10 GROUT AND CASING SPACERS

- A. Grout for Abandonment:
 1. Consisting of a mixture of water and Portland cement, with mineral fillers or admixtures as necessary to achieve a nonshrink, nonbleed, flowable grout.
 2. Sand: Clean natural silica sand, graded such that 100-percent of the material passes the No. 20 sieve and not more than 20-percent passes the No. 200 sieve.
 3. Compressive Strength: 50 psi minimum at 28 days.
- B. Backfill grout for annular space: The service lateral or main line would subsequently be installed

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within the casing with appropriate casing spacers and backfill grouted with appropriate backfill grout material. Casing spacers and backfill grouting materials and processes shall be submitted and reviewed with a no exceptions taken designation prior to installation.

PART 3 - EXECUTION

3.1 GENERAL

- A. The Contractor shall be responsible for his means and methods of directional drilling construction and shall ensure the safety of the work, the Contractor's employees, the public, and adjacent property, whether public or private.
- B. The Contractor shall provide and attach a suitable pull head to the product pipes prior to commencement of pullback operation. The pull head shall be watertight and to be installed in a manner that prevent ingress of drilling fluids/water into the carrier pipe.
- C. Contractor should anticipate that portions of the drilled excavation will be below the groundwater table.
- D. Notifications: Provide notification to the Engineer a minimum of 72 hours before mobilizing onto the site. Provide notification 48 hours in advance of casing installation and drilling. Provide notification 48 hours in advance of pressure and acceptance verification tests on the HDPE carrier pipe.
- E. Construct a perimeter control system for bentonite slurry, cuttings, and pit spoil, as well as storm water control barriers in accordance with Best Management Practices in the local area. The system shall provide positive containment for all drilling fluids and drainage from drill cuttings and prevent any of the drill fluid or drainage fluids or other drill fluid contaminated material from leaving the open pit areas.
- F. Spill and bentonite slurry management shall be in accordance with requirements stated in the project permits, and in the approved Drill Fluid Management and Contingency Release Plan.
- G. Notify the Engineer of circulation losses greater than 25% of downhole pump volumes and for all observable bentonite slurry releases at the earliest opportunity, and include in the DailyReport.
- H. Contractor to be responsible for providing proper equipment to be used for lifting and placing the pipe.
- I. Pipe to be installed to the required alignment shown on the drawings.
- J. Every precaution shall be taken to prevent foreign material from entering the pipe. When pipe installation is not in progress, the open ends of the pipe must be closed to the satisfaction of the Engineer.
- K. The leading edge of the pipe shall be examined for significant external damage after pull back. If the pipe is deemed by the Engineer to have suffered significant damage, the damaged pipe shall be cut off and additional pipe pulled through the hole prior to the relaxation period.
- L. Disposal of waste, slurry or volatile material into waterways, storm or sanitary sewers shall not be permitted.
- M. Pumping or draining water containing slurry, silt or bentonite in suspension into waterway, sewers or drainage systems is strictly prohibited.
- N. All waste material shall be removed and disposed by the Contractor at a disposal site located by the

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Contractor and approved by the Engineer. Obtain required permits for waste disposal. Provide copies to the Owner. The work area shall be organized and clean by the end of each workingday.

- O. Do not use pipe with physical damage such as cuts, gashes, nicks or abrasions which are deeper than 10 percent of wall thickness. Remove and dispose of damaged pipe from Site.
- P. Provide freshwater, free of hazardous or toxic substances, for drilling and grouting purposes.
- Q. Provide Engineer free access to observe HDD operations and instrumentation at all times.
- R. Install 6-foot high chain link safety fence around perimeter of open trenches and HDD pits during nonworking hours.
- S. Request and obtain written authorization prior to working overtime, nights, or weekends.
- T. Exercise care and caution during construction to ensure safety of nearby operations and residents, and to avoid damage to adjacent properties and other facilities.
- U. Site shall be free of trash and unsightly debris for duration of the Work.
- V. The Contractor shall be aware that the Owner may implement a monitoring program to monitor water quality of any drilled water course crossing.
- W. Where such effort is necessary, cost for groundwater control during the course of the drilling work shall be included in the unit contract price for the work.
- X. Dewatering required during the course of the project to lower water table, to remove standing water, surface drainage seepage, or to protect ongoing work against rising waters or floods shall be considered incidental to the work being performed.

3.2 PRECONSTRUCTION AND POSTCONSTRUCTION SURVEYS

- A. Preconstruction:
 1. After Contract is awarded and before starting the Work, examine and take photographs in color, and a color video recording in digital format, of existing structures, vegetation, other improvements which be damaged by Contractor's operations.
 2. Prepare records in triplicate of observations. Provide two copies of each photograph and one copy of digital video to Owner within 30 days after Notice to Proceed.
 3. The above records and photographs are intended for use as evidence in ascertaining the extent of any damage which may occur as a result of the Contractor's operations and are for the protection of the adjacent property owners, the Contractor, and the Owner. The records will provide a means of determining whether, and to what extent, damage may have occurred as a result of the Contractor's operations.
- B. Post construction:
 1. After construction is completed, perform post construction survey using same parameters as specified for preconstruction survey.
 2. Repair all damages resulting from the construction activities to the satisfaction of Owner and without delay.

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3.3 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

- A. When the Plans require construction operations in close proximity to existing structures, the Contractor shall take all reasonable precautions to prevent damage to such structures. The requirements described herein apply to all types of structures (on or off the right-of-way) that may be adversely affected by construction operations due to boring, reaming, vibrations, ground loss, ground heave, dewatering, or other activities.
- B. The Contractor shall employ a qualified Specialty Engineer to inspect and document the condition of structures prior to and after excavation and drilling activities. Inspect and monitor the following structures:
- C. When excavating for construction, the Contractor is responsible for evaluating the need for, design of, and providing any necessary precautionary features to protect adjacent structures from damage, including, but not limited to, selecting construction methods and procedures that will prevent damaging the adjacent subsurface structures and monitoring and controlling the vibrations from construction activities, including driving of casings and sheeting. When sheeting and shoring are not detailed in the Plans, employ a qualified Specialty Engineer licensed in the State of Rhode Island to design the sheeting and shoring, and to sign and seal the plans and specification requirements. Send these designs to the Engineer for his record before beginning construction.
- D. Contractor shall be responsible for damage to piping or utilities shown on Drawings and/or field located prior to construction.
- E. Consult utility owner immediately when unidentified utilities are encountered during the Work.
- F. Cooperate with Engineer and utility companies in keeping respective services and facilities in operation.
- G. Do not interrupt existing utilities serving occupied facilities, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
- H. Coordinate with Engineer and utility companies for service shut-off, if required.
- I. Settlement Points:
 - 1. Instrumentation locations and monitoring procedures shall be in accordance with this section and Section 05813 Geotechnical Instrumentation and Monitoring.
- J. Protection of Utilities:
 - 1. Protect existing utilities within 50 feet of HDD alignment and construction zone in accordance with this specification and Section 05813, Geotechnical Instrumentation and Monitoring.

3.4 PREPERATION

- A. Inspect locations where horizontal directional drilling operations will be conducted and pipe installed.
- B. Inspect existing storm sewer inlet and outlets prior to directional drilling operations.
- C. Locate positions of operation and reception pits, establish elevation and horizontal datum for bore head control, and lay out pipe assembly area. Entry and exit locations shall be surveyed by experienced survey personnel licensed in the State of Rhode Island prior to start of directional drilling.
- D. Operations Within Pipe Staging Area:

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1. Conduct operations in a manner that minimized disturbance to public or private properties boarding staging area or where construction easements have been obtained by Owner.
2. Areas where drilling fluids are in use shall be bordered by appropriate silt fences and hay bales.
3. Easement limits for exit point as well as pipe staging shall be bordered by ultraviolet stabilized polyethylene or polypropylene safety fence.
4. Provide silt fences and hay bales where pipe staging areas border or are within 50-feet of river bank of the surface body of water.
5. Layout and assemble pipe in manner that does not obstruct adjacent roads, nearby railroads, commercial access, or residential activities adjacent to construction easements. Elevate pipe over streets or railroads as necessary to avoid disruption to traffic.

3.5 EQUIPMENT

- A. Diesel, electrical, or air-powered equipment will be acceptable, subject to applicable federal and state regulations.
- B. Any method or equipment that the Contractor can demonstrate will produce the specified results will be considered.
- C. Provide adequate secondary containment for any and all drilling fluids mixing and storage tanks.
- D. All equipment shall meet the noise requirements set forth in the City of Warwick.
- E. The Contractor shall provide additional sound buffering around equipment in order to meet City of Warwick ordinances and the requirements of Section 05813 Geotechnical Instrumentation and Monitoring at no additional cost to the Owner.

3.6 CONTROL OF THE DRILL LINE AND GRADE

- A. Construction Control.
 1. The Contractor shall establish and be fully responsible for the accuracy of his own control for the construction of the entire project, including structures, drill line and grade.
 2. The Contractor shall maintain daily records of alignment and grade and shall submit an electronic and hard copy of these records to the Engineer. However, the Contractor remains fully responsible for the accuracy of his work and the correction of it, as required.
 3. The Contractor shall check his control for the bore alignment against an above ground undisturbed reference at least once for each rod length of bore constructed, or more often as needed or directed by the Engineer. Contractor shall furnish a "Directional Bore Log" for each bore completed inclusive of horizontal and vertical location information.

3.7 INSTALLING STEEL CASING (CONDUCTOR CASING) – IF USED

- A. The casing will be rammed open-ended or drilled.
- B. A soil shoe can be installed on the leading edge of the casing. The overcut created by the soil shoe shall be limited to one inch (1”) in diameter.
- C. Lubrication can be utilized to reduce friction between the casing pipe and the soil formation. The amount of lubrication directed to the outside of the pipe shall not be more than that required to fill the annular

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space between the casing pipe and the native formation, as created by the soilshoe.

- D. The pneumatic pipe driving device selected shall be specifically designed for installing the casing pipe through the geological material described in the geotechnical report.
- E. Spoil removal system shall be capable of being operated in a manner which prevents loss of ground during the installation.
- F. Pipe ramming work shall be executed such that settlement is minimized and the in- place casing has full-bearing against the earth.
- G. The Contractor will be monitoring settlement and vibration above the alignment of the casing during installation and following the completion of the casing installation, following Section 05813 Geotechnical Instrumentation and Monitoring.

3.8 DRILLING PILOT HOLE

- A. Drill operators shall wear electrical shock protection equipment and operate from common grounded mats as required.
- B. Install conductor casing, if used, and drill pilot hole from entrance point to exit point following vertical and horizontal alignment shown on Drawings. Loss of control due to interference from known structures and utilities will be corrected at no cost to Owner.
- C. Control drilling fluid viscosity, density, and pressure to prevent frac-outs.
- D. Monitor ground movements as specified in Section 05813, Geotechnical Instrumentation and Monitoring.
- E. As pilot hole is advanced, plot actual horizontal and vertical alignment of pilot hole at intervals not exceeding thirty feet.
 - 1. Provide Engineer with position or inclination of pilot bore upon request and at completion of installation.
 - 2. Contractor shall assume liability for loss or damage to down-hole equipment.
- F. Alignment Requirements:
 - 1. Entry point location shall be within the predetermined pits or within the continuous trench on Tidewater Drive all as shown on the drawings.
 - 2. Pilot hole exit points shall be within the pre-determined pits or within the continuous trench on Tidewater Drive all as shown on the drawings.
 - 3. Where a utility exists, pilot hole shall be closer to horizontal alignment shown on Drawings, to avoid damaging existing utilities and to satisfy permit or utility owner's requirements.
 - 4. Minimum separation distance is defined as the shortest distance between the outer most edge of the reamer and the outer most edge of an existing utility or another underground structure.
 - 5. Pilot hole shall be no shallower than vertical alignment shown on Drawings.
 - 6. If directional drill pipeline alignment differs from Drawings such that additional pipe or different fittings are necessary to join the excavated pipe, notify Engineer and Owner so additional pipe or different fittings can be reviewed by Owner (at their option) on a timely basis without delaying construction.
 - 7. Contractor will not receive compensation for longer or deeper pipeline profile or other deviation from Drawings.

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- G. Acceptance:
1. If pilot hole alignment fails to conform to specified requirements, properly abandon the pilot hole and drill a new pilot hole with alignment meeting specified requirements.
 2. If hole is lost or damaged during performance of the Work, loss and damage shall be borne by Contractor.
 3. If hole is not carried to Contract length or to within exit point tolerance, withdraw partially or fully and drill a modified or new crossing. Requirement to drill a substitute crossing shall be recurring until hole is acceptable and at no additional cost to the Owner.
 4. Owner reserves right to hire independent inspector to verify location of installed pipeline and to recover the cost of the inspection from Contractor if inspection reveals pipeline does not meet specified requirements.

3.9 PREREAMING, REAMING PILOT HOLE, AND PULLING PIPE

- A. Prereaming operations shall be conducted at discretion of the Contractor. Provisions of this Specification relating to simultaneous reaming and pulling back operations shall also pertain to prereaming operations.
- B. Obtain Engineer's approval to proceed before enlarging pilot hole and pulling pipe into position.
- C. While pulling pipe, monitor pulling force and handle pipe in manner that does not overstress pipe. Limit radius of curvature along length of pipe during installation to the minimum radius as specified by the drill rig manufacturer, pilot rod manufacturer, product pipe manufacturer, and as verified through the Contractor's pipe stress analysis.
- D. Use swivel to connect pipe pull section to reaming assembly to minimize torsional stress imposed on section. If pipe buckles or is otherwise damaged, remove damaged section and replace it with new pipe.
- E. Protect exterior of pipe from damage. Support pull section as it proceeds during pull back so that it moves freely and pipe is not damaged.
- F. Monitor drill fluid viscosity, density and pressure to prevent frac-outs.
- G. Maintain full control of pipe string at all times. Maintain neutral pipe buoyancy during pull back by filling pipe with water as needed. Do not use any buoyancy control measures that have not been submitted to the Engineer and returned as "No Exceptions Taken".
- H. After pullback, pipe may take several hours or days to recover from axial strain. When pulled from reamed bore hole, pull pull-nose out a distance longer than the design length to avoid having pull-nose retract back below bore hole exit level. Do not make connections until stretch recovery and thermal contraction cycles are complete, and no less than 24 hours.
- I. Pull pipe so that minimum of 20 feet of pipe is exposed at both ends of bore. In confined work areas, the minimum exposed pipe may be reduced at the discretion of the Engineer.
- J. Open ends of installed pipeline string shall be closed or plugged with metal or plastic cover to prevent water or soil from entering pipeline during nonworking hours or as otherwise required.
- K. Notify Engineer if pullback pressures exceed 80% of the maximum allowable value.

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3.10 DRILLING FLUIDS

- A. Testing:
1. Sample and test drilling fluid pH, chloride, salinity, Marsh viscosity, mud density and gel strength per API 13A and API RP 13B-1 during pilot bore to verify conformance with design.
 2. During pullback, sample drilling fluids and measure pH and Marsh viscosity at least twice per working shift.
 3. Record results on daily drilling logs.
 4. Test other mud design parameters if evidence of significant variation exists or if drilling contingency actions are required.
- B. Measure drilling fluid pressure, flow rate of recirculation fluids, and flow rate of added fresh fluids.
- C. Field verify estimated drilling fluid losses by recording the observed drilling fluid return to the entry pit while continuing to temporarily pump planned mud at planned maximum pump rate, or by other reasonable means.
- D. Frac-outs:
1. Avoid impact to existing utilities, structures, facilities, waterways and wetlands in the Project area during drilling operation.
 2. If drilling fluid starts leaking to surface or if fluid loss results in surface movement, cease drilling until fluid loss volumes can be brought under control.
 3. In such event, notify Engineer immediately.
 4. Clean up locations where drilling fluids surface.
 5. Pay particular attention to potential of inadvertent frac-outs washing out along existing utility crossings and provide preventive measures.
- E. Recirculation:
1. Maximize recirculation of drilling fluid surface returns.
 2. Design and construct facilities to recirculate fluids.
 3. Remove temporary recirculation line if used.
 4. Provide solids control and fluids cleaning equipment of a configuration and capacity that will process surface returns and produce drilling fluid suitable for reuse.
- F. Density Calculations:
1. Drilling fluid density shall be measured a minimum of once each working hour when drilling fluid is pumped into hole.
 2. Record density calculations in daily drilling log.
 - 3.

3.11 HANDLING AND DISPOSAL OF DRILLING MUD AND CUTTINGS

- A. Dispose of drilling fluids and drill cuttings in approved offsite location in accordance with local, state and Federal laws and regulations at no additional cost to the City.
- B. Do not use additives that would prevent nonhazardous disposal of drilling mud.
- C. Make adequate provisions for handling and containing muddy water, drilling mud, and cuttings during drilling operations. Do not discharge these contaminants into waterways.
- D. Construct mud pits at entry and exit points in manner that completely contains mud and prevents its escape.

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- E. When onsite provisions for storing muddy water, drilling mud, or cuttings onsite are exceeded, haul contaminants away to a licensed land fill or otherwise approved disposal sites.
- F. Conduct directional drilling operation in such manner that drilling mud is not forced through bay sub-bottom or adjacent areas.

3.12 JOINING PIPE SECTIONS

- A. End Fittings:
 1. Fabricate and install mitered fittings at ends of pipe for attachment of adjacent sections of pipe.
 2. Fitting angles shall correspond to field conditions and shall be as approved by Engineer.
- B. Join pipe to one another, to fittings, and to flange connections by means of thermal butt fusion. Pipe, fittings, and flanged connections shall be same type, grade, and class of polyethylene compound.
- C. Butt Fusion Joining:
 1. Perform in accordance with pipe manufacturer's recommendations.
- D. Special Precautions at Flanges:
 1. Support pipe connected at flange to flange connections to heavy fittings, manholes, and rigid structures in such a manner that no subsequent relative movement between polyethylene pipe at flanged joint and rigid structure is possible.
 2. Inside edge of flange in contact with HDPE flange to be beveled and not in contact with the weld bead.

3.13 OBSTRUCTIONS AND PIPE ABANDONMENT

- A. Obstruction: When condition or unknown obstruction is encountered which precludes further drilling, Contractor may elect to discontinue drilling, sidetrack to avoid obstacle, or drill in a substitute location upon written acceptance from Engineer and Owner.
- B. Abandonment:
 1. Abandon boreholes installed or partially installed that fail to meet requirements of these Specifications at Contractor's expense.
 2. Drill/bore new borehole along alignment approved by Engineer and install new product pipe.
 3. Grout abandoned boreholes and product pipes as follows:
 - a. Inject until borehole or product pipe is flushed of drilling fluid and return flow at collar of boring or product pipe shows undiluted grout.
 - b. Plug boring or product pipe to maintain grout in boring or product pipe until grout has set.
 - c. Inject additional grout as necessary to fill voids left as a result of shrinkage or bleeding of grout.

3.14 FIELD QUALITY CONTROL

- A. Daily Drilling Logs: Record at a minimum the following on an hourly basis and at every noticeable change in materials throughout each drill pass, back ream pass, and pipe installation pass.
 1. Drilling fluid batch quantities and mix proportions.
 2. Drilling fluid flow rate, both fresh and recirculated fluids.
 3. Drilling fluid pressure, including maximum and average values.

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4. Drilling of fluid density calculations.
5. Drill thrust.
6. Drill pullback force, including maximum and average values.
7. Head torque and rate of rotation.
8. Spoil material quantities.
9. Description of spoil material and drilling conditions.
10. Locator/tracking system data including position, roll and tilt angles, depth, temperature of data transmitter and remaining batter life.
11. Drill bit location at least every 30 feet along drill path.
12. Observations of drilling conditions and periodic field tests.

B. Provide field survey and datum for establishing location of installation at end of each installation

C. Hydrostatic Testing

1. The Contractor must supply all testing equipment and personal to perform hydrostatic tests on the installed product pipe to demonstrate that the pipe is installed in accordance with the Specifications.
2. The Contractor must advise the Engineer 24 hours in advance of filling the line for testing.

3.15 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site for installation assistance and to certify butt fusion joints are acceptable.

3.16 SURFACE RESTORATION

A. Promptly replace damaged pavement. Restore pavement around entry and exit pits as soon as the Work specified is completed.

B. At completion of construction, restore work areas to preconstruction condition including, but not be limited to, damaged gravel surfaces, grassed areas or lawns, fences and gates, damaged trees and plantings.

3.17 CLOSEOUT ACTIVITIES

A. Within 48 hours of completion of the work, remove all rubbish and debris from the job site. Remove all construction equipment, leaving the area involved in a neat condition acceptable to the Engineer. Disposal of any material onsite is strictly prohibited.

B. Immediately clean "blow holes" or "breakouts" of drilling fluid to the surface and return the surface area to its original condition.

C. Repair environmental damage occurring from pipeline installation operations.

D. Remove frac-out material from storm sewers.

E. Submit one electronic copy and two hard copies of the record drawings to the Engineer within five days after completing the pull back. Clearly tie the record drawings to the project's survey control. Maintain and submit upon completion all work logs of guided directional drill operations. All work logs shall be signed.

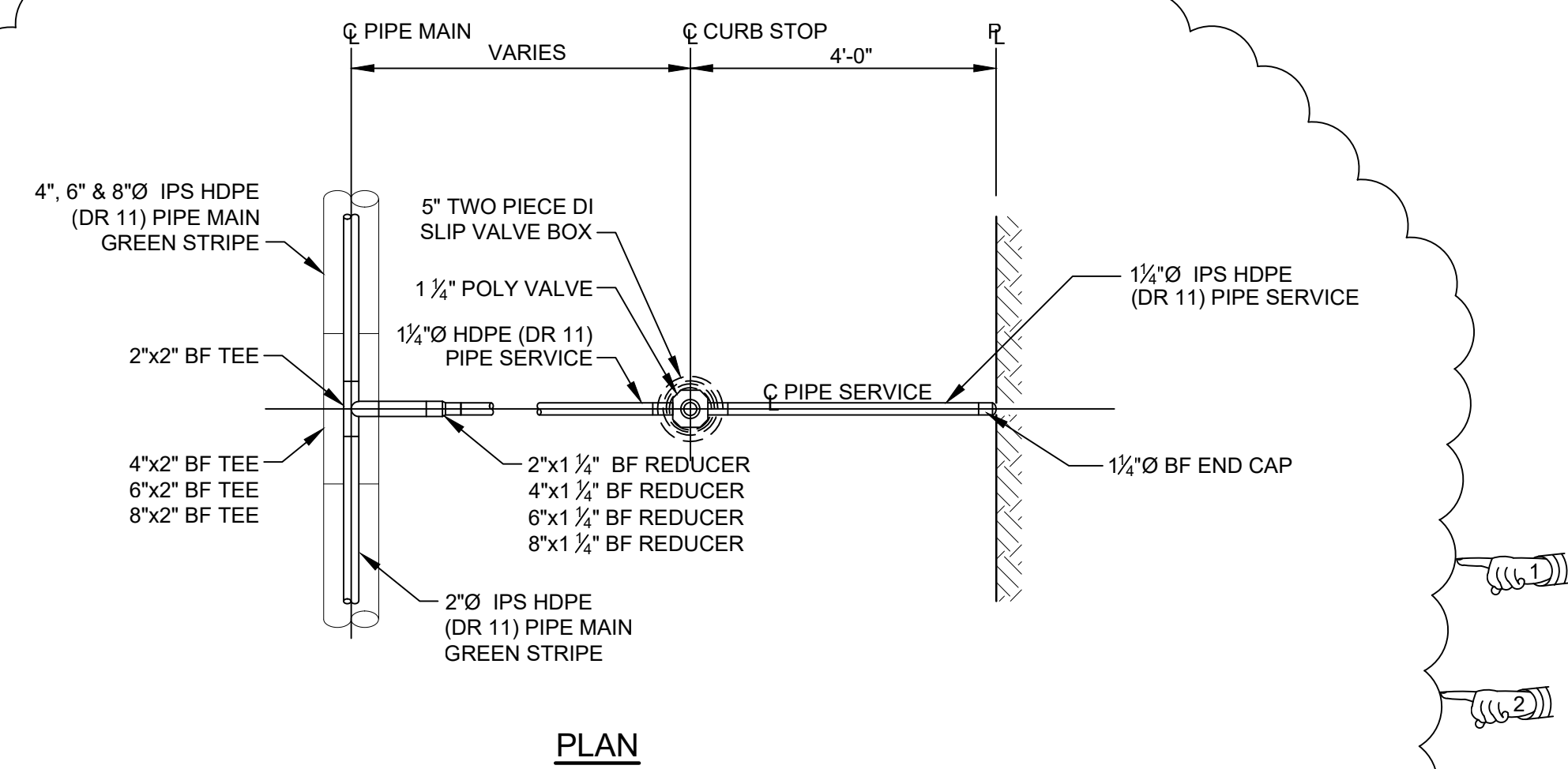
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3.18 FINAL INSPECTION FOR ACCEPTANCE OF HDD

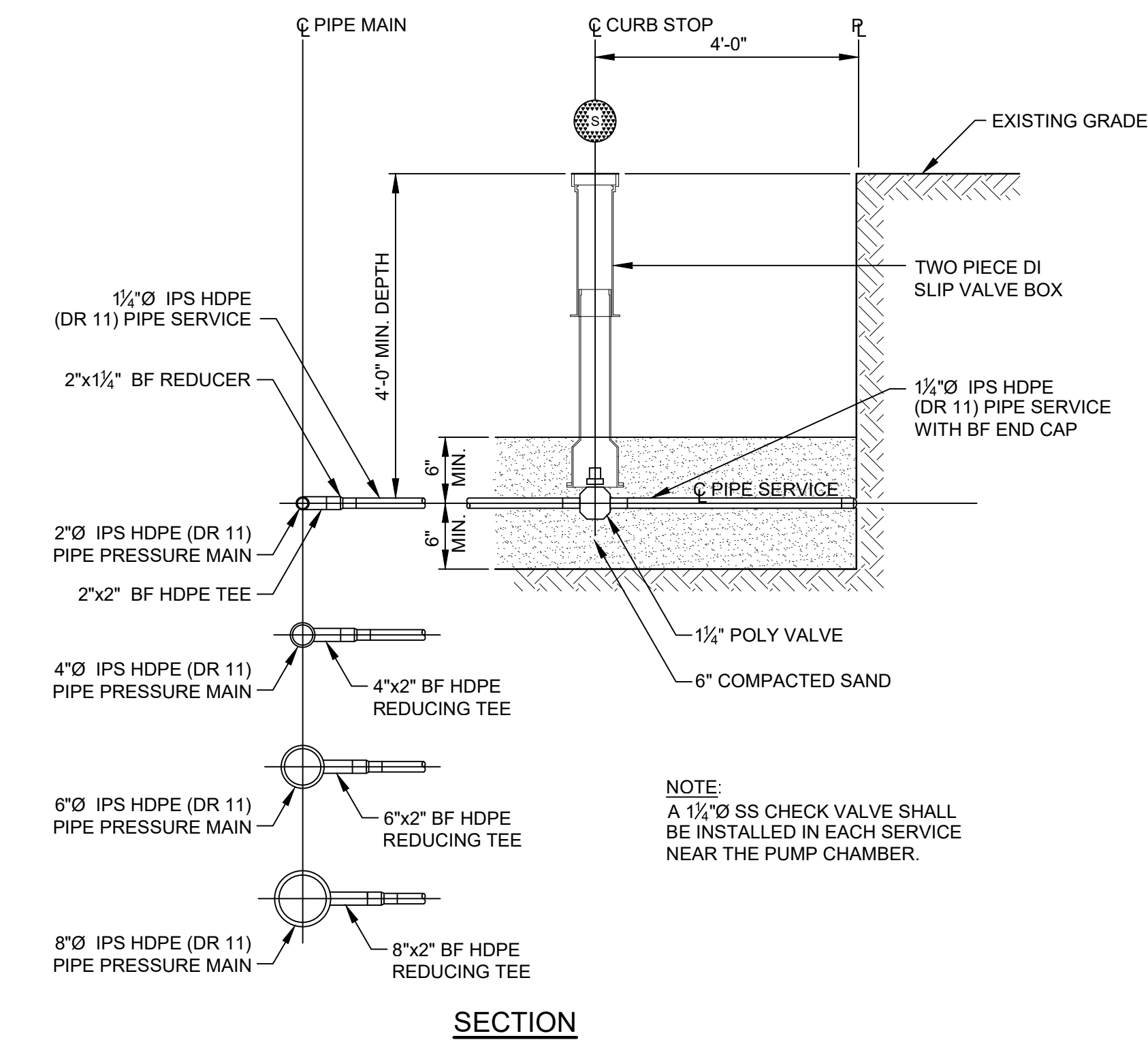
- A. Final inspection of the work shall include a visual inspection of each section of pipe. The pipe shall be within the tolerances specified herein and in the drawings for both, line and grade, shall show no leaks, shall be free of cracks or ovality greater than 2%, and contain no deposits of sand, dirt or other materials. All finished work shall be neat in appearance and of high-quality work.

END OF SECTION

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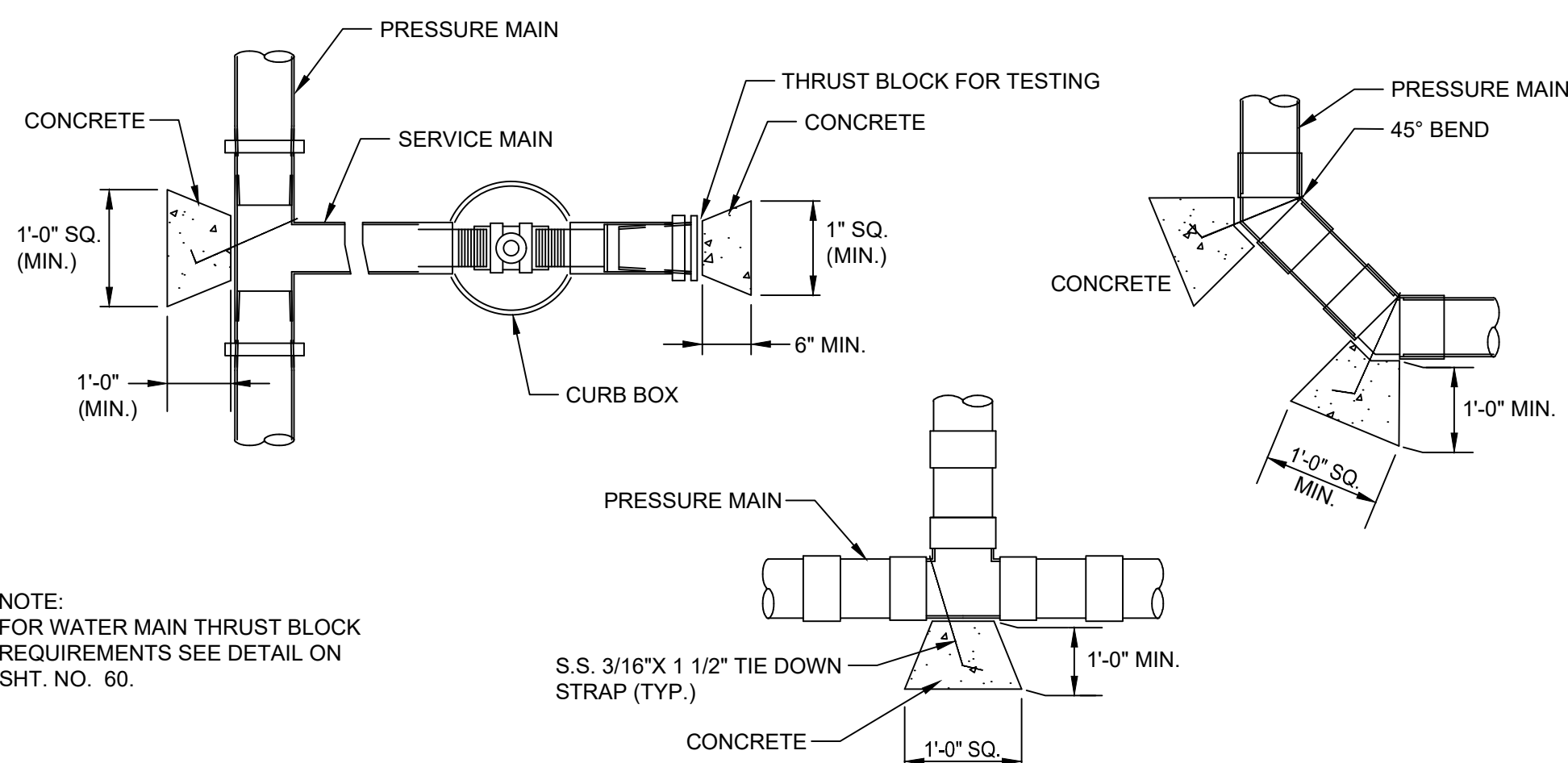
PLAN



SECTION

**PRESSURE SEWER MAIN SERVICE CONNECTION DETAILS
OPEN TRENCH EXCAVATION**

N.T.S.



TYPICAL THRUST BLOCK DETAILS

NOT TO SCALE

* NOTE: LESSER MANHOLE DIAMETERS MAY BE PERMITTED IF DEMONSTRATED THAT PROPOSED FITTINGS, VALVES, AND CONNECTIONS CAN BE PROPERLY FIT WITHIN THE STRUCTURE. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS IN ACCORDANCE WITH SUBMITTAL REQUIREMENTS FOR APPROVAL.

ABBREVIATIONS

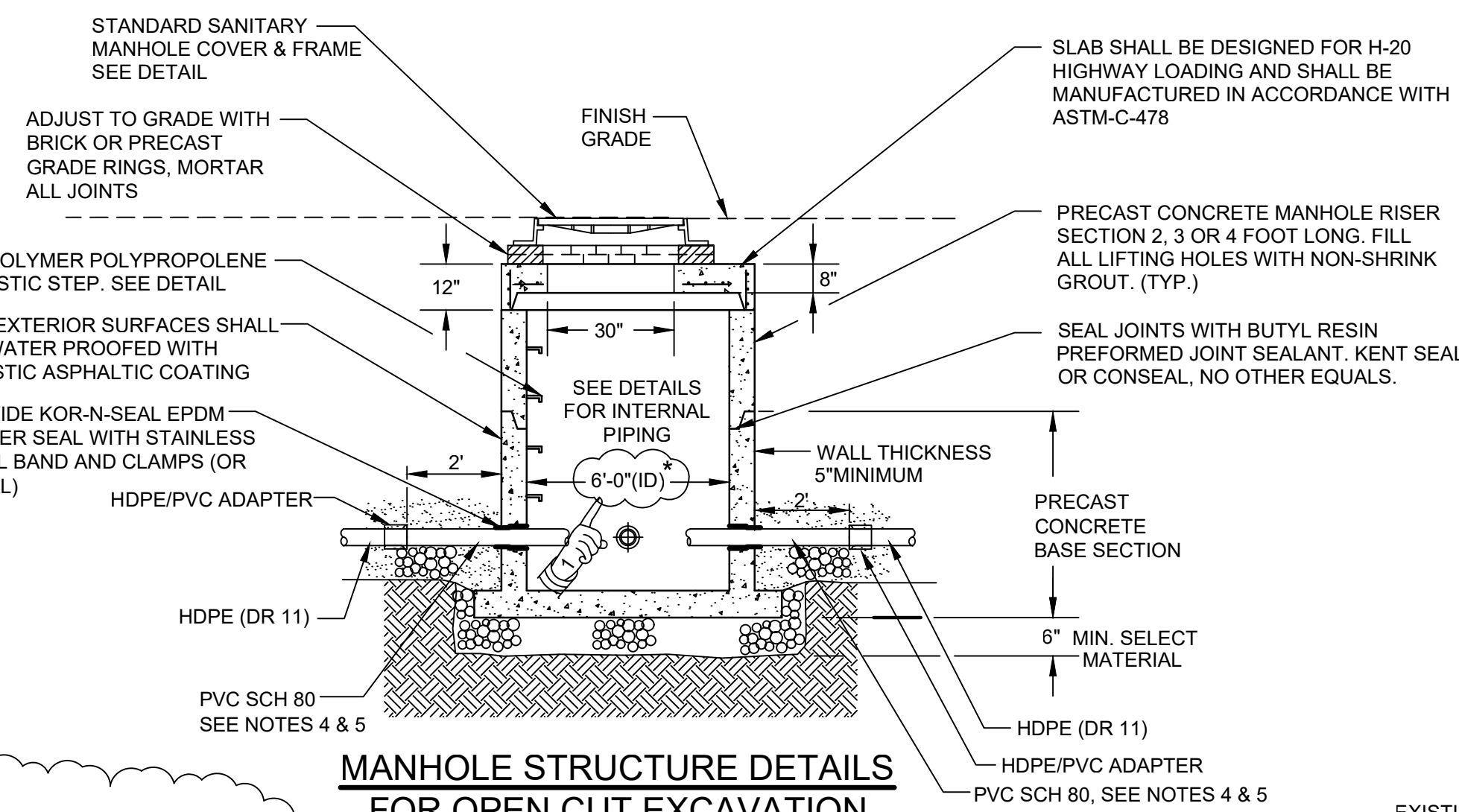
- MIPT - MALE IRON PIPE THREADED
- FIPT - FEMALE IRON PIPE THREADED
- S - SOLVENT WELD JOINT
- G - GASKET JOINT
- ARV - AIR RELEASE VALVE M.H.

NOTES

1. ALL CONCRETE SHALL BE 4000 PSI @ 28 DAYS.
2. CONCRETE THRUST BLOCKS SHALL BEAR AGAINST M.H. WALL OR UNDISTURBED EARTH AS APPLICABLE.
3. ALL FORCE MAIN BENDS, TEES, MAIN TAPS, AND END CAPS SHALL REQUIRE A CONCRETE THRUST BLOCK.
4. ALL PIPING AND FITTING INSIDE MANHOLE SHALL BE PVC SCH 80 AS SHOWN. PIPING BEYOND 2' OF MANHOLE WALL SHALL BE BUTT FUSED HDPE PIPE (DR 11).
5. WHERE PRESSURE SEWER MAIN CHANGES SIZE, PROVIDE REDUCER 2' OFF MANHOLE WALL AT JUNCTION OF SCH 80 AND DR 11 PIPE. SEE PLAN & PROFILE SHEETS FOR LOCATIONS.
6. BALL VALVES ON PRESSURE MAIN SHALL BE SAME SIZE AS PRESSURE SEWER MAIN.
7. A 1 1/2" SS CHECK VALVE SHALL BE INSTALLED IN EACH SERVICE PIPE NEAR THE PUMP CHAMBER.

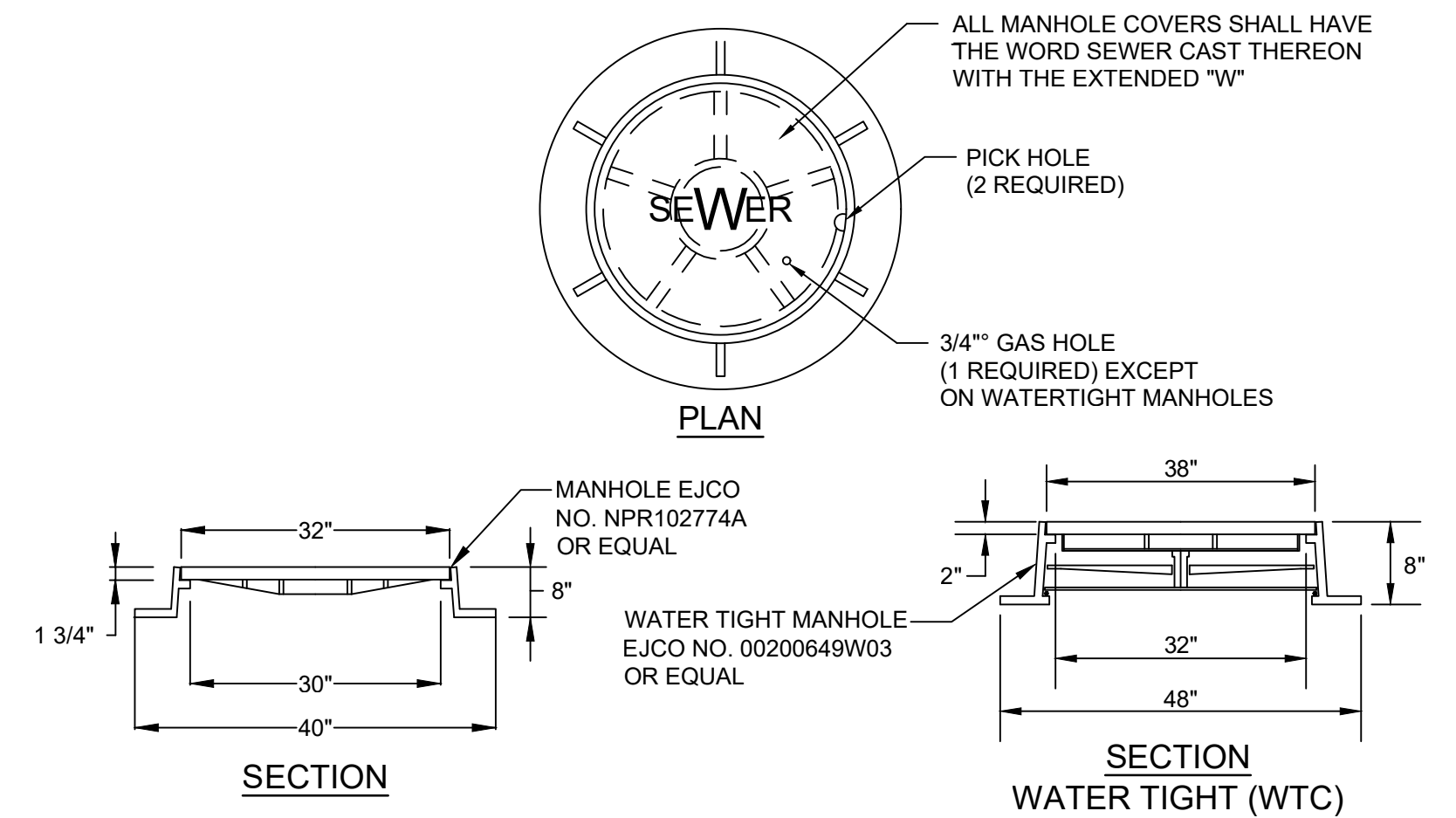
**SANITARY SEWER MANHOLE
PLAN-INVERT TABLE**

NOT TO SCALE



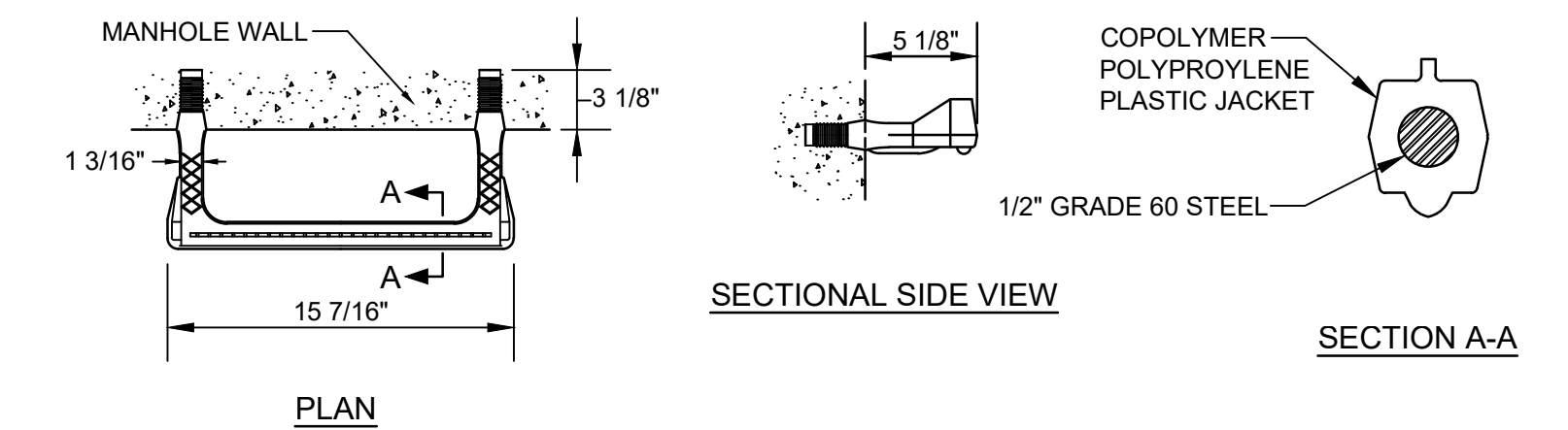
**MANHOLE STRUCTURE DETAILS
FOR OPEN CUT EXCAVATION**

NOT TO SCALE



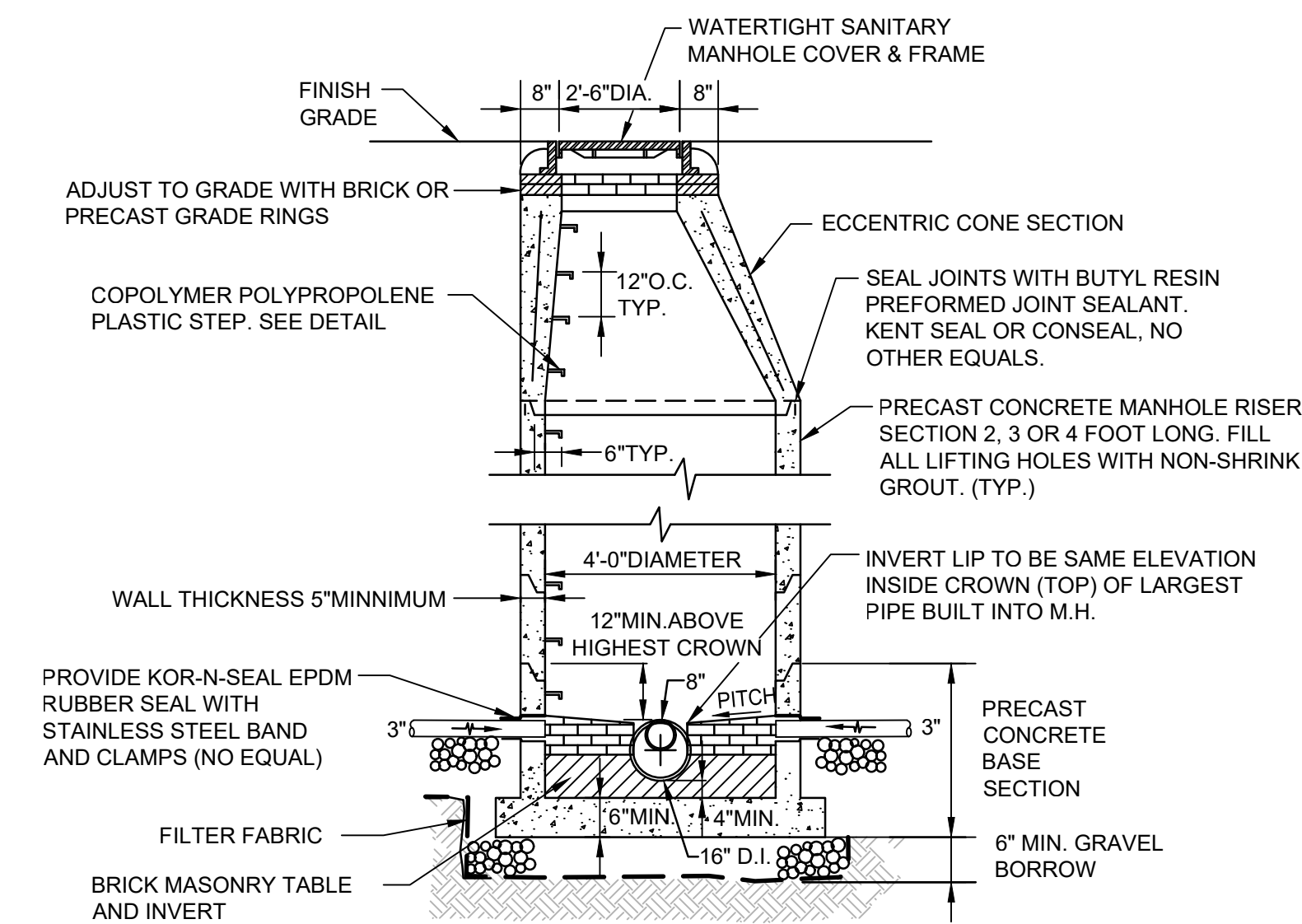
STANDARD MANHOLE COVER DETAILS

N.T.S.



SANITARY SEWER MANHOLE STEP DETAIL

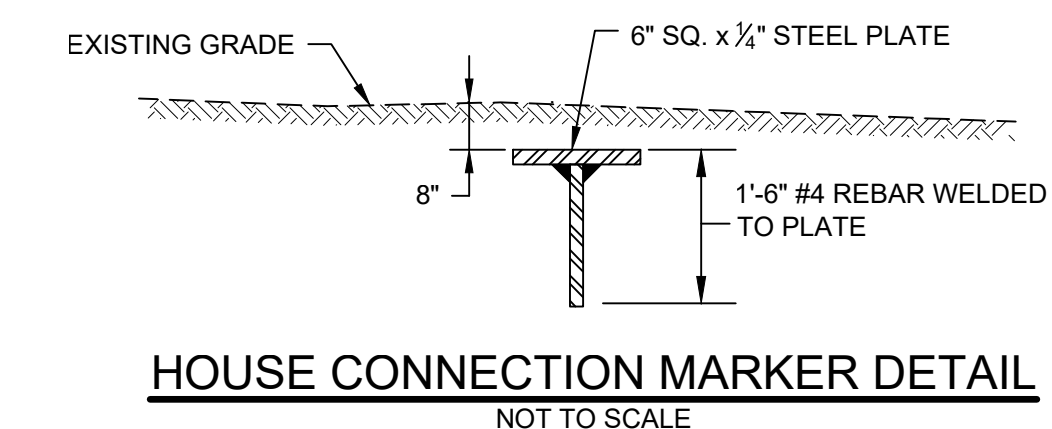
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SANITARY SEWER MANHOLE DETAIL

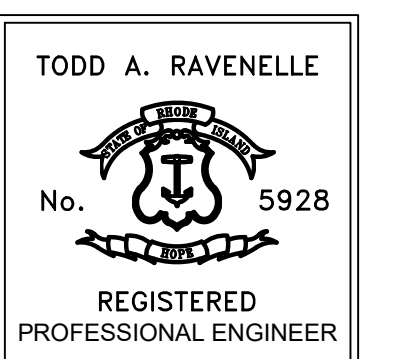
(1 LOCATION ONLY - TIDEWATER DRIVE & FRIENDSHIP / HEIGHTSHIP AVENUES)

NOT TO SCALE



HOUSE CONNECTION MARKER DETAIL

NOT TO SCALE



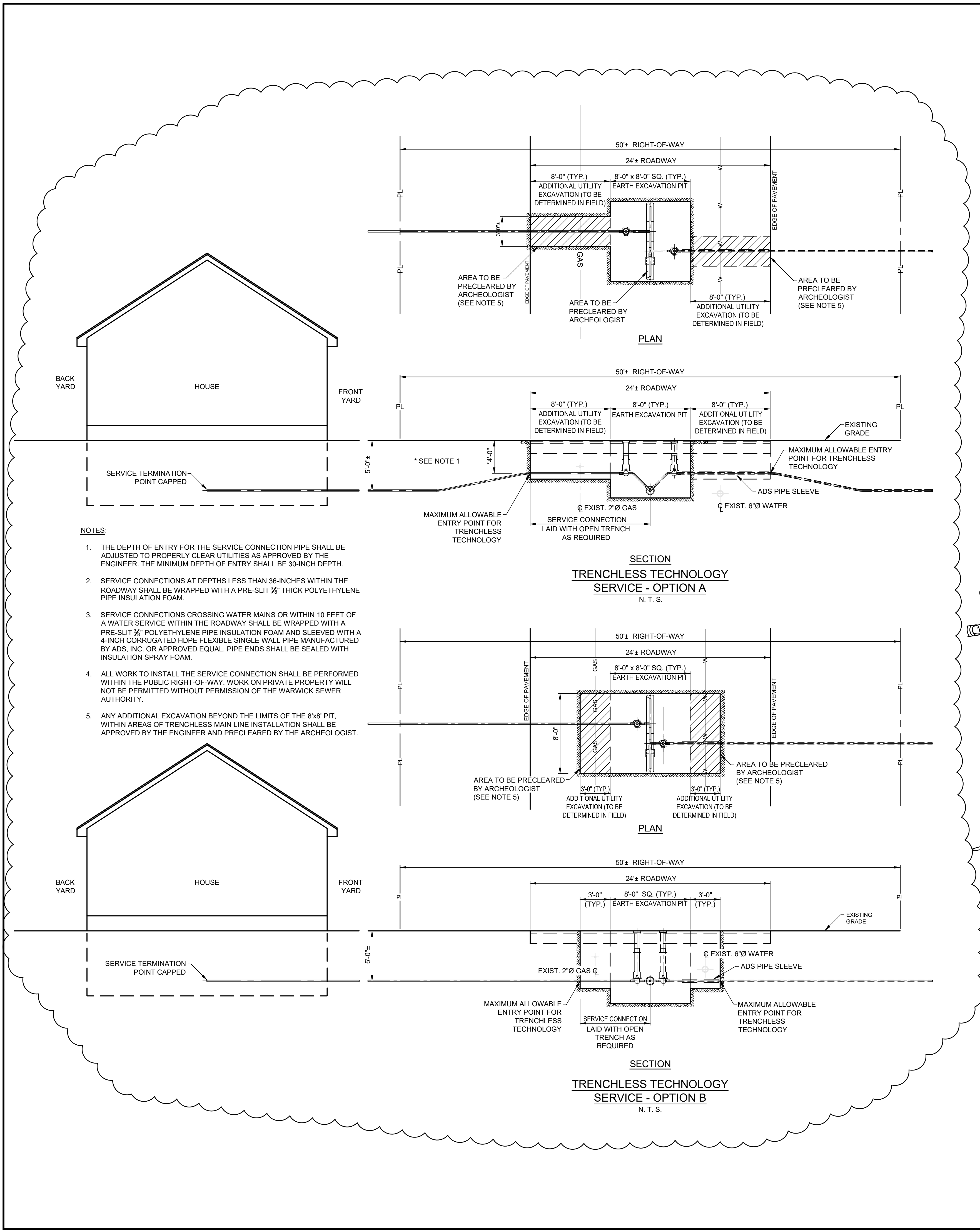
1	ADDENDUM 2	1/8/2020	TAR	DRAWN LBD	CHECKED TAR
2	ADDENDUM 7	2/05/2020	TAR	APPROVED	DATE NOV 2019
				SCALE AS SHOWN	
REV. NO.	DESCRIPTION	DATE	INT.		
APPROVED				SHT. NO. 58 OF 75	
WARWICK SEWER AUTHORITY				FILE NO. 998	

CITY OF WARWICK, RHODE ISLAND
WARWICK SEWER AUTHORITY
SYSTEM OF SEWERS
CONTRACT NO. 86B

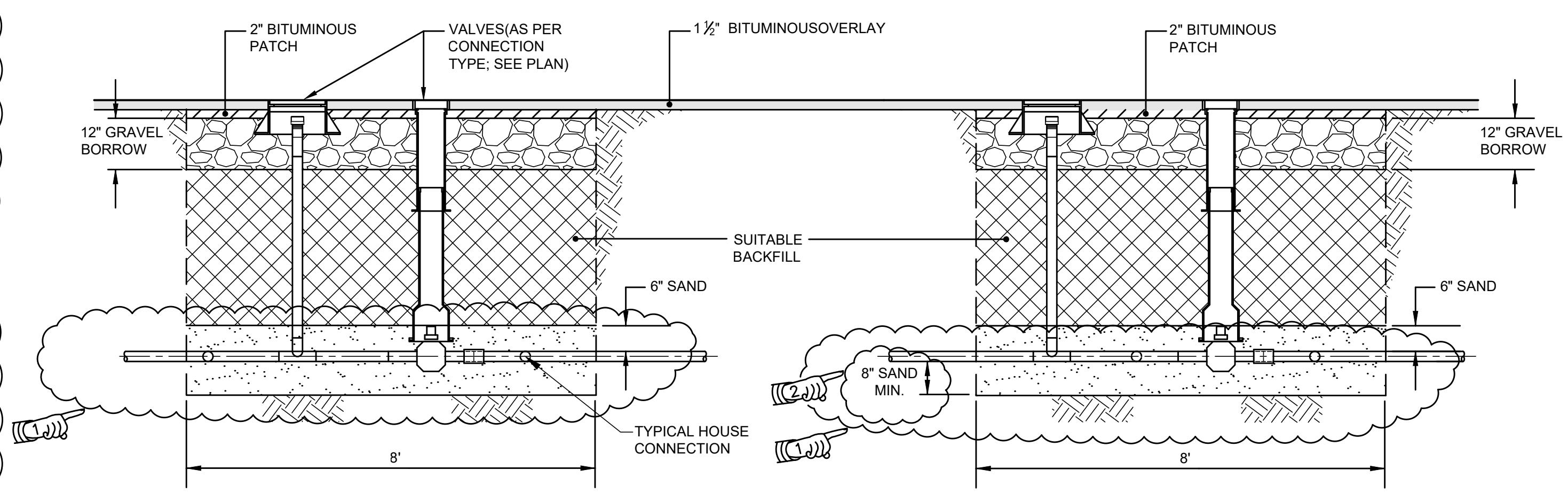
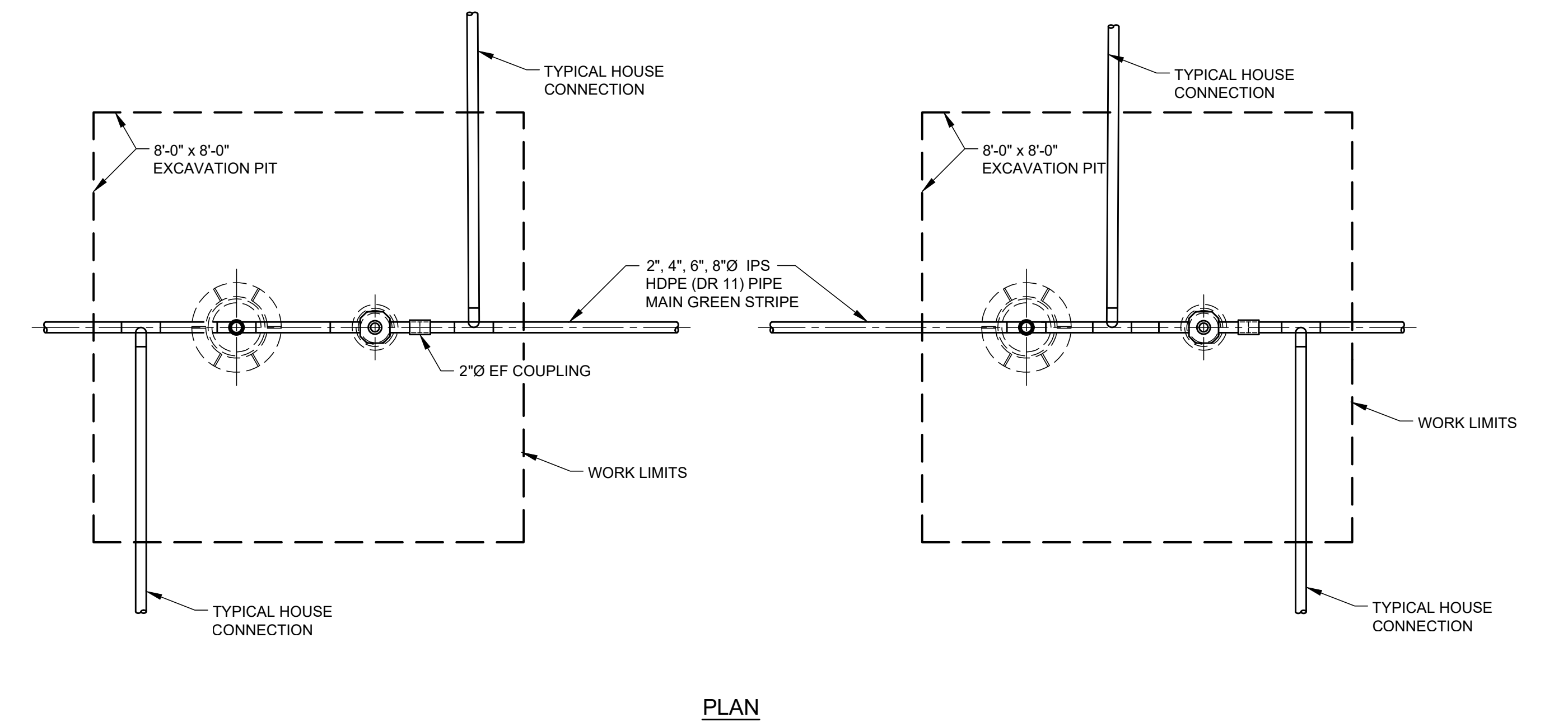
**DETAILS - 1
OPEN TRENCH EXCAVATIONS**



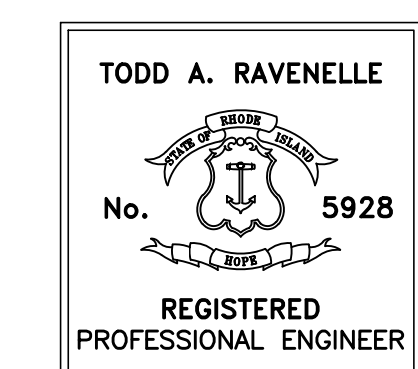
Gordon R. Archibald, Inc.
Civil and Environmental Engineers
Pawtucket, Rhode Island



- NOTES:**
1. THE DEPTH OF ENTRY FOR THE SERVICE CONNECTION PIPE SHALL BE ADJUSTED TO PROPERLY CLEAR UTILITIES AS APPROVED BY THE ENGINEER. THE MINIMUM DEPTH OF ENTRY SHALL BE 30-INCH DEPTH.
 2. SERVICE CONNECTIONS AT DEPTHS LESS THAN 36-INCHES WITHIN THE ROADWAY SHALL BE WRAPPED WITH A PRE-SLIT 3/8" THICK POLYETHYLENE PIPE INSULATION FOAM.
 3. SERVICE CONNECTIONS CROSSING WATER MAINS OR WITHIN 10 FEET OF A WATER SERVICE WITHIN THE ROADWAY SHALL BE WRAPPED WITH A PRE-SLIT 3/8" POLYETHYLENE PIPE INSULATION FOAM AND SLEEVED WITH A 4-INCH CORRUGATED HDPE FLEXIBLE SINGLE WALL PIPE MANUFACTURED BY ADS, INC. OR APPROVED EQUAL. PIPE ENDS SHALL BE SEALED WITH INSULATION SPRAY FOAM.
 4. ALL WORK TO INSTALL THE SERVICE CONNECTION SHALL BE PERFORMED WITHIN THE PUBLIC RIGHT-OF-WAY. WORK ON PRIVATE PROPERTY WILL NOT BE PERMITTED WITHOUT PERMISSION OF THE WARWICK SEWER AUTHORITY.
 5. ANY ADDITIONAL EXCAVATION BEYOND THE LIMITS OF THE 8'x8' PIT, WITHIN AREAS OF TRENCHLESS MAIN LINE INSTALLATION SHALL BE APPROVED BY THE ENGINEER AND PRECLEARED BY THE ARCHEOLOGIST.



TYPICAL EXCAVATION PITS
NOT TO SCALE



1	ADDENDUM 4	1-15-2020	TR	DRAWN LBD
				CHECKED TAR
2	ADDENDUM 7	2-05-2020	TR	APPROVED
				DATE NOV 2019
				SCALE AS SHOWN
REV. NO.	DESCRIPTION	DATE	INT.	
APPROVED				SHT. NO. 63 OF 75
WARWICK SEWER AUTHORITY				FILE NO. 998

CITY OF WARWICK, RHODE ISLAND
WARWICK SEWER AUTHORITY
SYSTEM OF SEWERS
CONTRACT NO. 86B

DETAILS - 6
EXCAVATION PITS

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