

BID PROPOSAL FORM

PROJECT: CRMWA PIPE PURCHASE 2024
RECEIPT OF BIDS: 2:00 PM, LOCAL TIME, MONDAY, APRIL 15, 2024
ADDRESSED TO CRMWA
ATTN: DARREN SCHICK
By Mail: 9875 WATER AUTHORITY RD (PO BOX 9)
SANFORD, TX 79078
By Email: DSCHICK@CRMWA.COM

The undersigned, having carefully examined and thoroughly perused specifications for the above named project; and become fully familiar with all conditions affecting the work required by these specifications, including the scopes of work, hereby proposes to provide all materials, labor, services, etc., required thereby for the bid(s) below:

Base Bid \$ _____

Additive Alternate 1 \$ _____

Additive Alternate 2 \$ _____

Additive Alternate 3 \$ _____

BID BOND: Not Required

PERFORMANCE & PAYMENTS BONDS: Not Required

BIDDER'S NAME: _____

ADDRESS: _____

TELEPHONE NUMBER: _____

EMAIL ADDRESS: _____

BIDDER'S SIGNATURE: _____

DATE: _____



CRMWA New Wells Collection Lines - MATERIAL PROPOSAL

Sanford, TEXAS

April 15, 2024

BASE						
Item No.	Description	Quantity	Unit	Unit Price	Amount	Lead Time (wks)
	16" PVC C900 DR18 Water Line	3,800	LF			
	12" PVC C900 DR18 Water Line	4,320	LF			
	10" PVC C900 DR18 Water Line	340	LF			
	16" tee with 6" flanged outlet	2	EA			
	16"x3" tapping saddle w/flanged outlet	2	EA			
	16"x12" reducer	1	EA			
	12" tee with 6" flanged outlet	4	EA			
	12"x3" tapping saddle w/flanged outlet	3	EA			
	12" tee	1	EA			
	Valve box	5	EA			
	10" tee with 6" flanged outlet	1	EA			
	10" 22.5 deg bend	1	EA			
	16" flanged gate valve w/bevel gear	1	EA			
	12" flanged gate valve w/bevel gear	2	EA			
	10" flanged gate valve w/bevel gear	1	EA			
	6" flanged gate valve w/bevel gear	7	EA			
	3" Flanged gate valve	5	EA			
	3" Combo Air/Vac APCO AVV-140 w/3" flanged nipple inlet or approved equal	5	EA			
	4'dia x 6' tall 16 gauge galvanized corrugated steel can with ladder and hinged lid	12	EA			
	Warning Tape	8,620	LF			
BASE TOTAL						

ADDITIVE ALTERNATE 1						
Item No.	Description	Quantity	Unit	Unit Price	Amount	Lead Time (wks)
1	10" PVC C900 DR18 Water Line	160	LF			

ADDITIVE ALTERNATE 2						
Item No.	Description	Quantity	Unit	Unit Price	Amount	Lead Time (wks)
	16" C906 DIPS HDPE Pipe, DR 11 Water Line	3,800	LF			
	12" C906 DIPS HDPE Pipe, DR 11 Water Line	4,320	LF			
	10" C906 DIPS HDPE Pipe, DR 11 Water Line	340	LF			
	16" bw tee with 6" flanged outlet	2	EA			
	16" bw tee with 3" flanged outlet	2	EA			
	16"x12" reducer	1	EA			
	12" bw tee with 6" flanged outlet	4	EA			
	12" bw tee with 3" flanged outlet	3	EA			
	12" tee	1	EA			
	Valve box	5	EA			
	10" bw tee with 6" flanged outlet	1	EA			
	10" 22.5 deg bend	1	EA			
	16" flanged gate valve w/bevel gear	1	EA			
	12" flanged gate valve w/bevel gear	2	EA			
	10" flanged gate valve w/bevel gear	1	EA			
	6" flanged gate valve w/bevel gear	7	EA			
	3" Flanged gate valve	5	EA			
	3" Combo Air/Vac APCO AVV-140 w/3" flanged nipple inlet or approved equal	5	EA			
	4'dia x 6' tall 16 gauge galvanized corrugated steel can with ladder and hinged lid	12	EA			
	Warning Tape	8,620	LF			
BASE TOTAL						

ADDITIVE ALTERNATE 3						
Item No.	Description	Quantity	Unit	Unit Price	Amount	Lead Time (wks)
1	10" C906 DIPS HDPE Pipe, DR 11 Water Line	160	LF			

SECTION 33 14 13 - PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Constructing all piping and pipe accessories required for project. Contractor shall furnish all materials, equipment, tools, labor, superintendence, and incidentals required for complete construction of the Work as shown on Contract Drawings and specified herein.
2. All materials used in potable water line construction shall be new and the size, type, and class as shown on the Contract Drawings and specified herein for the various items of construction.

B. Related Sections:

1. Division 01 Specification Sections apply to Work of this Section.
2. Section 03 11 00 "Concrete Forming."
3. Section 03 20 00 "Concrete Reinforcing."
4. Section 03 30 00 "Cast-in-Place Concrete."
5. Section 31 10 00 "Site Clearing."
6. Section 31 20 00 "Earth Moving."

1.2 REFERENCES

A. Public Water Utility Distribution Piping and associated components shall conform to the following standards:

1. AWWA B300 – Hypochlorites.
2. AWWA B301 – Liquid Chlorine.
3. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 through 60 inches.
4. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
5. AWWA C110 – Ductile Iron and Gray Iron Fittings.
6. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
7. AWWA C153 – Ductile Iron Compact Fittings.
8. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
9. AWWA M23 – PVC Pipe – Design and Installation.
10. AWWA C502 – Dry-Barrel Fire Hydrants.
11. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
13. AWWA C651 – Disinfecting Water Mains.
14. AWWA C655 – Field Dechlorination.
15. AWWA C800 – Underground Service Line Valves and Fittings.
16. AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Pipe, 1/2- through 3-inch, for Water Service.
17. ASTM D2774 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
18. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing.
19. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.

- 20. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- 21. ASTM A536 – Standard Specification for Ductile Iron Castings.
- 22. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- 23. NSF/ANSI 61 – Drinking Water System Components – Health Effects.
- 24. AASHTO – LRFD Bridge Design Construction Specifications.
- 25. Uni-Bell PVC Pipe Association – Handbook of PVC Pipe Design and Construction.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 “Submittal Procedure.”
- B. Submit manufacturer data on all pipe, fittings, specials, service tape, valves, meters, and other materials specified herein to use on project. Include pipe thickness class calculations, special coatings, lining information, and special embedment requirements differing from that indicated in the Contract Documents.
- C. Laboratory analysis for rock embedment including sieve analysis, fracture faces, abrasion tests and soundness tests.
- D. Trench Safety Program.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.
- B. All applicable TCEQ regulations shall be strictly adhered to.

1.5 TRENCH SAFETY

- A. Contractor shall be responsible for complying with all federal, state, and local trench safety requirements, and for the safety of trenches and excavations.

1.6 CERTIFICATION

- A. Certifications properly executed by manufacturer shall be furnished to Engineer showing compliance to specification requirements and standards sighted herein. Test data from tests performed shall be provided as requested by Engineer.

1.7 INSPECTION

- A. Engineer and representatives shall have access to all phases of Work. Manufacturer and Contractor shall provide proper facilities for access and inspection. Material, fabricated parts, and pipes discovered defective, or do not conform to Specification requirements, will be subject to rejection at any time prior to final acceptance of pipe.

1.8 SCHEDULE OF PIPE

- A. Only type of pipe considered for use on this project are those specified in this Section. Each specified type of pipe shall be used only on those pipelines for which its use is designated.

Size and Use	Type and Class
10-inch Waterline	PVC, C900 DR 18
12-inch Waterline	PVC, C900 DR 18
16-inch Waterline	PVC, C900 DR 18

1.9 SEPARATION CRITERIA

- A. New water lines and appurtenances shall be installed in accordance with the separation requirements of 30 TAC §290.44 (e)(4).
- B. Parallel water and sewer lines must be installed in separate trenches.
- C. New water lines shall be installed at least 9 feet from all sewer lines and manholes. If this is not achievable refer to 30 TAC §290.44 (e)(4).

PART 2 - PRODUCTS

2.1 GENERAL

- A. Contractor may select type of pipe to be installed on a particular water line, provided that, type of pipe is specified herein for use on that water line. All pipe of like size and use, however, shall be of the same type and class. Only approved pipe shall be used in the construction of all pipelines and piping.
- B. All pipe and fittings used in this project shall comply with all applicable requirements of NSF/ANSI 61.

2.2 POTABLE WATER PIPE

- A. PVC Pressure Pipe:
 - 1. 4-inch to 24-inch AWWA C900 PVC Pipe, DR 18:
 - a. Shall meet the requirements of AWWA C900, elastomeric gasket shall meet the requirements of ASTM F477, solid wall, virgin PVC resin, cell class 12454 in accordance with ASTM D1784, blue in color, 20 foot lay length.
 - b. Shall qualify for a minimum HDB of 4,000 psi in accordance with ASTM D2837. Bell section shall be designed to be at least as hydrostatically strong as pipe. Joint shall comply with ASTM D3139 requirements.
 - c. Shall be marked with AWWA standards including size, dimension ratio, pressure class, manufacture name and code, and seal of testing agency that verified the suitability of pipe material for potable water service.
 - d. Each length of pipe (standard and random), including the integral bell, shall be pressure tested to 4 times the rated pressure for a minimum of 5 seconds. Pipe shall meet all additional test requirements as defined in AWWA C900; and
 - e. As manufactured by Napco, Diamond Plastics, or approved equal.
 - 2. 4-inch – 24-inch AWWA C900 Restrained Joint PVC Pipe, DR 18:
 - a. Pipe provided under this Section shall meet all AWWA C900 requirements and Article 2.2A except as modified herein.
 - b. Pipe shall be restrained joint by utilizing precision-machined grooves on the pipe spigot and inside the bell. When assembled, a nylon spline is inserted through an entry hole in the pipe bell, resulting in a continuous circumferential restrained joint; and
 - c. Pipe shall be Certa-Lok as manufactured by Napco or approved equal.
 - 3. 3 inch - 12 inch AWWA C151 Ductile Iron Pipe, Pressure Class 350.
 - a. Meet AWWA C151 requirements.
 - b. Have an exterior, bituminous coating and an inside cement-mortar lining in accordance with AWWA C104.

2.3 PIPE FITTINGS

- A. Pipe fittings used with PVC water lines shall be ductile or cast iron, mechanical joint (MJ), cement-mortar lined, asphaltic coated fittings conforming to requirements of AWWA C153 and suitable for use with the specified PVC pipe with which they are used.
- B. Unless otherwise specified joint restraints shall be used for all buried fittings where indicated on Contract Drawings. Mechanical joint restraints shall be used in combination with concrete thrust-blocking unless indicated otherwise. Restraining glands shall have a pressure rating equal to pipe used. MJ restraints shall be EBAA Series 2000PV, Romac PVC Romagrip, or approved equal.

2.4 VALVES

- A. Gate Valves:
 - 1. Furnish and install gate valves of the size, type, and configuration indicated, where shown on Contract Drawings. Gate valves shall be flanged, mechanical joint, or hub end as shown on Contract Drawings or required by type of joint used in piping. All valves shall open by turning left and unless otherwise specified, shall have a non-rising stem and furnished with a 2-inch operating nut when valves are buried, and with hand wheels when above ground. In cases where operating nut is more than 3 feet below ground, valves shall be supplied with an operator extension to position operating nut within 3 feet of finished ground surface.
 - 2. Gate valves shall meet all the requirements as specified in AWWA C515.
 - 3. Gate valves shall be designed for a working pressure of 250 psi and as manufactured by Mueller Co. or approved equal.
 - 4. Buried gate valves shall be MJ restrained in accordance with Section 2.3 of this Specification.
 - 5. A concrete foundation with compacted base shall be provided for all gate valve installations in accordance with the specifications herein and the Contract Drawings.
- B. Valve Boxes and Extension Stems:
 - 1. Extension stems shall be furnished on buried valves where the top of operating nut is more than 36 inches below finished grade. Top of extension stem shall be within 3 feet of finished ground surface.
 - 2. Buried gate valves shall be provided with cast iron valve boxes. Valve boxes to be asphaltic bituminous coated, placed at a depth as required in the field. Valve boxes shall be installed with a reinforced concrete collar as indicated in the Contract Drawings.
 - 3. Valve boxes to be Dallas Shorty with 6-inch C900 PVC with lid marked "Water" or approved equal. Where necessary valve box extensions shall be provided.

2.5 TAPPING VALVES

- A. Furnish and install tapping gate valves of the size, type, and configuration indicated, where shown on Contract Drawings. Tapping gate valves shall be mechanical joint by flanged joint unless otherwise specified. All tapping gates valves shall open by turning left and unless otherwise specified, shall have a non-rising stem and furnished with a 2-inch operating nut when valves are buried. In cases where operating nut is more than 3 feet below ground, valves shall be supplied with an operator extension to position operating nut within 3 feet of finished ground surface.
- B. Tapping gate valves shall meet all the requirements as specified in AWWA C509.
- C. Tapping gate valves shall be designed for a working pressure of 250 psi and as manufactured by Mueller Co. or approved equal.

- D. Buried tapping gate valves shall be MJ restrained in accordance with Section 2.3 of this Specification.
- E. A concrete foundation with compacted base shall be provided for all gate valve installations in accordance with the specifications herein and the Contract Drawings.
- F. Valve Boxes and Extension Stems:
 - 1. Extension stems shall be furnished on buried valves where the top of operating nut is more than 36 inches below finished grade. Top of extension stem shall be within 3 feet of finished ground surface.
 - 2. Buried tapping gate valves shall be provided with cast iron valve boxes. Valve boxes to be asphaltic bituminous coated and placed at a depth as required in the field. Valve boxes shall be installed with a reinforced concrete collar as indicated in the Contract Drawings.
 - 3. Valve boxes to be Dallas Shorty with 6-inch C900 PVC with lid marked "Water" or approved equal. Where necessary valve box extensions shall be provided.

2.6 TAPPING SLEEVES

- A. Furnish and install tapping sleeves of the size, type, and configuration indicated, where shown on the Contract Drawings. Tapping sleeves shall be full wrap-around type, 200 psi rated, stainless steel, ductile iron, or approved equal. All bolts and various other hardware shall be stainless steel.
- B. Tapping sleeves to be Thompson Pipe Group or approved equal.

2.7 PIPE REPAIR

- A. As necessary furnish and install pipe repair clamps.
- B. Pipe repair clamps shall be stainless steel, full seal clamps.
- C. Repair clamps to be Smith Blair 261/262 Series or approved equal.

2.8 ACCESSORIES

- A. Warning Tape
 - 1. Provide traceable tape made of plastic, blue in color, and a minimum of 3-4 inches wide; and lettering which states there is a buried water line below.

PART 3 - EXECUTION

3.1 POTABLE WATER LINE INSTALLATION

- A. General:
 - 1. All pipe and accessories for the Work specified herein shall be unloaded, handled, laid, jointed, tested for defects and for leakage in the manner herein specified.
 - 2. Coordinate delivery storage, and delivery schedule with Owner's Representative.
 - 3. Pipe Bending and Joint Angular Deflection:
 - a. Shall meet the requirements of AWWA C605 and manufactures specifications. Whichever is more stringent shall apply to this project.

4. Connections to Existing Lines:
 - a. Connections between new Work and existing Work, where required, shall be made using proper transition sleeves and fittings to suit actual conditions. Additional bends may also be necessary to provide minimum pipe separations as required by TCEQ. These fittings, special sleeves, and bends shall be provided after verification from Engineer. When necessary to interrupt service to existing facilities to make connection to an existing line, Contractor may be required to make connections at a time designated by Owner at no additional cost to Owner.
- B. Responsibility for Materials:
 1. Contractor shall be responsible for all material furnished by them and shall replace at own expense all such material that is found to be defective in manufacture or has become damaged in handling after delivery.
- C. Storage, Handling Pipe and Accessories:
 1. All pipe, fittings, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the Work by Contractor. In loading and unloading, they shall be lifted by hoists or slid, or rolled on skidways in such a manner as to avoid shock or damage to the materials. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.
 2. The pipe, fittings and accessories shall be placed along the site in such a manner as to be kept as free as possible from dirt, sand, mud and other foreign matter.
 3. When prolonged exposure to direct sunlight is anticipated, PVC pipe and accessories should be covered with an opaque material while still permitting adequate air circulation above and around the pipe.
- D. Trench Safety Systems:
 1. The scope of Work includes, but is not limited to, trench and excavation safety systems either by cut back method or braced excavation method for all trenches 5-feet and deeper whether indicated on Drawings or required by actual field conditions. Trenches exceeding or not exceeding 5 feet in depth shall be protected as required by OSHA, State and Local standard and as specified in Section 31 41 10 "Trench Safety Systems."
 2. Contractor shall be responsible for complying with all applicable State of Texas safety standards and with the applicable OSHA regulations concerning trench excavation, general excavation and construction safety.
 3. Contractor shall be responsible for implementing a trench shoring system wherever the trench depth exceeds 5 feet.
- E. Trench Excavation:
 1. Contractor shall provide construction-staking services. Contractor is responsible for notifying Owner's Representative of any concerns with construction staking.
 2. Contractor shall excavate to the alignment and elevations indicated on the Contract Drawings or as staked in the field. Any deviations shall be approved by the Engineer.
 3. There will be no classification of or extra payment for excavated materials and all materials encountered shall be excavated as required. Adjacent structures and property shall be protected from damage by construction equipment.
 4. Excavated materials should be stockpiled in a manner that will not endanger the workers or the public and which will cause the least obstruction to roadways.
 5. Contractor's attention is drawn to the fact that the trench bottom, as shown on the Contract Drawings, is approximately 4-inch – 6-inch below the bottom of the pipe grade so that bedding material can be placed beneath the pipe in accordance with the trench cross-section details and these specifications. The minimum depth of cover for the piping shall be 48 inches unless otherwise specifically shown on the Contract Drawings.

6. Trench safety systems as specified shall be installed where required. The trench walls shall be made vertical to a point at least 1 foot above the top of the pipe. Vertical trench walls above this point will not be required; however, in areas of limited right-of-way or when necessary to protect existing facilities or private property, the slope of the trench wall shall be limited. Where necessary to stay within the maximum width limits at the top of the pipe or to maintain a relatively straight trench wall to remain within available right-of-way, the trench walls shall be adequately supported as required by these specifications and OSHA regulations. Contractor shall be fully responsible for any damage to private property or existing facilities due to inadequate support.
 7. Excavate trench only as necessary to install the pipe. Excavation limits are as follows:
 - a. Pipe less than 18 inches in diameter: Pipe O.D. + 12 inches.
 - b. Pipe from 18 to 36 inches in diameter: Pipe O.D. + 18 inches.
 8. The trenching equipment shall be maintained on a sufficiently level roadbed to provide substantially vertical trench walls.
 9. To obtain a true even grade, the trench shall be fine graded and shaped in accordance with the details as shown on the Contract Drawings. Any part of the trench excavated below grade shall be corrected by filling with approved material and thoroughly compacting. If clay, rock or other unyielding material is encountered in the bottom of the trench, it shall be removed to a depth of 4-inch – 6-inch below grade, refilled with approved material and thoroughly compacted to grade.
 10. Trench digging machinery may be used to make trench excavations except in places where operations of same would cause damage to existing structures either above or below ground; in such instances, hand methods shall be employed.
 11. Contractor will be required to locate all existing utility lines, whether or not they are shown on the Contract Drawings, including consumer service lines, far enough in advance of the trenching to make proper provisions for protecting the lines and to allow for any deviations that may be required from the established lines and grades. The operators of all oil or gas pipelines shall be notified prior to excavation around such lines so that these operators may be present during excavation.
 12. Contractor shall not be allowed to disrupt the service on any utility lines except consumer service lines, which may be taken out of service for short periods of time, if Contractor obtains permission from Owner's Representative.
 13. Contractor shall immediately notify the proper utility company of any damage to utility lines, in order that service may be established with the least possible delay. Any damage to existing lines and the repair of consumer lines which are authorized to be cut or temporarily taken out of service shall be repaired or replaced by Contractor at own expense, and as directed by an official representative of Owner of the damaged line.
 14. All new and existing lines shall be properly supported to prevent settlement or damage to the line both during and after construction.
 15. Wherever necessary to prevent caving, the trench shall be adequately supported.
 16. Maximum horizontal offset of trench wall from bottom of trench to top of trench (undercutting) shall be 4 inches.
 17. All excavation shall be unclassified, and no extra compensation made for solid rock excavation. Contractor is expected to make boring of his own and satisfy himself to character of material encountered.
- F. Dewatering:
1. Where running or standing water occurs in the trench bottom the water should be removed by pumps and other suitable means to prevent pipe flotation, until the pipe has been installed and the backfill has been placed and compacted.

- G. Trench Methods:
1. Trench Boxes - Submit manufacturer's standard data sheet and certificate of compliance signed by a registered professional Engineer stating the maximum allowable depth for the given design pressure for each type of trench box proposed for use.
 2. Alternative Systems - If alternative systems composed of steel, aluminum, wood or a combination of materials are proposed, submit design calculations signed by a registered professional Engineer showing all member properties, design strengths and any stress increases used with justification for their use.
- H. Laying of Pipe:
1. Placement of pipe and fittings into a trench should be done with ropes and skids, slings on a backhoe bucket, or by hand. Pipe or fittings should not be thrown into the trench and no part of the pipe should be allowed to take an unrestrained fall onto the trench bottom.
 2. When pipe laying is not in progress, open ends of installed pipe should be closed to prevent trench water, dirt, and foreign matter from entering the line.
 3. Contractor is responsible for laying pipe to the elevations as shown in the Contract Drawings.
- I. Joint Assembly, Field-Cutting, Chamfering, and Curvature:
1. Joint assembly, field-cutting, chamfering, and curvature shall be performed in accordance with the Uni-Bell PVC Pipe Association PVC Pipe Design and Construction handbook and/or manufacturers recommended procedures. Whichever is more stringent shall apply.
- J. Backfill:
1. Foundation:
 - a. A foundation is only required when the trench bottom is unstable. In such cases the bottom of the trench is to be over-excavated and brought back to grade. Class I, II, or III may be utilized for the foundation, if necessary, as follows:

Soil Class	Placement
Class I	Install in 12 in. thick lifts
Class II	
Class III	Install in 6 in. thick lifts
 - b. Material shall be moistened and placed in lifts as indicated above and compacted by tamping to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content.
 2. Bedding:
 - a. Bedding is required to bring the trench bottom up to grade, it should be placed to provide uniform and adequate support under the pipe and placed by hand. Holes for pipe bells should be provided at each joint to ensure uniform support for the pipe.
 - b. Bedding layer shall be 4 - 6 inches in thickness Sand or Class IB, II, or III soil that meets the following criteria should, be used for backfilling.

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	</= 50%	< 5%	n/a	n/a
II	100%	</= 50%	< 5%	n/a	n/a
III	100%	> 50%	> 12% - < 50%	n/a	GM < 4 GC < 7 SM > 4 SC > 7

c. The material should be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable materials.

d. No particles larger than 3/4-inch in diameter are allowed in the bedding layer.

3. Haunching:

a. Haunching is defined as the backfill from the bottom of the pipe to the springline of pipe. Material should be placed and consolidated under the pipe haunch so adequate side support is provided to the pipe without causing displacement from its proper alignment.

b. Material shall be moistened and placed in lifts not exceeding 6 inches in thickness and compacted by tamping to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content.

c. Material shall be placed by hand or by approved mechanical methods. Class IB, II, III soil that meets the following criteria should be used for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	</= 50%	< 5%	n/a	n/a
II	100%	</= 50%	< 5%	n/a	n/a
III	100%	> 50%	> 12% - < 50%	n/a	GM < 4 GC < 7 SM > 4 SC > 7

d. The material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.

e. Water jetting will not be allowed.

4. Initial Backfill:

a. Initial backfill is defined as the backfill from the springline of the pipe to 1 foot above the pipe. Material should be moistened and placed in lifts not exceeding 6-inch in thickness and compacted to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content. Care should be taken to not damage the pipe during compaction.

b. Material shall be placed by hand or by approved mechanical methods. Class IB, II, or III soil that meets the following criteria should be used for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	</= 50%	< 5%	n/a	n/a
II	100%	</= 50%	< 5%	n/a	n/a
III	100%	> 50%	> 12% - < 50%	n/a	GM < 4 GC < 7 SM > 4 SC > 7

- c. The material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.
- d. Water jetting will not be allowed.
- 5. Final Backfill:
 - a. Final backfill is defined as the backfill from 1 foot above the pipe to the bottom of the subgrade for paved areas or to the existing grade for unpaved areas. Material should be moistened and placed in lifts not exceeding 6 inches in thickness and compacted to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content. Care should be taken to not damage the pipe during compaction.
 - b. Material shall be placed by hand or by approved mechanical methods. Class IB, II, or III soil that meets the following criteria should be used for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	$\leq 50\%$	$< 5\%$	n/a	n/a
II	100%	$\leq 50\%$	$< 5\%$	n/a	n/a
III	100%	$> 50\%$	$> 12\% - < 50\%$	n/a	GM < 4 GC < 7 SM > 4 SC > 7

- c. The material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.
- d. Water jetting will not be allowed.
- e. At Contractor's expense/option, flowfill can be utilized in place of soil for the final backfill zone.
- f. If Contractor elects to use flowfill in the final backfill zone it should be composed of a mixture of Portland cement, pea gravel and sand with a cement content of 1-1/2 sacks per cubic yard of flowfill.
- g. Tracible warning tape should be installed in the Final Backfill zone 18 inches below the finished grade of the trench directly above the potable water line.

K. Cleanup:

1. The backfill shall not be rounded up over trenches. The surface of the trench backfill shall be compacted and bladed to final grading contours.
2. Contractor shall maintain the trench surfaces in a satisfactory manner until final completion and acceptance of the Work. The maintenance shall include blading from time to time as necessary, filling depressions caused by settlement, and other Work required to keep all areas in a presentable condition.
3. Any trench settlement which occurs within the 1-year warranty period shall be corrected by Contractor at no expense to Owner.

3.2 POTABLE WATER LINE FITTING INSTALLATION

- A. General: Fittings, meters, and valves shall be connected with flanged or mechanical joints as indicated on Contract Drawings. Each joint shall include flanged ends or gland retainer, gasket, and bolts required to complete connection. Contractor shall perform all Work necessary to make connections and be responsible for the quality and proper operation of those joints.

- B. Procedures
 - 1. Before making connections, pipe, fittings, or valves shall be properly supported, but free to move as bolted. Flange faces shall be set so bolt holes are properly aligned, flange faces bear uniformly on gaskets, and flanges will not be under strain after joint completion.
 - 2. To avoid strains upon flanges, bolts shall be gradually tightened at uniform rates sequentially on opposite sides of flanges. To assure flanges are not under strain, Engineer may request bolts loosened in any joint. Mechanical joint fittings and valves shall be installed in a similar fashion as previously described for flanged.
 - 3. Buried fittings will require polyethylene wrap with a thickness of 10 mils minimum.
- C. All underground water line fittings shall be mechanical joint with a pressure rating equal to or greater than that of the water line pipe material.
- D. Joints shall be restrained by concrete blocking and MJ restraints as specified on the Contract Drawings.
 - 1. Concrete Blocking:
 - a. Concrete blocks shall be provided bearing solidly against the undisturbed trench bank, at all changes in direction and/or elevation. Concrete for blocking shall contain not less than 3 sacks of cement per cubic yard and have a 28-day compressive strength of 3,000 psi.
 - 2. MJ Restraints:
 - a. MJ restraints shall be provided at all changes in direction and/or elevation.
 - b. MJ restraints shall be installed in accordance with manufacturer recommendations.

3.3 VALVE, TAPPING VALVE, TAPPING SLEEVE, FIRE HYDRANT, AND PIPE REPAIR INSTALLATION

- A. Install valves, tapping valves, tapping sleeves, fire hydrants, and pipe repairs in the configuration indicated on the Contract Drawings and in accordance with the manufacturer's specifications and specifications herein.

3.4 SERVICE CONNECTION INSTALLATION

- A. Shall be installed in the orientation and configuration indicated on the Contract Drawings and in accordance with the manufacturer's specifications and specifications herein.

3.5 HYDROSTATIC TESTING

- A. Water lines shall be tested in accordance with AWWA C605 and the specifications herein.
- B. Contractor shall provide all materials, equipment, tools, labor, superintendence, and incidentals required to achieve a completed and approved hydrostatic test.
- C. Procedure:
 - 1. Each section of pipe shall be slowly filled with water at the point of lowest elevation. Pressure shall be applied and maintained by means of a pump connected to pipe in a satisfactory manner.
 - 2. As line is filled and before applying test pressure, all air shall be expelled from pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, taps shall be tightly plugged, in accordance with the specifications herein.

3. Test shall not begin until after the water line has been properly filled, flushed, and purged of air. The water line shall be pressurized to 1.25 times the system working pressure or a minimum of 150 psi, whichever is greater, at the highest point on section of line tested. Duration of each pressure test shall be as directed by Engineer but shall not exceed 2 hours.
4. During the time test pressure is on the pipe, line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks, shall be repaired and any cracked or defective pipes or fittings removed and replaced with sound materials in the manner provided. Repeat test until satisfactory results are obtained.
5. After all defects in line are satisfactorily repaired and all visible leaks stopped, make a leakage test on each valved section of line to determine quantity of water lost by leakage. Contractor will furnish all labor, material, and equipment required for making test. Leakage shall be determined by measuring quantity of water supplied to each valved section of line, during test period, when various sections of line are under pressure.
6. Maximum allowable leakage for pressure drop in the potable water line is calculated as:

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Where:

Q = Quantity make up water in gallons per hour

L = Length of pipe section being tested, in feet

D = Nominal diameter of the pipe in inches

P = Test pressure in psi \pm 5 psi of specified

7. If sections show excessive leakage, locate and repair defective joints until leakage is within specified allowance.

3.6 DISINFECTION

- A. Water lines shall be disinfected in accordance with 30 TAC §290.46(g) and AWWA C651 and the specifications herein. Prior to acceptance for operation, all portions of water lines installed shall be disinfected as specified. Prior to putting lines in service and after pressure tests are made, unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud are removed before introducing chlorinating material.
- B. Forms of Chlorine for Disinfection:
 1. Liquid chlorine (gas):
 - a. Conforming to AWWA B301, containing 100 percent available chlorine.
 2. Sodium hypochlorite:
 - a. Conforming to AWWA B300, containing 5-15 percent available chlorine.
 3. Calcium hypochlorite:
 - a. Conforming to AWWA B300, containing 65 percent available chlorine.
- C. Chlorination Methods for Disinfection:
 1. Tablet/Granule Method:
 - a. If elected, shall be performed in accordance with AWWA C651, Section 4.3.
 2. Continuous-Feed Method:
 - a. If elected, shall be performed in accordance with AWWA C651, Section 4.4.
 3. Slug Method:
 - a. If elected, shall be performed in accordance with AWWA C651, Section 4.5.
 4. Spray Disinfection:
 - a. If elected (only to be used for large transmission lines), shall be performed in accordance with AWWA C651, Section 4.6.

- D. Verification:
 - 1. Bacteriological Tests:
 - a. Bacteriological tests should be performed in accordance with AWWA C651, Section 5.
 - b. Test samples must be submitted to a TCEQ approved laboratory and must indicate that the facility is free from microbiological contamination before it is placed into service.
- E. Contractor shall arrange for satisfactory disposal of water flushed from lines, using pipe, dikes, or channels to an adequate drain so no nuisance will be created.
- F. Contractor shall include costs for disinfection in unit cost for installing pipe.

3.7 CLEAN UP

- A. After construction Work is completed, Contractor shall remove all rubbish, excess materials from excavations, and other debris from site of Work. Replace/repair all affected items (surfacing, landscaping, etc.) to equal or better condition than preconstruction conditions. Cost of cleanup shall be included in bid prices for various units of Work.

END OF SECTION

SECTION 33 05 07.13 – UTILITY DIRECTIONAL DRILLING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes
 - 1. PVC and HDPE pipe, including standards for dimensionality, testing, quality, safe handling, storage, and installation of pipe by horizontal directional drilling (HDD), directional boring, or guided boring.
- B. Related Requirements
 - 1. Division 01 Specification Sections apply to Work of this Section.
 - 2. Section 03 11 00 “Concrete Forming.”
 - 3. Section 03 20 00 “Concrete Reinforcing.”
 - 4. Section 03 30 00 “Cast-in-Place Concrete.”
 - 5. Section 31 10 00 “Site Clearing.”
 - 6. Section 31 20 00 “Earth Moving.”
 - 7. Section 32 01 17.10 “Removing and Replacing Asphalt Paving.”
 - 8. Section 33 14 13 “Public Water Utility Distribution Piping.”
- C. Scope
 - 1. Contractor shall provide acceptable restrained joint PVC and/or HDPE pipe as shown in Plans, which meets all testing and material properties as described herein for installation by HDD.
 - 2. Contractor responsible for all installation processes and procedures associated with installation by HDD per this specification.

1.2 REFERENCES

- A. Restrained joint PVC pipe installed by HDD method shall conform with the following standards:
 - 1. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 in. Through 60 inch.
 - 2. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
 - 3. AWWA C110 – Ductile Iron and Gray Iron Fittings.
 - 4. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 5. AWWA M23 – PVC Pipe – Design and Installation.
 - 6. ASTM D2774 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 7. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing.
 - 8. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
 - 9. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 10. ASTM A536 – Standard Specification for Ductile Iron Castings.
 - 11. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 12. NSF/ANSI 61 – Drinking Water System Components – Health Effects.
 - 13. AASHTO – LRFD Bridge Design Construction Specifications.
 - 14. Uni-Bell PVC Pipe Association – Handbook of PVC Pipe Design and Construction.

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- B. HDPE pipe installed by HDD method shall conform to the following standards:
 - 1. AWWA C906 - PE pressure Pipe and Fittings, 4 in. through 63 in. for Water Distribution and Transmission
 - 2. AWWA M55 - Manual for the Design and Installation of Polyethylene Pipe in Water Applications
 - 3. ASTM D2239 Standard Specification for Polyethylene Plastic Pipe
 - 4. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping
 - 5. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
 - 6. ASTM F714 - Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter
 - 7. ASTM F2620 - Standard Practice for Heat Fusion Joining of Polyethylene Pipe and
 - 8. ASTM F1962 - Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of PE Pipe or Conduit Under Obstacles, including River Crossings
 - 9. NSF/ANSI 14 - Plastics Piping System Components and Related Materials

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 "Submittal Procedures."
- B. Product data required on pipe:
 - 1. Pipe size.
 - 2. Pipe standard.
 - 3. Dimension ratios and pressure ratings.
 - 4. Lay length.
 - 5. Color.
 - 6. Recommended minimum bending radius.
 - 7. Recommended maximum safe pull force.
 - 8. Work plan and information required from Contractor and/or HDD Contractor, also supplied to pipe supplier, if requested:
 - a. Work plan includes for each HDD installation, any excavation locations and dimensions, interfering utilities, bore dimensions and locations including bend radii used, and traffic control schematics.
 - b. Project safety and contingency plan shall include but not limited to drilling fluid containment and cleanup procedures, equipment and plan for compromised utility installations including electrical and power lines, water, wastewater, and any other subsurface utility in the area.
 - c. HDD schedule identifying daily work hours and dates for each installation.
- C. Post-Construction Submittals. As-recorded data required from Contractor to Owner upon request:
 - 1. Approved datalogger device reports.
 - 2. As-recorded Information
 - a. As-recorded plan and profile reflects actual installed alignment and horizontal offset from baseline and depth of cover.
 - b. Reference and show all fittings, valves, or other appurtenances.
 - c. Daily project log and tracking log sheets, if used, are provided. Tracking log sheet data, if needed, includes all that apply including inclination, depth, azimuth, and hydraulic pull-back and rotational force measured.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.
- B. All applicable ODEQ regulations to which shall be strictly adhered.

1.5 CERTIFICATION

- A. Certifications properly executed by manufacturer shall be furnished to Engineer showing compliance to specification requirements and standards sighted herein. Test data from tests performed shall be provided as requested by Engineer.

1.6 INSPECTION

- A. Engineer and representatives shall have access to all phases of Work. Manufacturer and Contractor shall provide proper facilities for access and inspection. Material, fabricated parts, and pipes discovered defective, or which do not conform to Specification requirements, will be subject to rejection at any time prior to final acceptance of pipe.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products shall be in accordance with Section 33 14 13 “Public Water Utility Distribution Piping.”

2.2 DRILLING SYSTEM EQUIPMENT

- A. Directional drilling equipment, at minimum, consists of directional drilling rig of sufficient capacity to perform bore(s) and pull-back of pipe(s), drilling fluid mixing and delivery system of sufficient capacity to successfully complete crossing, guidance system to accurately guide boring operations, and trained and competent personnel to operate system. All equipment shall be in good, safe, operating condition with sufficient supplies, materials, and spare parts on hand to maintain system in good working order for Project duration. All required equipment included in emergency and contingency plan as submitted per specifications.
- B. Drilling Rig
 1. Directional drilling machine consists of hydraulically-powered system designed to rotate, push, and pull drill pipe while delivering pressurized fluid mixture to drill head. Machine anchored to withstand pulling, pushing, and rotating forces required to complete Project.
 2. Drilling rig hydraulic system shall be of sufficient pressure and volume to power drilling operations. Hydraulic system shall be free from leaks.
 3. Drilling rig has system to monitor pull-back hydraulic pressure during pull-back operations.
- C. Drill Head
 1. HDD equipment produces stable fluid-lined tunnel with steer-able drill head and any subsequent pre-reaming heads.
 2. System must control depth and direction of drilling operation.
 3. Drill head contains all necessary cutters and fluid jets for operation, and appropriate design for ground medium drilled.

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- D. Drilling Fluid System
1. Drilling Fluid (Drilling Mud)
 - a. Drilling fluid composed of clean water and appropriate additive(s) for fluid to used. Water to be from clean source and meet mixing requirements of mixture manufacturer(s).
 - b. Mix water and additives thoroughly to assure absence of clumps or clods. No hazardous additives may be used.
 - c. Maintain drilling fluid at viscosity sufficient to suspend cuttings and maintain integrity of bore wall(s).
 - d. Dispose drilling fluid off-site per local, state, and federal requirements and/or permit conditions.
 - e. No additional chemicals or polymer surfactants allowed to add to drilling fluid unless submitted per specification.
 2. Mixing System
 - a. Drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid for Project.
 - b. Mixing system shall ensure thorough mixing of drilling fluid. Drilling fluid reservoir tank sized for adequate fluid storage.
 - c. Mixing system continually agitates drilling fluid during drilling operations.
 3. Drilling Fluid Delivery and Recovery System
 - a. Drilling fluid pumping system has minimum capacity to supply drilling fluid per drilling equipment pull-back rating at constant required pressure.
 - b. Delivery system has filters or other appropriate in-line equipment to prevent solids from pumping into drill pipe.
 - c. Contain used and spilled drilling fluid during drilling operations and properly dispose. Maintain spill containment measures around drill rigs, drilling fluid mixing system, entry and exit pits, and drilling fluid recycling system (if used) to prevent spills into surrounding environment. Place pumps, vacuum truck(s), and/or storage of sufficient size to contain excess drilling fluid.
 - d. Use a closed-loop drilling fluid and drilling fluid cleaning system to whatever extent practical, depending upon project size and conditions. Do not reuse drilling fluid that escaped containment in drilling system.
- E. Drilling Control System
1. Calibrating electronic detection and control system verified before start of bore.
 2. Drilling head shall be remotely steerable by electronic or magnetic detection system. Drilling head location monitored in 3 dimensions:
 - a. Offset from baseline.
 - b. Distance along baseline.
 - c. Depth of cover.
 3. Point of head rotation also monitored.
 4. For gravity application and on-grade drilling, use sonde/beacon or approved equipment applicable for grade increments of 1/10th of 1 percent.

2.3 PIPE PULL HEADS

- A. Utilize pipe pull heads that always employ positive through-bolt design assuring smooth wall against pipe cross-section.
- B. Pipe pull heads specifically designed for use with fusible PVC and/or HDPE pipe as needed and as recommended by pipe supplier.

2.4 PIPE ROLLERS

- A. Pipe rollers, if required, shall be of sufficient size to fully support pipe weight during handling and pullback operations.
- B. Use a sufficient quantity of rollers and spacing, per pipe supplier guidelines to assure adequate support and excessive sagging of product pipe.

PART 3 - EXECUTION

3.1 GENERAL

- A. All pipe and accessories for the Work specified herein shall be unloaded, handled, laid, jointed, tested for defects and for leakage in the manner herein specified.
- B. Coordinate delivery storage, and delivery schedule with Owner's Representative.
- C. Pipe Bending and Joint Angular Deflection of PVC Pipe:
 - 1. Meets requirements of AWWA C605 and manufacturer specifications. Whichever is more stringent shall apply.
- D. Pipe Bending and Joint Angular Deflection of HDPE Pipe:
 - 1. Meets requirements of AWWA M55 and manufacturer specifications. Whichever is more stringent shall apply.
- E. Connections to Existing Lines:
 - 1. Connections between new Work and existing Work, where required, shall be made using proper transition sleeves and fittings to suit actual conditions. Additional bends may also be necessary to provide minimum pipe separations as required by ODEQ. These fittings, special sleeves, and bends shall be provided after verification from Engineer. When necessary to interrupt service to existing facilities to make connection to an existing line, Contractor may be required to make connections at a time designated by Owner at no additional cost to Owner.
- F. Responsibility for Materials:
 - 1. The Contractor shall be responsible for all material furnished by them and shall replace at own expense all such material that is found to be defective in manufacture or has become damaged in handling after delivery.
- G. Storage, Handling Pipe and Accessories:
 - 1. All pipe, fittings, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to, and distributed at the site of the Work by the Contractor. In loading and unloading, they shall be lifted by hoists or slid, or rolled on skidways in such a manner as to avoid shock or damage to the materials. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.
 - 2. The pipe, fittings and accessories shall be placed along the site in such a manner as to be kept as free as possible from dirt, sand, mud, and other foreign matter.
 - 3. When prolonged exposure to direct sunlight is anticipated, PVC and HDPE pipe and accessories should be covered with an opaque material while still permitting adequate air circulation above and around the pipe.

3.2 DRILLING OPERATIONS

A. General

1. Bore path and alignment as indicated in Contract Documents. Bore path may be modified based on field and equipment conditions. Entry and exit locations and control-point elevations maintained as indicated in Contract Documents.
2. Bend radii shown in Contract Documents are minimum allowable radii and shall not be reduced.

B. Location and Protection of Underground Utilities

1. Correct location of all underground utilities that impact HDD installation, is Contractor responsibility, regardless of locations shown on Contract Drawings or previous surveys completed.
2. Contractor contacts utility location and notification services before construction.
3. Positively identify all existing lines and underground utilities including exposing facilities located within envelope of possible impact of HDD installation as determined for Project specific site conditions. Contractor and HDD system operator hold responsibility to determine this envelope of safe offset from existing utilities. This includes but not limited to soil conditions and layering, utility proximity and material, HDD system and equipment, and foreign subsurface material.

C. Site Location Preparation

1. Grade of fill Work site, as indicated on Contract Drawings, to provide level working area. No alterations beyond required for operations are to be made.
2. Contractor confines all activities to designated Work areas.

D. Drilling Layout and Tolerances

1. Accurately survey drill path with entry and exit areas placed in appropriate locations where indicated on Contract Drawings. If using magnetic guidance system, survey drill path for any surface geomagnetic variations or anomalies.
2. Instrumentation provided and maintained all times to accurately locate pilot hole, measure drill-string axial and torsional loads, and measure drilling fluid discharge rate and pressure.
3. Drill entry and exit areas, not to exceed bending limitations of pipe as recommended by pipe supplier.

E. Pilot Hole Bore

1. Drill pilot hole along bore path. If pilot bore does deviate from bore path, Contractor may pull-back and re-drill from location along bore path before deviation.
2. Contractor limits curvature in any direction to reduce force on pipe during pull-back. Minimum radius of curvature shall be no less than specified by pipe supplier and indicated on Contract Drawings.

F. Reaming

1. After successfully completing pilot hole, ream bore hole to diameter meeting requirements of pipe installed:

Nominal Pipe Diameter	Bore Hole Diameter
<8 inches	Pipe Diameter + 4 inches
8 to 24 inches	Pipe Diameter x 1.5
>24 inches	Pipe Diameter + 12 inches

2. Use multiple reaming passes at Contractor discretion and conform to specification.
3. In the event of drilling fluid fracture, returns loss or other loss of drilling fluid, Contractor responsible for restoring any damaged property to original condition and cleaning up area near damage or loss.

3.3 PIPE PULL-BACK AND INSERTION

- A. Cartridge load and assemble pipe before insertion.
- B. Contractor handles pipe to not over-stress pipe before insertion. Limit vertical and horizontal curves so pipe does not bend past pipe supplier's minimum allowable bend radius, buckle, or otherwise become damaged. Remove and replace damaged pipe portions.
- C. Grade pipe entry area as needed to provide support for pipe and allow free movement into bore hole.
 - 1. Guide pipe into bore hole to avoid deformation of, or damage to, pipe.
 - 2. Continuously or partially support pipe on rollers or other Owner- and Engineer-approved friction decreasing implement during insertion, as long as pipe not over-stressed or critically abraded before or during installation.
 - 3. Use a swivel between reaming head and pipe to minimize torsion stress on pipe assembly.
- D. Buoyancy modification is at sole discretion of Contractor and not exceed pipe supplier's guidelines regarding maximum pull force or minimum bend radius of pipe. Damage caused by buoyancy modifications is Contractor responsibility.
- E. Once pull-back operations commence, continue operation without interruption until pipe is completely pulled through bore hole.
- F. Install pipe not causing upheaval, settlement, cracking, or movement and distortion of surface features. Contractor corrects damages caused by his operations.

3.4 POTABLE WATER LINE FITTING INSTALLATION

- A. Fittings shall be installed in accordance with Section 33 14 13 "Public Water Utility Distribution Piping."

3.5 VALVE, TAPPING VALVE, TAPPING SLEEVE, FIRE HYDRANT, AND PIPE REPAIR INSTALLATION

- A. Shall be installed in accordance with Section 33 14 13 "Public Water Utility Distribution Piping."

3.6 SERVICE CONNECTION INSTALLATION

- A. Shall be installed in accordance with Section 33 14 13 "Public Water Utility Distribution Piping."

3.7 HYDROSTATIC TESTING

- A. Shall be performed in accordance with Section 33 14 13 "Public Water Utility Distribution Piping."

3.8 DISINFECTION

- A. Shall be performed in accordance with Section 33 14 13 "Public Water Utility Distribution Piping."

3.9 CLEAN UP

- A. After construction Work is completed, Contractor shall remove all rubbish, excess materials from excavations, and other debris from site of Work. Properly dispose all drilling fluid per specifications and all applicable jurisdictional laws. Replace/Repair all affected items (surfacing, landscaping, etc.) to equal or better condition than preconstruction conditions. Cost of cleanup shall be included in bid prices for various units of Work.
- B. Contractor verifies all utilities, structures, and surface features in Project area are sound.

END OF SECTION

All iron and steel products used in this project for the construction, alteration, maintenance or repair of a public water system or water treatment plant shall be produced in the United States in accordance with the Consolidated Appropriation Act of 2014. Such products include lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete and construction materials.

SECTION 33 14 13 - PUBLIC WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Constructing all piping and pipe accessories required for Project. Contractor shall furnish all materials, equipment, tools, labor, superintendence, and incidentals required for complete construction of the Work as shown on Contract Drawings and specified herein.
 2. All materials used in potable water line construction shall be new and the size, type, and class as shown on the Contract Drawings and specified herein for the various items of construction.
- B. Related Sections:
1. Division 01 Specification Sections apply to Work of this Section.
 2. Section 03 11 00 "Concrete Forming."
 3. Section 03 20 00 "Concrete Reinforcing."
 4. Section 03 30 00 "Cast-in-Place Concrete."
 5. Section 31 10 00 "Site Clearing."
 6. Section 31 20 00 "Earth Moving."
 7. Section 32 01 17.10 "Removing and Replacing Asphalt Paving."
 8. Section 33 05 07.13 "Utility Directional Drilling."

1.2 REFERENCES

- A. Public Water Utility Distribution Piping and associated components shall conform to the following standards:
1. AWWA B300 – Hypochlorites.
 2. AWWA B301 – Liquid Chlorine.
 3. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 4. AWWA C110 – Ductile Iron and Gray Iron Fittings.
 5. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 6. AWWA C153 – Ductile Iron Compact Fittings.
 7. AWWA C502 – Dry-Barrel Fire Hydrants.
 8. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
 9. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
 10. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
 11. AWWA C651 – Disinfecting Water Mains.
 12. AWWA C655 – Field Dechlorination.
 13. AWWA C800 – Underground Service Line Valves and Fittings.
 14. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 through 60 inches.
 15. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 3/4 In. Through 3 In., For Water Service.
 16. AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Pipe, 1/2- through 3-inch, for Water Service.
 17. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 65 In., For Waterworks

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18. AWWA M23 – PVC Pipe – Design and Installation.
 19. AWWA M55 - Manual for the Design and Installation of Polyethylene Pipe in Water Applications.
 20. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
 21. ASTM A536 – Standard Specification for Ductile Iron Castings.
 22. ASTM D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing.
 23. ASTM D2774 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 24. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
 25. ASTM D3035 - Standard Specification for Polyethylene (PE Plastic Pipe (DR-PR) Based on Outside Diameter.
 26. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 27. ASTM D3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material.
 28. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 29. ASTM F714 - Standard Specification for Polyethylene (PE Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.
 30. NSF/ANSI 61 – Drinking Water System Components – Health Effects.
 31. AASHTO – LRFD Bridge Design Construction Specifications.
 32. Uni-Bell PVC Pipe Association – Handbook of PVC Pipe Design and Construction.
 33. PPI TR 33 - Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 “Submittal Procedures.”
- B. Submit manufacturer data on all pipe, fittings, specials, service tape, valves, meters, and other materials specified herein. Include pipe thickness class calculations, special coatings, lining information, and special embedment requirements differing from that indicated in the Contract Documents.
- C. Laboratory analysis for rock embedment including sieve analysis, fracture faces, abrasion tests and soundness tests.
- D. Trench Safety Program.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for piping and component requirements.
- B. All applicable ODEQ regulations shall be strictly adhered to.

1.5 TRENCH SAFETY

- A. Contractor shall be responsible for complying with all federal, state, and local trench safety requirements, and for the safety of trenches and excavations.

1.6 CERTIFICATION

- A. Certifications properly executed by manufacturer shall be furnished to Engineer showing compliance to specification requirements and standards sighted herein. Test data from tests performed shall be provided as requested by Engineer.

1.7 INSPECTION

- A. Engineer and representatives shall have access to all phases of Work. Manufacturer and Contractor shall provide proper facilities for access and inspection. Material, fabricated parts, and pipes discovered defective, or do not conform to Specification requirements, will be subject to rejection at any time prior to final acceptance of pipe.

1.8 SEPARATION CRITERIA

- A. New water lines and appurtenances shall be installed in accordance with the separation requirements of OAC 252:626-19-2 (h).
- B. Parallel water and sewer lines must be installed in separate trenches.
- C. New water lines shall be installed at least 9 feet from all sewer lines and manholes. If this is not achievable refer to OAC 252:626-19-2 (h).

PART 2 - PRODUCTS

2.1 GENERAL

- A. Contractor may select type of pipe to be installed on a particular water line, provided that type of pipe is specified herein for use on that waterline. All pipe of like size and use, however, shall be of the same type and class. Only approved pipe shall be used in the construction of all pipelines and piping.
- B. All pipe and fittings used in this Project shall comply with all applicable requirements of NSF/ANSI 61.

2.2 POTABLE WATER PIPE

- A. PVC Pressure Pipe:
 - 1. 4-inch to 24-inch AWWA C900 PVC Pipe, DR 18:
 - a. Shall meet the requirements of AWWA C900, elastomeric gasket shall meet the requirements of ASTM F477, solid wall, virgin PVC resin, cell class 12454 in accordance with ASTM D1784, blue in color, 20-foot lay length;
 - b. Shall qualify for a minimum HDB of 4,000 psi in accordance with ASTM D2837. Bell section shall be designed to be at least as hydrostatically strong as pipe. Joint shall comply with ASTM D3139 requirements.
 - c. Shall be marked with AWWA standards including size, dimension ratio, pressure class, manufacture name and code, and seal of testing agency that verified the suitability of pipe material for potable water service;
 - d. Each length of pipe (standard and random), including the integral bell, shall be pressure tested to 4 times the rated pressure for a minimum of 5 seconds. Pipe shall meet all additional test requirements as defined in AWWA C900; and
 - e. As manufactured by Napco, Diamond Plastics, or approved equal.

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2. 4-inch to 24-inch AWWA C900 Restrained Joint PVC Pipe, DR 18:
 - a. Pipe provided under this Section shall meet all AWWA C900 requirements and Article 2.2A except as modified herein;
 - b. Pipe shall be restrained joint by utilizing precision-machined grooves on the pipe spigot and inside the bell. When assembled, a nylon spline is inserted through an entry hole in the pipe bell, resulting in a continuous circumferential restrained joint; and
 - c. Pipe shall be Certa-Lok as manufactured by Napco or approved equal.
 - B. HDPE Pressure Pipe:
 1. 4-inch to 65-inch AWWA C906 DIPS HDPE Pipe, DR 11:
 - a. Shall meet the requirements of AWWA C906, PE4710 material shall meet the requirements of ASTM D3350 with a cell classification of 445574C as listed with the Plastics Pipe Institute (PPI) TR4, virgin PE compounds, blue stripe, 40/50 - foot lay length;
 - b. PE compound in the pipe shall contain color and ultraviolet stabilizer meeting the requirements of ASTM D3350 Codes C or E. Code C compounds shall contain 2 to 3 percent carbon black. Code E compounds shall contain sufficient UV stabilizer to protect the pipe against UV degradation for at least 24 months of unprotected outdoor exposure.
 - c. Shall qualify for a minimum HDB of 1,600 psi in accordance with ASTM D2837. Shall qualify for a minimum HDS of 1,000 psi in accordance with ASTM D3350
 - d. Shall be marked with AWWA standards including size, dimension ratio, pressure class, manufacture name and code, and seal of testing agency that verified the suitability of pipe material for potable water service;
 - e. As manufactured by JM Eagle or approved equal.

2.3 PIPE FITTINGS

- A. Pipe fittings used with PVC and HDPE water lines shall be ductile or cast iron, mechanical joint (MJ), cement-mortar lined, asphaltic coated fittings conforming to requirements of AWWA C153 and suitable for use with the specified pipe with which they are used.
- B. Unless otherwise specified, joint restraints shall be used for all buried fittings where indicated on Contract Drawings. Mechanical joint restraints shall be used in combination with concrete thrust-blocking unless indicated otherwise. Restraining glands shall have a pressure rating equal to pipe used. MJ restraints for PVC pipe shall be EBAA Series 2000PV, Romac PVC Romagrip, or approved equal. MJ restraints for HDPE pipe shall be EBAA Series 2000PV or approved equal. Internal pipe wall stiffeners must be utilized and sized to encompass the entire bearing length of the restraint device.
- C. As required in Contract Drawings, a restraint harness shall be utilized for restraining PVC pipe joints when MJ restraints alone utilized at pipe bends.
- D. Restraint harness shall be an EBAA Series 1900 or approved equal.

2.4 VALVES

A. Gate Valves

1. Furnish and install gate valves of the size, type, and configuration indicated, where shown on Contract Drawings. Gate valves shall be flanged, mechanical joint, or hub end as shown on Contract Drawings or required by type of joint used in piping. All valves shall open by turning left and unless otherwise specified, shall have a non-rising stem, and be furnished with a 2-inch operating nut when valves are buried, and with hand wheels when above ground. In cases where operating nut is more than 3 feet below ground, valves shall be supplied with an operator extension to position operating nut within 3 feet of finished ground surface.
2. Gate valves shall meet all the requirements as specified in AWWA C515.
3. Gate valves shall be designed for a working pressure of 250 psi and as manufactured by Mueller Co. or approved equal.
4. Buried gate valves shall be MJ restrained in accordance with Section 2.3 of this Specification.
5. A concrete foundation with compacted base shall be provided for all gate valve installations in accordance with the Contract Documents.

B. Valve Boxes and Extension Stems

1. Extension stems shall be furnished on buried valves where the top of operating nut is more than 36 inches below finished grade. Extension stem shall be placed to be 36 inches below finished grade.
2. Buried gate valves shall be provided with cast iron valve boxes. Valve boxes to be asphaltic bituminous coated, placed at a depth as required in the field. Valve boxes shall be installed with a reinforced concrete collar as indicated in the Contract Drawings.
3. Valve boxes to be Tyler Union 6850 Heavy Duty with lid marked "Water" or approved equal. Where necessary valve box extensions shall be provided.

2.5 TAPPING VALVES

- A. Furnish and install tapping gate valves of the size, type, and configuration indicated, where shown on Contract Drawings. Tapping gate valves shall be mechanical joint by flanged joint unless otherwise specified. All tapping gates valves shall open by turning left and unless otherwise specified, shall have a non-rising stem, and be furnished with a 2-inch operating nut when valves are buried. In cases where operating nut is more than 3 feet below ground, valves shall be supplied with an operator extension to position operating nut within 3 feet of finished ground surface.
- B. Tapping gate valves shall meet all the requirements as specified in AWWA C509.
- C. Tapping gate valves shall be designed for a working pressure of 250 psi and as manufactured by Mueller Co. or approved equal.
- D. Buried tapping gate valves shall be MJ restrained in accordance with Section 2.3 of this Specification.
- E. A concrete foundation with compacted base shall be provided for all gate valve installations in accordance with the specifications herein and the Contract Drawings.
- F. Valve Boxes and Extension Stems
 1. Extension stems shall be furnished on buried valves where the top of operating nut is more than 36 inches below finished grade. Top of extension stem shall not be more than 9 inches below the top of valve box.

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2. Buried tapping gate valves shall be provided with cast iron valve boxes. Valve boxes to be asphaltic bituminous coated and placed at a depth as required in the field. Valve boxes shall be installed with a reinforced concrete collar as indicated in the Contract Drawings.
 3. Valve boxes to be Tyler Union 6850 Heavy Duty with lid marked "Water" or approved equal. Where necessary valve box extensions shall be provided.

2.6 TAPPING SLEEVES

- A. Furnish and install tapping sleeves of the size, type, and configuration indicated, where shown on the Contract Drawings. Tapping sleeves shall be full wrap-around type, 200 psi rated, stainless steel, ductile iron, or approved equal. All bolts and various other hardware shall be stainless steel.
- B. Tapping sleeves to be Mueller H-304 or approved equal.

2.7 FIRE HYDRANT

- A. Furnish and install fire hydrants where shown on the Contract Drawings. Fire hydrants shall conform to all the requirements of AWWA C502 and ANSI/NSF 61. Unless otherwise specified all hydrants shall have an operating nut that opens by turning left, with an arrow cast on hydrant specifying turn direction.
- B. 250 psi minimum working pressure.
- C. Fire hydrants shall contain a 5-1/4-inch main opening (pumper) with two 2-1/2-inch additional openings (hose).
- D. Fire hydrant shall contain a standard mechanical joint complying with AWWA C111, for connection to water system.
- E. Fire hydrant shall be restrained via a combination of mechanical joint restraint and concrete thrust blocking.
- F. Install fire hydrants in accordance with manufacturers specifications, specifications herein, and the Contract Drawings.
- G. Fire hydrant to be a Mueller Super Centurion A423 or approved equal.

2.8 PIPE REPAIR

- A. As necessary furnish and install pipe repair clamps.
- B. Pipe repair clamps shall be stainless steel, full seal clamps.
- C. Repair clamps to be Smith Blair 261/262 Series or approved equal.

2.9 STANDARD SERVICE CONNECTIONS

- A. Furnish and install service connections (3/4-inch to 2-inch) with the following items:
 1. Polyethylene (PE) Tubing:
 - a. Shall be copper tube sizing (CTS), SDR 9. Shall meet NSF/ANSI 61 standards and ASTM D2737.
 - b. Tubing pressure rating shall be 250 psi max working pressure at 73 degrees F.
 - c. Made from PE4710 material
 - d. PE Tubing shall be ADS Pipe or approved equal.
 2. Service Saddles:
 - a. Shall be for use on the type of pipe being connected to.
 - b. Meet all the requirements of AWWA C800 and NSF/ANSI 61 standards.
 - c. For PVC installations: Romac 202S or approved equal.
 - d. For HDPE installations: Romac 202N-H or approved equal.

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3. Corporation Stops:
 - a. Shall be a ground key type, with AWWA taper (CC) inlet, and compression outlet.
 - b. Meet all the requirements of AWWA C800 and NSF/ANSI 61 standards.
 - c. 3/4-inch and 1-inch corporation stops shall be AY McDonald 74701-22 or approved equal.
 4. Meter Setters:
 - a. Meter setters shall be built utilizing the following components as applicable and utilizing service tubing as specified.
 - b. AY McDonald 74602-22 or approved equal on city side.
 - c. AY McDonald 7112 or approved equal on customer side.
 - d. Any additional components as necessary for a complete installation.
 5. Meter Boxes:
 - a. Meter boxes for 3/4-inch and 1-inch services shall be a Carson 1520-18 Body with a AMI recessed lid or approved equal.
 - b. Larger services shall be as specified by City.
- B. All components, specified or not, shall be per Owner standards and Specifications.

2.10 LARGE SERVICE CONNECTIONS

- A. Furnish and install service connections (4-inches and larger) with the following items:
1. PVC or HDPE pressure pipe in accordance with Section 2.2 of this Specification.
 2. Tapping sleeve in accordance with Section 2.6 of this Specification or tee fitting in accordance with Section 2.3 of this Specification.
 3. Precast concrete vault as specified in Contract Drawings.
 4. A dismantling joint is required on all installations, dismantling joint to be a Romac DJ400 or approved equal.
 5. A bypass line with gate valves on both ends in accordance with Section 2.4 of this Specification.
 6. All fittings shall be mechanical joint and restrained as specified in Section 2.3 of this Specification.
 7. A sample point riser on the utilities side of meter.
 8. Gate valves installed on both ends of meter in accordance with Section 2.4 of this Specification.

2.11 ACCESSORIES

- A. Warning Tape
1. Provide traceable tape made of plastic, blue in color, and a minimum of 3 to 4 inches wide and have lettering that states there is a buried water line below.
- B. Tracer Wire
1. Provide tracer wire and install according to Section 3.5 of this Specification.

PART 3 - EXECUTION

3.1 POTABLE WATER LINE INSTALLATION

- A. General
1. All pipe and accessories for the Work specified herein shall be unloaded, handled, laid, jointed, tested for defects and for leakage in the manner herein specified.
 2. Coordinate delivery storage, and delivery schedule with Owner's Representative.

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3. Pipe Bending and Joint Angular Deflection:
 - a. Shall meet the requirements of AWWA C605 and manufacturers specifications. Whichever is more stringent shall apply to this Project.
 4. Connections to Existing Lines
 - a. Connections between new Work and existing Work, where required, shall be made using proper transition sleeves and fittings to suit actual conditions. Additional bends may also be necessary to provide minimum pipe separations as required by ODEQ. These fittings, special sleeves, and bends shall be provided after verification from Engineer. When necessary to interrupt service to existing facilities to make connection to an existing line, Contractor may be required to make connections at a time designated by Owner at no additional cost to Owner.
 5. Contractor will be required to photograph/video all existing conditions along the entire route of construction. Contractor will be required to submit the photographs and/or videos to the Engineer or Owner to verify existing conditions, as requested.
- B. Responsibility for Materials
1. Contractor shall be responsible for all material furnished by them and shall replace at own expense all such material that is found to be defective in manufacture or has become damaged in handling after delivery.
- C. Storage, Handling Pipe and Accessories
1. All pipe, fittings, and other accessories shall, unless otherwise directed, be unloaded at the point of delivery, hauled to and distributed at the site of the Work by Contractor. In loading and unloading, they shall be lifted by hoists or slid, or rolled on skidways in such a manner as to avoid shock or damage to the materials. Under no circumstances shall they be dropped. Pipe handled on skidways must not be skidded or rolled against pipe already on the ground.
 2. The pipe, fittings and accessories shall be placed along the site in such a manner as to be kept as free as possible from dirt, sand, mud, and other foreign matter.
 3. When prolonged exposure to direct sunlight is anticipated, PVC and HDPE pipe and accessories should be covered with an opaque material while still permitting adequate air circulation above and around the pipe.
- D. Trench Safety Systems
1. The Scope of Work includes, but is not limited to, trench and excavation safety systems either by cut back method or braced excavation method for all trenches 5-feet and deeper whether indicated on Drawings or required by actual field conditions. All trenches shall be protected as required by OSHA, State, and Local standards, and as specified in Section 31 41 10 "Trench Safety Systems."
 2. Contractor shall be responsible for complying with all applicable State of Oklahoma safety standards and with the applicable OSHA regulations concerning trench excavation, general excavation, and construction safety.
 3. Contractor shall be responsible for implementing a trench shoring system wherever the trench depth exceeds 5 feet.
- E. Trench Excavation:
1. Contractor shall provide construction-staking services. Contractor is responsible for notifying Owner's Representative of any concerns with construction staking.
 2. Contractor shall excavate to the alignment and elevations indicated on the Contract Drawings or as staked in the field. Any deviations shall be approved by the Engineer.
 3. There will be no classification of or extra payment for excavated materials and all materials encountered shall be excavated as required. Adjacent structures and property shall be protected from damage by construction equipment.
 4. Excavated materials should be stockpiled in a manner that will not endanger the workers or the public and which will cause the least obstruction to roadways.

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5. Contractor's attention is drawn to the fact that the trench bottom, as shown on the Contract Drawings, is approximately 4 to 6 inches below the bottom of the pipe grade so that bedding material can be placed beneath the pipe in accordance with the trench cross-section details and these Specifications. The minimum depth of cover for the piping shall be 48 inches unless otherwise specifically shown on the Contract Drawings.
 6. Trench safety systems as specified shall be installed where required. The trench walls shall be made vertical to a point at least 1 foot above the top of the pipe. Vertical trench walls above this point will not be required; however, in areas of limited right-of-way or when necessary to protect existing facilities or private property, the slope of the trench wall shall be limited. Where necessary to stay within the maximum width limits at the top of the pipe or to maintain a relatively straight trench wall to remain within available right-of-way, the trench walls shall be adequately supported as required by these Specifications and OSHA regulations. Contractor shall be fully responsible for any damage to private property or existing facilities due to inadequate support.
 7. Excavate trench only as necessary to install the pipe. Excavation limits are as follows:
 - a. Pipe less than 18 inches in diameter: Pipe O.D. + 12 inches.
 - b. Pipe from 18 to 36 inches in diameter: Pipe O.D. + 18 inches.
 8. The trenching equipment shall be maintained on a sufficiently level roadbed to provide substantially vertical trench walls.
 9. In order to obtain a true even grade, the trench shall be fine graded and shaped in accordance with the details as shown on the Contract Drawings. Any part of the trench excavated below grade shall be corrected by filling with approved material and thoroughly compacting. If clay, rock, or other unyielding material is encountered in the bottom of the trench, it shall be removed to a depth of 4 to 6 inches below grade, refilled with approved material, and thoroughly compacted to grade.
 10. Trench digging machinery may be used to make trench excavations except in places where operations of same would cause damage to existing structures either above or below ground; in such instances, hand methods shall be employed.
 11. Contractor will be required to locate all existing utility lines, whether or not they are shown on the Contract Drawings, including consumer service lines, far enough in advance of the trenching to make proper provisions for protecting the lines and to allow for any deviations that may be required from the established lines and grades. The operators of all oil or gas pipelines shall be notified prior to excavation around such lines so that these operators may be present during excavation.
 12. Contractor shall not be allowed to disrupt the service on any utility lines except consumer service lines, which may be taken out of service for short periods of time, if Contractor obtains permission from Owner's Representative.
 13. Contractor shall immediately notify the proper utility company of any damage to utility lines, in order that service may be established with the least possible delay. Any damage to existing lines and the repair of consumer lines which are authorized to be cut or temporarily taken out of service shall be repaired or replaced by Contractor at own expense, and as directed by an official representative of Owner of the damaged line.
 14. All new and existing lines shall be properly supported to prevent settlement or damage to the line both during and after construction.
 15. Wherever necessary to prevent caving, the trench shall be adequately supported.
 16. Maximum horizontal offset of trench wall from bottom of trench to top of trench (undercutting) shall be 4 inches.
 17. All excavation shall be unclassified, and no extra compensation made for solid rock excavation. Contractor is expected to make boring of his own and satisfy himself to character of material encountered.

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- F. Dewatering
 - 1. Where running or standing water occurs in the trench bottom the water should be removed by pumps and other suitable means to prevent pipe flotation, until the pipe has been installed and the backfill has been placed and compacted.
 - G. Trench Methods
 - 1. Trench Boxes - Submit manufacturer's standard data sheet and certificate of compliance signed by a Registered Professional Engineer stating the maximum allowable depth for the given design pressure for each type of trench box proposed for use.
 - 2. Alternative Systems - If alternative systems composed of steel, aluminum, wood, or a combination of materials are proposed, submit design calculations signed by a Registered Professional Engineer showing all member properties, design strengths and any stress increases used with justification for their use.
 - H. Laying of Pipe
 - 1. Placement of pipe and fittings into a trench should be done with ropes and skids, slings on a backhoe bucket, or by hand. Pipe or fittings should not be thrown into the trench and no part of the pipe should be allowed to take an unrestrained fall onto the trench bottom.
 - 2. When pipe laying is not in progress, open ends of installed pipe should be closed to prevent trench water, dirt, and foreign matter from entering the line.
 - 3. Contractor is responsible for laying pipe to the elevations as shown in the Contract Drawings.
 - I. Joint Assembly, Field-Cutting, Chamfering, and Curvature
 - 1. Joint assembly, field-cutting, chamfering, and curvature shall be performed in accordance with the Uni-Bell PVC Pipe Association PVC Pipe Design and Construction handbook and/or manufacturers recommended procedures. Whichever is more stringent shall apply.
 - J. Backfill
 - 1. Foundation
 - a. A foundation is only required when the trench bottom is unstable. In such cases the bottom of the trench is to be over-excavated and brought back to grade. If necessary, Class I, II, or III may be utilized for the foundation as follows:

Soil Class	Placement
Class I	Install in 12 in. thick lifts
Class II	
Class III	Install in 6 in. thick lifts
 - b. Material shall be moistened and placed in lifts as indicated above and compacted by tamping to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content.
 - 2. Bedding
 - a. Bedding is required to bring the trench bottom up to grade, it should be placed so as to provide uniform and adequate support under the pipe and placed by hand. Holes for pipe bells should be provided at each joint to ensure uniform support for the pipe.
 - b. Bedding layer shall be 4 to 6 inches in thickness Sand or Class IB, II, or III soil that meets the following criteria should, be used for backfilling.

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	<= 50%	< 5%	n/a	n/a
II	100%	<= 50%	< 5%	n/a	n/a
III	100%	> 50%	> 12% - < 50%	n/a	GM < 4 GC < 7 SM > 4 SC > 7

c. The material should be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable materials.

d. No particles larger than 1/2-inch in diameter are allowed in the bedding layer.

3. Haunching

a. Haunching is defined as the backfill from the bottom of the pipe to the springline of pipe. Material should be placed and consolidated under the pipe haunch so adequate side support is provided to the pipe without causing displacement from its proper alignment.

b. Material shall be moistened and placed in lifts not exceeding 6 inches in thickness and compacted by tamping to a density of not less than 95 percent of ASTM D698 with a moisture of ±2 percent optimum moisture content.

c. Material shall be placed by hand or by approved mechanical methods. Class IB, II, III soil that meets the following criteria should be used for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	<= 50%	< 5%	n/a	n/a
II	100%	<= 50%	< 5%	n/a	n/a
III	100%	> 50%	> 12% - < 50%	n/a	GM < 4 GC < 7 SM > 4 SC > 7

d. The material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.

e. Water jetting will not be allowed.

f. No particles larger than 1/2-inch diameter are allowed in the haunching layer.

4. Initial Backfill:

a. Initial backfill is defined as the backfill from the springline of the pipe to 1 foot above the pipe. Material should be moistened and placed in lifts not exceeding 6-inch in thickness and compacted to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content. Care should be taken to not damage the pipe during compaction.

b. Material shall be placed by hand or by approved mechanical methods. Class IB, II, or III soil that meets the following criteria should be used for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	<= 50%	< 5%	n/a	n/a
II	100%	<= 50%	< 5%	n/a	n/a
III	100%	> 50%	> 12% - < 50%	n/a	GM < 4 GC < 7 SM > 4 SC > 7

- c. The material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.
- d. Water jetting will not be allowed.
- 5. Final Backfill
 - a. Final backfill is defined as the backfill from 1 foot above the pipe to the bottom of the subgrade for paved areas or to the existing grade for unpaved areas. Material should be moistened and placed in lifts not exceeding 6 inches. in thickness and compacted to a density of not less than 95 percent of ASTM D698 with a moisture of ± 2 percent optimum moisture content. Care should be taken to not damage the pipe during compaction.
 - b. Material shall be placed by hand or by approved mechanical methods. Class IB, II, or III soil that meets the following criteria should be used for backfilling:

Soil Class	Percent Passing			Atterberg Limits	
	1.5 in	No. 4	No. 200	LL	PL
IB	100%	$\leq 50\%$	$< 5\%$	n/a	n/a
II	100%	$\leq 50\%$	$< 5\%$	n/a	n/a
III	100%	$> 50\%$	$> 12\% - < 50\%$	n/a	GM < 4 GC < 7 SM > 4 SC > 7

- c. The material shall be free from cinder, ashes, refuse, vegetable or organic material, boulders, or other unsuitable material.
- d. Water jetting will not be allowed.
- e. At Contractor's expense/option, flowfill can be utilized in place of soil for the final backfill zone.
- f. If Contractor elects to use flowfill in the final backfill zone it should be composed of a mixture of Portland cement, pea gravel and sand with a cement content of 1-1/2 sacks per cubic yard of flowfill.
- g. Tracible warning tape should be installed in the Final Backfill zone 18 inches below the finished grade of the trench directly above the potable water line.

K. Cleanup

1. The backfill shall not be rounded up over trenches. The surface of the trench backfill shall be compacted and bladed to final grading contours.
2. Contractor shall maintain the trench surfaces in a satisfactory manner until final completion and acceptance of the Work. The maintenance shall include blading from time to time as necessary, filling depressions caused by settlement, and other Work required to keep all areas in a presentable condition.
3. Any trench settlement which occurs within the 1-year warranty period shall be corrected by Contractor at no expense to Owner.

3.2 POTABLE WATER LINE FITTING INSTALLATION

- A. General:** Fittings, meters, and valves shall be connected with flanged or mechanical joints as indicated on Contract Drawings. Each joint shall include flanged ends or gland retainer, gasket, and bolts required to complete connection. Contractor shall perform all Work necessary to make connections and be responsible for the quality and proper operation of those joints.

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- B. Procedures
 - 1. Before making connections, pipe, fittings, or valves shall be properly supported, but free to move as bolted. Set flange faces so bolt holes are properly aligned, flange faces bear uniformly on gaskets, and flanges will not be under strain after joint completion.
 - 2. To avoid strains upon flanges, gradually tighten bolts at uniform rates sequentially on opposite sides of flanges. To assure flanges are not under strain, Engineer may request bolts loosened in any joint. Install mechanical joint fittings and valves in a similar fashion as previously described for flanged.
 - 3. Buried fittings will require polyethylene wrap with a thickness of 10 mils minimum.
 - C. All underground water line fittings shall be mechanical joint with a pressure rating equal to or greater than that of the water line pipe material.
 - D. Restrain joints by concrete blocking and MJ restraints as specified on the Contract Drawings.
 - 1. Concrete Blocking:
 - a. Provide concrete blocks bearing solidly against the undisturbed trench bank at all changes in direction and/or elevation. Concrete for blocking shall contain not less than 3 sacks of cement per cubic yard and have a 28-day compressive strength of 3,000 psi.
 - 2. MJ Restraints:
 - a. Provide MJ restraints at all changes in direction and/or elevation. When MJ restraints are used alone at vertical, pipe joints for a distance as specified in the Contract Drawings shall be restrained with a restraint harness.
 - b. Install MJ restraints in accordance with manufacturer recommendations.

3.3 VALVE, TAPPING VALVE, TAPPING SLEEVE, FIRE HYDRANT, AND PIPE REPAIR INSTALLATION

- A. Install valves, tapping valves, tapping sleeves, fire hydrants, and pipe repairs in the configuration indicated on the Contract Drawings and in accordance with the manufacturer's specifications and Specifications herein.

3.4 SERVICE CONNECTION INSTALLATION

- A. Install in the orientation and configuration indicated on the Contract Drawings and in accordance with manufacturer's specifications and Specifications herein.

3.5 TRACER WIRE SYSTEM

- A. Open Cut/Open Ditch:
 - 1. Tracer wire for open cut/open ditch shall be a #12 AWG HS-CCS high-strength copper clad steel conductor (HS-CCS), insulated with a 30 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. HS-CCS conductor must be at 21 percent conductivity for location purposes, break load 380 lbs. minimum. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Manufacturers supplying copper-clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper clad steel manufacturer is required, and steel core must be manufactured in the United States. If manufacturer has not completed 5-year corrosion testing, a 5-year warranty must be provided.

B. Directional Drilling/Boring:

1. Tracer wire for directional drilling/boring shall be (12 AWG) extra-high-strength copper-clad steel conductor (EHS-CCS), insulated with a 45 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. EHS-CCS conductor must be at 21 percent conductivity for locate purposes, break load will be 1150 lbs. minimum. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Manufacturers supplying copper-clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper-clad steel manufacturer is required, and steel core must be manufactured in the United States. If manufacturer has not completed 5-year corrosion testing, a 5-year warranty must be provided. Tracer wire shall be Copperhead™ SoloShot™ EHS-CCS HDPE 45 mil or approved equal.

3.6 HDPE BUTT FUSION

A. General

1. Butt fusions shall be made by qualified operators using mechanical butt fusion machines that secure and precisely align the pipe ends for the fusion process.
2. HDPE pipe shall be handled in a safe and non-destructive manner before, during, and after the fusion process in accordance with this Specification and pipe manufacturer's guidelines.
3. Butt fusion process shall follow the requirements of PPI TR-33 and this Specification as applicable.
4. Fusion procedure and equipment shall be as approved by Engineer.
5. Contractor shall perform in presence of Engineer one joint for inspection and approval prior to beginning construction operations.
6. Each joint shall be re-cored and logged by an electronic monitoring device (data logger) connected to the fusion machine.

B. Butt Fusion Parameters

1. Generic Fusion Interface Pressure Range: 60 to 90 psi
2. Generic Heater Surface Temperature Range: 400 to 450 degrees Fahrenheit

C. Butt Fusion Procedure

1. Clean the inside and outside of the pipe to be joined by wiping with a clean lint-free cloth. Remove all foreign matter.
2. Clamp the components in the machine. Check alignment of the ends and adjust as needed.
3. Pipe ends shall be faced to establish clean, parallel mating surface. Butt fusion machine shall incorporate a rotating planer block facer at a minimum. Facing shall be continued until a minimal distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaw bushings. Open the jaws and remove the facer. Remove any pipe chips from the facing operation and any foreign matter with a clean, lint-free cotton cloth. Bring the pipe ends together with minimal force and inspect the face off. A visual inspection shall be performed to ensure faces are square, perpendicular to the pipe centerline on each pipe end and with no gap.
4. Pipe profiles must be rounded and aligned with each other to minimize mismatch of the pipe walls. Clamping jaws must not be loosened to allow the pipe to slip during fusion. Re-face the pipe ends and remove any chips from re-facing operation with a clean, lint-free cotton cloth.

5. A heating tool that simultaneously heats both pipe ends are to be utilized. Heating tool shall contain a thermometer to measure internal heater temperature to ensure temperature requirements are met. A pyrometer should be used before the first joint of the day is made and periodically throughout the day to ensure proper temperature of the heating tool face that contacts the pipe or fitting ends. Heating tools shall be equipped with suspension and alignment guides that center them on the pipe ends. Heater faces that come into contact with the pipe shall remain clean, oil-free, and coated with a nonstick coating as recommended by the pipe manufacturer. Remaining molten plastic must be removed in between each operation to not interfere with fusion quality. Chemical cleaners and solvents are not permitted for use on heating tool surfaces.
6. Contractor must maintain a surface temperature of 400 to 450 degrees Fahrenheit during the fusion operation.
7. To ensure that full and proper contact is made between the pipe ends and the heater, the initial contact should be under moderate pressure. After holding the pressure briefly, it should be released without breaking contact. Continue to hold the components in contact with each other, without force, while a bead of molten polyethylene develops between the heater and the pipe ends. When the proper bead size is formed against the heater surface remove the heater and join the pipe.
8. Melt Bead Size

Pipe Size	Melt Bead Size
1.25" and Smaller	1/32-1/16"
Above 1.25" to 3"	1/16"
Above 3" to 8"	1/8-3/16"
Above 8" to 12"	3/16-1/4"
Above 12" to 24"	1/4-7/16"

9. Once the heater is removed, quickly inspect the pipe and bring the molten pipe ends together with sufficient fusion force to form a double rollback bead against the pipe wall. If a concave melt surface is observed the joint shall not be installed and shall be cooled, cut, and fusion procedure restarted. Equipment shall contain a hydraulic gauge to ensure pressure requirements are met. Gauge reading is theoretical and internal and external drags are added to this figure to obtain the actual fusion pressure required.
10. Hold the joint immobile under fusion force until the joint has cooled adequately to develop strength. Fusion force must be held between the pipe ends for 30 to 90 seconds per inch of pipe diameter. Pipe shall not be pulled, installed or rough handled for an additional 30 minutes at a minimum. Additional time may be necessary as recommended by pipe manufacturer.
11. All joints shall be visually inspected and documented. The width of the butt fusion bead should be approximately 2 to 2.5 times the bead height above the pipe and the bead should be rounded and uniformly sized all around the pipe circumference. Any beads that do not meet this requirement will be rejected and shall be cut out and refused. The v-groove between the bead should not be deeper than half the bead height above the pipe surface.
12. Contractor is responsible for ensuring that all joints meet the requirements herein and manufacturer requirements. Any failing joints either by visual inspection or hydrostatic pressure shall be cut out and replaced at Contractor's expense. No angled or off-set joints will be accepted.

3.7 HYDROSTATIC TESTING

- A. Water lines shall be tested in accordance with AWWA C605 and the specifications herein.

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- B. Contractor shall provide all materials, equipment, tools, labor, superintendence, and incidentals required to achieve a completed and approved hydrostatic test.
- C. Procedure:
1. Each section of pipe shall be slowly filled with water at the point of lowest elevation. Pressure shall be applied and maintained by means of a pump connected to pipe in a satisfactory manner.
 2. As line is filled and before applying test pressure, all air shall be expelled from pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation. After the test, taps shall be tightly plugged, in accordance with the specifications herein.
 3. Test shall not begin until after the water line has been properly filled, flushed, and purged of air. The water line shall be pressurized to 1.25 times the system working pressure or a minimum of 150 psi, whichever is greater, at the highest point on section of line tested. Duration of each pressure test shall be as directed by Engineer but shall not exceed 2 hours.
 4. During the time test pressure is on the pipe, line shall be carefully checked at regular intervals for breaks or leaks. Any joints showing appreciable leaks, shall be repaired and any cracked or defective pipes or fittings removed and replaced with sound materials in the manner provided. Repeat test until satisfactory results are obtained.
 5. After all defects in line are satisfactorily repaired and all visible leaks stopped, make a leakage test on each valved section of line to determine quantity of water lost by leakage. Contractor will furnish all labor, material, and equipment required for making test. Leakage shall be determined by measuring quantity of water supplied to each valved section of line, during test period, when various sections of line are under pressure.
 6. Maximum allowable leakage for pressure drop in the potable water line is calculated as:

$$Q = \frac{LD\sqrt{P}}{148,000}$$

Where:

Q = Quantity make up water in gallons per hour

L = Length of pipe section being tested, in feet

D = Nominal diameter of the pipe in inches

P = Test pressure in psi \pm 5 psi of specified

7. If sections show excessive leakage, locate and repair defective joints until leakage is within specified allowance.

3.8 DISINFECTION

- A. Water lines shall be disinfected in accordance with AWWA C651 and these Specifications. Prior to acceptance for operation, all portions of water lines installed shall be disinfected as specified. Prior to putting lines in service and after pressure tests are made, unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud are removed before introducing chlorinating material.
- B. Forms of Chlorine for Disinfection:
1. Liquid chlorine (gas):
 - a. Conforming to AWWA B301, containing 100 percent available chlorine.
 2. Sodium hypochlorite:
 - a. Conforming to AWWA B300, containing 5 to 15 percent available chlorine.
 3. Calcium hypochlorite:
 - a. Conforming to AWWA B300, containing 65 percent available chlorine.

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- C. Chlorination Methods for Disinfection:
 - 1. Tablet/Granule Method:
 - a. If elected, shall be performed in accordance with AWWA C651, Section 4.3.
 - 2. Continuous-Feed Method:
 - a. If elected, shall be performed in accordance with AWWA C651, Section 4.4.
 - 3. Slug Method:
 - a. If elected, shall be performed in accordance with AWWA C651, Section 4.5.
 - 4. Spray Disinfection:
 - a. If elected (only to be used for large transmission lines), shall be performed in accordance with AWWA C651, Section 4.6.
 - D. Verification:
 - 1. Bacteriological Tests:
 - a. Bacteriological tests should be performed in accordance with AWWA C651, Section 5.
 - b. Test samples must be submitted to an ODEQ approved laboratory and must indicate that the facility is free from microbiological contamination before it is placed into service.
 - E. Contractor shall arrange for satisfactory disposal of water flushed from lines, using pipe, dikes, or channels to an adequate drain so no nuisance will be created.
 - F. Contractor shall include costs for disinfection in unit cost for installing pipe.

3.9 CLEAN UP

- A. After construction Work is completed, Contractor shall remove all rubbish, excess materials from excavations, and other debris from site of Work. Replace/repair all affected items (surfacing, landscaping, etc.) to equal or better condition than preconstruction conditions. Cost of cleanup shall be included in bid prices for various units of Work.

END OF SECTION