

**Item No. 510
Pipe**

510.1 Description

This item shall consist of furnishing and installing all pipe and/or materials for constructing water mains, force mains, sanitary sewers, laterals, stubs, and service connections including all applicable Work such as jointing, prescribed under this item in accordance with the provisions of the Edwards Aquifer Protection Ordinance, when applicable, and New Braunfels Utilities Design Criteria Manual. The pipe shall be of the sizes, types, class and dimensions indicated or as designated by the Engineer/Architect (E/A) and shall include all joints or connections to new or existing mains, pipes, sewers, manholes, etc., as may be required to complete the Work in accordance with specifications and published standard practices of the trade associations for the material specified and to the lines and grades indicated on the plans. This item shall include any pumping, bailing, drainage and Item No. 121, "Trench Safety Systems" for trench walls, when indicated or applicable. Trenching and back fill shall be covered under Item No. 120, "Utility Trenching and Backfill." Acceptance testing shall be covered under Item No. 515, "Testing and Acceptance."

510.2 Submittals

- A. Furnish Shop Drawings, product data, design calculations and test reports as described below:
 - 1. Certified copies of mill tests confirming the type of materials used in steel plates, mill pipe flanges and bolts and nuts to show compliance with the requirements of the applicable standards.
 - 2. Complete and dimensional working drawings of all pipe layouts. Shop Drawings shall include the grade of material, size, wall thickness of the pipe and fittings, type and location of fittings and the type and limits of the lining and coating systems of the pipe and fittings.
 - 3. Product data to show compliance of all couplings, supports, fittings, coatings and related items.

510.3 Standards

- A. The applicable provisions of the following standards shall apply as if written here in their entirety:
 - 1. American Water Works Association (AWWA):

AWWA C104	Cement-Mortar Lining for Ductile Iron Pipe and Fittings
AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	Ductile-Iron and Gray-Iron Fittings
AWWA C111	Rubber Gasket Joints for Ductile-Iron
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron

AWWA C150	Thickness Design of Ductile-Iron Pipe
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast, Sizes 3 inches through 64 inches
AWWA C153	Ductile-Iron Compact Fittings
AWWA C600	Installation of Ductile Iron Mains and their Appurtenances
AWWA C602	Cement-Mortar Lining of Water Pipelines, 4 inches and larger in Place.
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) and and Molecularly Oriented Polyvinly Chloride (PVCO) Pressure Pipe and Fittings.
AWWA C800	Underground Service Line Valves and Fittings
AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inches through 60 inches
AWWA M23	PVC Pipe – Design and Installation.
AWWA M41	Ductile – Iron Pipe and Fittings

2. ASTM international (ASTM):

ASTM D1784	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D2241	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated PVC Pipe (SDR) Series
ASTM D3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3139	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	“Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals”
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F679 & Annex	Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F1674	Standard Test Method for Joint Restraint Products for Use with PVC Pipe

3. NSF International

NSF 61	Drinking Water System Components – Health Effects
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510.4 Materials

A. Fire Lines

Fire line leads and fire hydrant leads shall be ductile iron, only.

B. Force Mains

All wastewater force mains shall be constructed of the following pipe materials:

- a. Ductile iron pipe of pressure class 250 minimum for pipe greater than 12-inch size, and ductile iron pipe pressure class 350 for pipe 12-inch size and smaller,
- b. D2241 PVC Pressure Class 200 (SDR 21) for pipe 12-inch size and smaller, integrally colored green,
- c. PE4710 HDPE DR-9 with a minimum diameter of four (4) inches,
- d. Polyvinyl Chloride Pipe meeting all requirements of section 510.4.D, integrally colored green,
- e. Ductile iron wastewater pipe shall be in accordance with New Braunfels Utilities Standard Products List and shall have a corrosion resistant interior lining acceptable to the Owner.

C. Ductile Iron Water Mains

- a. All water distribution pipe and fittings shall be listed in the Fire Protection Equipment Directory published by the Underwriter's Laboratories, Inc., or shall be Factory Mutual approved for fire service.
- b. Ductile Iron Pipe - Pipe shall be ductile iron pipe meeting all requirements of standards as follows:
 - i. For push-on and mechanical joint pipe: AWWA C151
 - ii. For flanged pipe: AWWA C115

Barrels shall have a nominal thickness required by Table 1 of AWWA C115, which thickness corresponds to Special Class 53 in sizes through 54 inch, and Class 350 in 60 and 64-inch sizes. Flanges shall be ductile iron (gray iron is not acceptable); they shall be as shown in ANSI/AWWA C115/A21.15 and shall conform to dimensions shown in Table 2 and Figure 1 of AWWA C115. These flanges are the same in all respects as flanges shown in ANSI/AWWA C110/A21.10 for fittings and are standard for all flanges used with pipe, valve, and equipment units in the water distribution and wastewater force main systems. Flanges shall be fabricated and attached to the pipe barrels by U.S. fabricators using flanges and pipe barrels of U.S. manufacture. If fabrication is to be by other than the pipe barrel manufacturer, a complete product submittal and approval by New Braunfels Utilities will be required. Additionally, such fabricator shall furnish certification that each fabricated joint has been satisfactorily tested hydrostatically at a minimum pressure of 300 psi.

- iii. Except as described above for flanged pipe (Thickness Class 53) and where not otherwise indicated, ductile iron pipe shall be minimum Class 250 as defined by ANSI/AWWA C150/A21.50-current; all ductile iron pipe and flanges shall meet the following minimum physical requirements:
 1. Grade 60-42-10:
 - a. Minimum tensile strength: 60,000 psi (414 mPa).

- b. Minimum yield strength: 42,000 psi (290 mPa).
 - c. Minimum elongation: 10 percent.
 - 2. Grade 70-50-05 (for AWWA C115 pipe):
 - a. Minimum tensile strength: 70,000 psi (483 map).
 - b. Minimum yield strength: 50,000 psi (345 mPa).
 - c. Minimum elongation: 5 percent.
- c. Ductile Iron Fittings:
 - i. Fittings shall be push-on, flanged or mechanical joint as indicated or approved and shall meet all requirements of standards as follows:
 - 1. Sizes 4 inch through 24 inch: AWWA C110 or AWWA C153
 - 2. Sizes larger than 24 inch: AWWA C110.
- d. Marking

Each pipe joint and fitting shall be marked as required by the applicable AWWA specification. This includes in all cases: Manufacturer's identification, Country where cast, year of casting, and "DUCTILE" or "DI". Barrels of flanged pipe shall show thickness class; others shall show pressure class. The flanges of pipe sections shall be stamped with the fabricators identification; fittings shall show pressure rating, the nominal diameter of openings and the number of degrees for bends. Painted markings are not acceptable.
- e. Linings and Coating:
 - i. Interior surfaces of all ductile iron water pipe shall have cement-mortar lining in accordance with AWWA C104 and bituminous seal coat.
 - ii. Interior surfaces of all ductile iron wastewater and force main fittings shall be coated with Protecto 401. Lining primers, applications, and thicknesses shall be in accordance with manufacturer's recommendations for sanitary sewer applications, but shall not be less than 40 mils.
 - iii. Exterior surfaces for buried pipe and fittings shall be coated with a 1 mil bituminous coating in accordance with AWWA C110 and C151, unless specified otherwise.
 - iv. Exterior surfaces for pipe and fittings installed above grade or within vaults shall be coated as required by the applicable coating specification.
- f. Joint Materials
 - i. Gaskets for mechanical joints shall conform to ANSI/AWWA A21.11/C111.
 - ii. Joining of slip joint iron pipe shall, without exception, be accomplished with the natural or synthetic rubber gaskets of the manufacturer of that particular pipe being used. A joint lubricant shall be used and applicable recommendations of the manufacturer shall be followed.

- iii. Gaskets for flanged joints shall be continuous full face gaskets, of 1/8 inch minimum thickness of natural or synthetic rubber, cloth-reinforced rubber or neoprene material, preferably of deformed cross section design and shall meet all applicable requirements of ANSI/AWWA A21.11/C111 for gaskets. They shall be manufactured by, or satisfy all recommendations of, the manufacturer of the pipe/fittings being used and be fabricated for use with Class 125 ANSI B16.1 flanges.
 - iv. Tee-head bolts, nuts and washers for mechanical joints shall be high strength, low alloy, corrosion resistant steel stock equal to "COR-TEN A" having UNC Class 2 rolled threads or alloyed ductile iron conforming to ASTM A 536; either shall be fabricated in accordance with ANSI/AWWA A21.11/C111.
 - v. Hex head bolts and nuts shall satisfy the chemical and mechanical requirements of ASTM A449 SAE Grade 5 plain, and shall be fabricated in accordance with ASTM B 18.2 with UNC Class 2 rolled threads.
 - vi. Either Tee-Head or Hex-Head bolts, nuts and washers as required, shall be protected with bonded fluoro-polymer corrosion resistant coating where specifically required by the E/A.
 - vii. All threaded fasteners shall be marked with a readily visible symbol cast, forged or stamped on each nut and bolt, which will identify the fastener material and grade. The producer and the supplier shall provide adequate literature to facilitate such identification; painted markings are not acceptable.
- g. Polyethylene Film Wrap
- All iron pipe, fittings and accessories shall be wrapped with standard 8 mil (minimum) low density polyethylene film or 4-mil (minimum) cross laminated high-density polyethylene conforming to AWWA C105, with all edges overlapped and taped securely with duct tape to provide a continuous wrap to prevent contact between the piping and the surrounding backfill. Repair all punctures of the polyethylene, including those caused in the placement of bedding aggregates, with duct tape to restore the continuous protective wrap before backfilling.

D. Polyvinyl Chloride (PVC) Water Pipe

a. General

All polyvinyl chloride (PVC) water pipe shall be of the rigid (unplasticized) type and must bear the National Sanitation Foundation seal of approval for potable water pipe. Each joint of pipe shall consist of single continuous extrusion; bells or other components attached by solvent welding are not acceptable. Pipe shall be pressure rated at 305 psi (DR-14) or 235 psi (DR-18) as indicated. All pipe 4 inches and larger must be approved Underwriter's Laboratories for use in buried water supply and fire protection systems.

- b. Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells with rubber gasket joints. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness. Clearance must be provided in every gasket joint for both lateral pipe deflection and for linear expansion and contraction. Concrete thrust blocking shall be placed behind bends and tees when required by the E/A. Concrete support cradles or blocking shall be required for support

of all fire hydrants, valves and AWWA C110 fittings; such support shall be provided for AWWA C153 fittings when required by the E/A.

c. Applicable Specifications

Except as modified or supplemented herein, PVC pipe shall meet the following standards:

- i. AWWA C900, DR 18 or DR 14 for PVC Pressure Pipe, in 4, 6, 8, 12, 16, and 24 inch nominal sizes, having Cast Iron Pipe size outside diameters.
- ii. Fittings used with PVC Pressure pipe shall be AWWA C110 or AWWA C153 compact ductile iron fittings.

d. Material Requirements

All pipe and fittings shall be made from clean, virgin, NSF approved, Class 12454B PVC. Clean reworked materials generated from the manufacturers own production may be used within the current limits of the referenced AWWA C900.

e. Marking

Permanent marking on each joint of pipe shall include the following at intervals of not more than 5 feet:

- i. Nominal pipe size and OD base (e.g., 4 CIPS).
- ii. Type of plastic material (e.g., PVC 12454B).
- iii. Dimension Ratio (e.g., DR 18).
- iv. Pressure Class (e.g., PC 235).
- v. AWWA designation with which the pipe complies (e.g., AWWA C900-16).
- vi. Manufacturer's name or trademark and production run record
- vii. The National Sanitation Foundation (NSF) mark.

E. Service Lines

a. Clamps or Saddles

Approved service clamps or saddles shall be used when tapping ductile iron pipe and PVC pipe 16 inch size and smaller. Outlets of service saddles shall be tapped with AWWA IP thread (female). External threads of corporation valve inlet must be compatible with internal threads of the service saddle.

b. Service Line Materials

1 inch service lines shall be annealed copper tubing meeting the requirements of paragraph 510.4.E.e. High Density Polyethylene (HDPE) meeting the requirements of paragraph 501.4.E.c may be allowed for 1 inch diameter service lines with approval from NBU. 2 inch diameter service lines shall be High Density Polyethylene (HDPE) meeting the requirements of paragraph 510.4.E.c and in no case shall copper tubing be allowed.

c. HDPE Tubing

- i. HDPE pipe with 1" to 2" diameter shall be PE 4710 conforming to the latest edition of AWWA C901 and ANSI/NSF Standard 61. PE 4710 shall conform to ASTM D3350 minimum cell classification PE 445574C-CC3.
- ii. Pipe shall have a minimum pressure class of 250 psi. The outside diameter of the pipe shall be based upon the CTS sizing system.
- iii. The pipe shall be marked in accordance with the standards to which it is manufactured. Markings shall include nominal size, outside diameter base (e.g. CTS), dimension ratio (e.g. DR 9), manufacturer's name or trademark, standard materials designation code (PE 4710), cell classification (e.g. PE 445574C), PE compound oxidative resistance for potable water (CC3), pressure class (e.g. PC 250), standard's designation (AWWA C901), manufacturer's production code, date of manufacture, mark of the certifying agency for potable water (such as NSF).
- iv. Color of exterior pipe product (pipe with color code E) shall be blue for potable water.
- v. Tracer wire shall be required on all HDPE Service Lines and in accordance with Paragraph 510.4.J of this Section and Item No. 512 "Conductive Trace Wire for Non-Metallic Pipe Installation".

d. HDPE Fittings

- i. Butt Fusion Fittings – HDPE Fittings shall be made of PE4710 and with a minimum Cell Classification of PE 445574C-CC3. All HDPE fittings shall meet the requirements of AWWA C901 and shall have a pressure rating equal to the pressure rating of the pipe to which the fitting is joined.
 1. Molded fittings shall be manufactured, tested and marked per ASTM D3261.
 2. Fabricated fittings shall be manufactured, tested and marked per ASTM F2206, or individual fittings standards.
 3. Socket fittings shall meet ASTM D2683. Fittings shall be butt fusion welded, made of PE 4710 material with the same minimum cell classification used for the service line.
- ii. Electrofusion Fittings - Fittings shall be PE4710, with a minimum Cell Classification of PE 445574C-CC3. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.
- iii. Flanges and Mechanical Joint adapters (MJ adapters) shall be PE4710, with a minimum Cell Classification of PE 445574C-CC3. Flanged and MJ adapters can

be made to ASTM D3261 or if machined, must meet the requirements of ASTM F2206. Flanges and MJ adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Markings for molded or machined flange adapters or MJ adapters shall be per ASTM D3261. Fabricated (including machined) flange adapters shall be per ASTM F2206.

- iv. Mechanical Fittings for service pipes - Three primary mechanical fittings or connections can be used, which are: Stab or insert type; compression type; and clamp ring. Per MAB-4, "Internal stiffeners should be used for all mechanical fittings".
 - v. Mechanical fittings shall be designed to restrain and to prevent pull-out or rotation.
- e. Copper Tubing

All copper service tubing shall be 1" diameter annealed seamless Type K water tube meeting ASTM B88 and rated at 150 psi working pressure. The tubing shall be homogenous throughout and free from cracks, holes, crimping, foreign inclusions or other defects. It shall be uniform in density and other physical properties.

Nominal Tube Size, inches	Outside Diameter, inches		Wall Thickness, inches	
	Average	Tolerance	Average	Tolerance
1	1.125	± 0.0035	0.065	± 0.0045

- f. Service Connection Fittings
- All fittings used in customer service connection - tapping mains, connecting meters, etc. must be currently listed on the Standard Products List, or called for in the New Braunfels Utilities Standard Details.
- g. Brass Fittings
- i. All brass valves, couplings, bends, connections, nipples and miscellaneous brass pipe fittings and accessories used in meter connections, service lines, air release piping assemblies, and wherever needed in the water distribution system, shall conform to the detail Standards, Standard Products Lists, and AWWA C800, except as herein modified or supplemented.
 - ii. Unless otherwise noted, the goods described herein shall be fabricated of Waterworks No-Lead Brass meeting the requirements of ASTM B584, UNS Copper Alloy C89833 or C89836, having not more than one fifth of one percent (0.2%) total lead content by weight.
 - iii. Exposed threads shall be covered with plastic caps or sheeting to protect the threads.
 - iv. Brass goods of each type and class shall be compatible with other fittings in common usage for similar purposes.
 - v. Brass pipe shall conform to the weights and dimensions for Extra Strong pipe given in Table A.2 of AWWA C800.

h. Corporation Valves

- i. Inlet threads of corporation valves shall be AWWA iron pipe (IP) thread (male). AWWA IP threads shall conform to ANSI/ASME B1.20.1 as required by AWWA C800 for "General Purpose (Inch) Pipe Threads". For 1" size only, corporation valve inlet threads, and the internal threads of saddles may be the AWWA taper thread conforming to AWWA C800 Figure 1 and Table 6. External threads of corporation valve inlet must be compatible with internal threads of the service saddle.
- ii. Connections of all new copper tubing, and of tubing repairs wherever possible, shall be by flared fittings. Flare connections - and compression connections when permitted - shall be designed to provide a seal and to retain the tubing, without slippage, at a working water pressure of 150 psig.
- iii. Connections of all new polyethylene tubing or pipe shall be by compression fittings. PE tubing or piping must have a stainless steel insert stiffener at the compression connections per manufacturer's recommendations.
- iv. Flanges shall conform to ANSI B16.1, Class 125, as to dimensions, drillings, etc. Copper tubing, when used, shall be Type K tubing having dimensions and weights given in Table A.1 of AWWA C800.
- v. All fittings shall be suitable for use at hydrostatic working pressures up to 150 psig (hydrostatic testing of installed systems is at 200 psig).

F. Certification

For pipes 16-inches and larger all pipe manufacturers and suppliers shall be certified by the American National Standards Institute (ANSI) for ISO 9000 compliance. It is the intent of this certification that all appropriate tests be documented with sampling criteria, frequency of testing, date of testing and date in which every piece was manufactured. A copy of the testing data to include results shall be sent with the shipment with appropriate identification as it relates to the specific shipment.

The quality of materials, the process of manufacture and the finished pipe shall be subject to inspection and approval by the E/A at the pipe manufacturing plant and at the project site prior to and during installation. Plant inspections shall be conducted at the discretion of the City Representative and shall require only 48 hours of advance notice to the manufacturer. Only manufacturers and suppliers meeting this certification will be considered as approved providers of products as listed in the Standard Products List (SPL).

G. Polyvinyl Chloride (PVC) Pipe (Non-pressure) and Fittings for Gravity Wastewater Mains

a. General

Where PVC gravity wastewater pipe is indicated, it shall conform to ASTM D3034 for pipe sizes 4 inch to 15 inch or ASTM F679 for pipe sizes 18 inch to 48 inch. Cell Class shall be as required by applicable ASTM pipe specification; pipe stiffness shall be 115 psi minimum.

Where pressure rated PVC gravity wastewater pipe is indicated, it shall conform to ASTM D2241 SDR 26 or meet the requirements of paragraph 510.4.D.

b. Joint Material

PVC pipe and fitting shall have elastomeric gasket joints conforming to ASTM D 3212; gaskets to ASTM F 477.

c. Pipe Markings

Permanent marking on the pipe shall include the manufacturer's name and/or trademark, nominal pipe size, PVC cell classification per ASTM D1784, and be marked at intervals of not more than 5 feet:

d. Fitting Markings

Fittings shall include the manufacturer's name or trademark, nominal size, material designation "PVC", PSM, and the designation, "Specification D3034".

e. Pipe Color

Pipe shall be integrally colored green by the manufacturer.

H. Fiberglass Reinforced Plastic (FRP) Pipe (Non-pressure) and Fittings for Gravity Wastewater Mains

a. General

FRP shall conform to Item No. 320 "Fiberglass Gravity Sewer Pipe".

I. Tracer Wire

Tracer wire shall be installed on all non-ferrous water mains, water services and force mains. The wire shall be installed in such a manner as to be able to properly trace all mains without loss or deterioration of signal or without the transmittal signal migrating off the tracer wire. Tracer wire shall be placed as per specifications in 512, "Conductive Trace Wire for Non-Metallic Pipe Installation".

J. Tracer Tape

Tracer tape shall be installed on all force mains in accordance with TCEQ §217.66 rules. The tape should be a minimum of 12 inches below subgrade, or a minimum of 18 inches below finished grade on areas outside the limits of pavement. The tape shall be encased in a protective, inert, plastic jacket and color-coded in accordance with APWA Uniform Color Code.

K. Concrete

Concrete shall conform to TxDOT Item No. 421, "Hydraulic Cement Concrete".

L. Material Approval

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work is of the kind and quality that satisfies the specified functions and quality. **New Braunfels Utilities Standard Products Lists (SPL)** forms a part of the Specifications. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the E/A is still required. Should the Contractor elect to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making

the product submittal. This will expedite the review process in which the E/A, decides whether the products meet the Contract requirements and the specific use foreseen by the E/A in the design of this engineered Project. The purpose of the SPL's is to expedite review, by the E/A of Contractor product submittals. The SPL's should not be interpreted as being a pre-approved list of products necessarily meeting the requirements for a given construction Project. Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the E/A. The Standard Product List current at the time of plan approval will govern.

510.5 Construction Methods

A. Water Line/New Wastewater Line Separation

Installation of new water or wastewater lines shall conform to the following:

1. Where feasible, water and wastewater lines shall be no closer to each other than 9 feet between outside diameters in all directions and shall be in separate trenches.
2. If the 9 foot separation cannot be achieved, any portion of a new gravity wastewater line within 9 feet in any direction (between OD's) of a potable water line, shall be in a separate trench and constructed of AWWA C900 (DR-18) 150 psi rated PVC or ASTM D 2241 (SDR-26) 160 PSI rated PVC.
3. If the lines are parallel, they shall not be closer than 4 feet horizontally or 2 feet vertically between OD's with the wastewater lower than the water line. If the lines cross, they may be no closer than 6 inches vertically between OD's with the sewer below the water line and one standard 20 foot length of AWWA C900 (DR-18) 150 psi rated PVC or ASTM D 2241 (SDR-26) 160 PSI rated PVC shall be centered at the point of crossing the water line.
4. Unless wastewater manholes and the connection to the sewer can be made completely watertight and tested for no leakage, they must be installed so as to provide a minimum of 9 feet of horizontal clearance from an existing or proposed water line.

B. Utility and Storm Sewer Crossings

1. When the Contractor installs a pipe that crosses under a utility structure or storm sewer and the top of the pipe is within 24 inches of the bottom of the utility structure, the pipe shall be encased in concrete as specified in Item No. 505, "Concrete Encasement and Encasement Pipe", for a distance of at least 1 foot on either side of the ditch line of the utility structure or the storm sewer. Unless otherwise specified by the E/A, concrete encasement will not be required for ductile iron or AWWA C900 (DR-18) 150 psi rated PVC in sizes to 12 inch. When the Contractor installs a pipe that crosses over a utility structure or storm sewer and the top of the utility structure or storm sewer is within 18 inches of the bottom of the pipe, the pipe shall be either ductile iron, AWWA C900 (DR-18) 150 psi rated PVC in sizes to 12 inch, unless otherwise specified by the E/A.
2. Steel casing must be used when water mains cross under box culverts, large storm drain pipes (48 inches or greater in diameter), or multiple barrel storm drains of any size. Casing sizes shall be in accordance with NBU Construction Specifications. Casing must extend 5' beyond the OD of the storm drain crossing.

3. Where trenches wider than 12 inches cross under existing wastewater lines, the sewer lines shall be replaced with one 20-foot joint of AWWA C900 (DR-18) 150 psi rated PVC or ASTM D 2241 (SDR-26) 160 PSI rated PVC centered over the trench.

C. Laying Pipe

1. All recommendations of the manufacturer shall be carefully observed during handling and installation of each material. Unless otherwise indicated, all materials shall be delivered to the project by the manufacturer or agent and unloaded as directed by the Contractor. Each piece shall be placed facing the proper direction near to where it will be installed.
2. The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times and stored in a manner that will protect them from damage. Stockpiled materials shall be stacked so as to minimize entrance of foreign matter.
3. The interior of all pipeline components shall be clean, dry and unobstructed when installed.
4. Piping materials shall not be skidded or rolled against other pipe, etc. and under no circumstances shall pipe, fittings or other accessories be dropped or jolted.
5. During handling and placement, materials shall be carefully observed and inspected and any damaged, defective or unsound materials shall be marked, rejected and removed from the job site. Minor damage shall be marked and repaired in a manner satisfactory to the E/A. Joints, which have been placed, but not joined, backfilled, etc., shall be protected in a manner satisfactory to the E/A.

D. Assembling of Pipe

1. Angular spacing of all joints shall meet the manufacturer's recommendations for the pipe and accessories being used. Side outlets shall be rotated so that the operating stems of valves shall be vertical when the valves are installed. Pressure pipe shall be laid with bell ends facing the direction of pipe installation. Pipe end bells shall be placed upgrade for all wastewater lines.
2. Orientation marks, when applicable, shall be in their proper position before pipe is seated.
3. Before joining any pipe, all foreign matter, lumps, blisters, excess coal tar coating, oil or grease shall be removed from the ends of each pipe and the pipe ends shall then be wire brushed and wiped clean and dry. Pipe ends shall be kept clean until joints are made.
4. Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing or other materials shall be placed in the pipe.

E. Joints

1. O-Ring and Push-on Joints
 - i. Just before making a joint the ends of the pipe shall be clean, dry, free of any foreign matter, lump blisters, excessive coal tar coating and grease or oil and shall

be wire brushed. The gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound (Flax Soap) to facilitate telescoping the joints. The rubber gasket if not factory installed shall be stretched uniformly as it is placed in the spigot groove to insure a uniform volume of rubber around the circumference of the groove. The spigot shall be centered in the bell, the pipe pushed home uniformly and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint. Care should be taken to prevent dirt or foreign matter from entering the joint space.

2. Bolted Joints

All flanged, mechanical or other bolted joints shall be joined with nuts and bolts and be coated as indicated above in Iron Pipe.

F. HDPE Service Line Joints

1. The pipe and fittings shall be joined by butt fusion or electrofusion couplings, mechanical joint (MJ) adapters, or by flange connections in accordance with manufacturer's recommendations and as required in this document. Unless otherwise shown on Drawings and except for connections to existing utilities, all joints shall be fused.

a. Butt Fusion: The pipe shall be joined by heat fusion of the ends. Prior to fusion the pipe shall be clean and the ends shall be cut square. Butt-fusion joining is applicable to pipes that have the same nominal outside diameter and wall thickness, within one SDR. Field site butt-fusion system operators shall be trained in the use of the high-quality butt-fusion equipment that secure and precisely align the pipe ends for the fusion process. Operators shall be trained by the pipe supplier or manufacturer of the fusing machine and be experienced in the operation of the equipment. Fusion quality shall be recorded, the recording of the information must be provided to the Owner. The Owner will review documents within 7 days and identify any fusion records that might indicate the need to replace an existing fused connection. The recorded fusion information must meet the standard requirements of ASTM F3124. All fusions failing to meet these requirements shall be removed and refused. Refer to ASTM F2620, ASTM F3124, ASTM F3183 and ASTM F3190.

b. Electrofusion: Electrofusion joining shall be done in accordance with the manufacturers recommended procedure and ASTM F1055, ASTM F1290, MAB-01 and MAB-02. Qualification of the fusion technician shall be demonstrated by evidence of electrofusion training within the past year on the equipment and pipe sizes to be utilized for this project. Installers shall follow the guidance shown in the previous documents to fabricate EF assemblies. The installer must remove oxidation from the pipe and maintain a clean surface on both pipe and fitting to ensure acceptable joint quality.

c. Mechanical:

i. Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use flanges or mechanical joint adapters and other devices in conformance with the AWWA Manual of Practice M55, Chapter 6. Mechanical connections shall be manufactured for HDPE pipe and approved by the connection manufacturer for use with polyethylene pipe. Uncontrolled tapering or hand-beveling in the field is not allowed.

- ii. Mechanical connections on pipe 3" and smaller are available to connect HDPE pipe to other HDPE pipe, or a fittings, or to a transition to another material. The use of stab fit style couplings is allowed, along with the use of metallic couplings of brass and other materials. All mechanical and compression fittings shall be recommended by the manufacturer for use with HDPE and with potable water.
- iii. Mechanical couplings that wrap around the pipe and act as saddles are made by several manufacturers specifically for HDPE pipe. All such saddles, tapping saddles, couplings and clamps shall be recommended by the manufacturer as being designed for use with HDPE pipe at the required pressure class; all mechanical couplings shall be fully restrained either by themselves or by an alternate means.
- d. Mechanical Joint/Flange: A flange assembly consists of a metal back-up flange or bolt-ring and a polyethylene flange adapter. MJ assembly consists of a MJ adaptor with gland ring, gasket and bolt kit. Both MJ adapters and flange adapters are fused onto the plain end of the pipe main. Bolting guidance for MJ connections is provided in AWWA C600 and guidance for flanges and gaskets is provided in PPI-TN38. Note that an HDPE flange adapter acts as both a flange and a gasket, and as such, no 'gasket' is required. For further information, refer to PPI TN38

G. Placing Pipe in Tunnels

Piping installed as a carrier pipe in a tunnel, encasement pipe, etc., shall have uniform alignment, grade, bearing, meet all requirements of the carrier pipe as specified, and conform to the reviewed Shop Drawings. All necessary casing spacers, joint restraints, bedding material, grout cradle or paving, bracing, blocking, etc., as stipulated by the Contract or as may be required to provide and maintain the required pipe alignment and grade, shall be provided by the Contractor at no cost except as provided by the Bid Items. This shall include casing spacers acceptable to the Owner attached to the carrier pipe in accordance with the manufacturer's recommendations. The insertion pushing forces shall not exceed the pipe manufacturer's recommendation. Carrier pipe may be pulled into place inside the encasement or tunnel using lubricants to ease pipe installation. Lubricants such as flax soap or drilling mud may be used for this purpose. Use of petroleum products such as oil or grease for this purpose shall not be permitted.

H. Temporary Pipe Plugs, Caps, Bulkheads and Trench Caps

1. Temporary plugs, caps or plywood bulkheads shall be installed to close all openings of the pipe and fittings when pipeline construction is not in progress.
2. All temporary end plugs or caps shall be secured to the pipe as provided under Item No. 507, "Bulkheads".
3. Trench caps shall be reinforced Class D concrete as indicated.

I. Corrosion Control

1. Protective Covering

Unless otherwise indicated, all flanges, nuts, bolts, threaded outlets and all other iron or steel components buried and in contact with earth or backfill shall be wrapped with 8-mil (minimum) polyethylene film meeting ANSI/AWWA C105 to provide a continuous wrap.

J. Pipe Anchorage, Support and Protection

Pressure pipeline tees, plugs, caps and shall be secured with thrust restraints. Joint restraints lengths shall be determined by the Engineer. Concrete thrust blocking may be approved on a case-by-case basis for connections to existing mains or other situations where restraint lengths cannot be achieved.

1. Concrete Thrust Blocking

- a. Concrete for use as reaction or thrust blocking shall be Class B conforming to TxDOT Item No. 421, "Hydraulic Cement Concrete".
- b. Concrete blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as indicated or directed by the E/A. The blocking shall, unless otherwise indicated, be so placed that the pipe, fittings and joints will be accessible for repair.
- c. The trench shall be excavated at least 6 inches outside the outermost projections of the pipe or appurtenance and the trench walls shaped or undercut according to the detail Drawings or as required to provide adequate space and bearing area for the concrete.
- d. The pipe and fittings shall be adequately weighted and laterally braced to prevent floating, shifting or straining of the pipeline while the concrete is being placed and taking initial set. The Contractor shall be solely responsible for the sufficiency of such restraints.

2. Metal Thrust Restraint

Fabricated thrust restraint systems such as those described below may be approved for use instead of concrete blocking. To obtain approval, the project Drawings must include sufficient drawings, notes, schedules, etc., to assure that the proposed restraints as installed will be adequate to prevent undesirable movement of the piping components. Such restraint systems may only be used where and as specifically detailed and scheduled on approved Project Drawings.

3. Thrust Harness

A metal thrust harness of tie rods, pipe clamps or lugs, turnbuckles, etc., may be approved. All carbon steel components of such systems, including nuts and washers, shall be hot-dip galvanized; all other members shall be cast ductile iron. After installation, the entire assembly shall be wrapped with 8-mil polyethylene film, overlapped and taped in place with duct tape to form a continuous protective wrap.

4. Restrained Joints

Piping or fitting systems utilizing integral mechanically restrained joints may be approved. All components of such systems shall be standard manufactured products fabricated from cast ductile iron, hot-dip galvanized steel, brass or other corrosion resistant materials and the entire assembly shall be protected with a continuous film wrap as described for (a) above.

Location, configuration and description of such products shall be specifically detailed on the Drawings. (Add-on attachments such as retainer glands, all-thread rods, etc., are not acceptable.)

K. Wastewater Connections

1. Connections to Mains 12 Inches and Smaller
 - a. All branch connections of new main lines shall be made by use of manholes.
 - b. Service stubs shall be installed as indicated. Minimum grade shall be 2 percent downward to main and minimum cover shall be 4 1/2 feet at the curb. Standard plugs shall be installed in the dead end before backfilling.
 - c. Where a service connection to a main 12 inches or smaller is indicated, a wye, tee or double wye shall be installed.
 - d. Where a service connection to a main 15 inches or larger is indicated, a field tap may be made with the pipes installed crown to crown. The tap should be made conforming to the pipe manufacturer's recommendations with the E/A's approval.
 - e. Where not otherwise indicated, (wastewater) service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.
2. Connections to the Existing System
 - a. Unless otherwise specified by the E/A, all connections made to existing mains shall be made at manholes with the crown of the inlet pipe installed at the same elevation as the crown of the existing pipe. Service stubs installed on the existing system shall be installed by use of tapping saddles unless otherwise approved by the E/A. Extreme care shall be exercised to prevent material from depositing in the existing pipe as the taps are being made.
 - b. When connections to existing mains are made, a temporary plug approved by the E/A must be installed downstream in the manhole to prevent water and debris from entering the existing system before Final Completion. These plugs shall be removed after the castings are adjusted to finish grade or prior to Final Completion.

L. Water System Connections

1. The Contractor shall, at his expense, make all necessary connections of new piping or accessories to the existing water system. To minimize any inconvenience from outages, the Contractor shall schedule all such connections in advance and such schedule must be approved by the E/A before beginning any Work.
2. Line Stoppers

NBU will require contractors to use line stoppers to take an outage during construction if system valves are not available or existing valves do not function. Line stoppers will be required based on the following criteria.

 - a. If the number of residential customers affected is greater than 20 and expected to last more than 4 hours.
 - b. If any commercial customers are affected by the outage then the use of line stoppers will be determined on a case by case basis.

- c. If any critical care customers are affected by the outage then the use of line stoppers will be determined on a case by case basis.
 - d. System conditions may require a line stopper and may not be known until construction commences.
 3. Shutoffs
 - a. New Braunfels Utilities will make all shutoffs on existing water mains. The Contractor shall be required to notify the E/A's field representative on the job at least 72 hours prior to the desired time for any shutoff. The E/A's field representative will notify any affected utility customers at least 24 hours prior to the shutoff. The Utility will make the shutoff after ensuring that all appropriate measures have been taken to protect the water system, customers and employees.
 - b. New Braunfels Utilities will operate all valves to fill existing mains. Where a newly constructed main has not been placed in service and has only one connection to the public water supply, the Contractor may operate one valve to fill the main after approval has been obtained from the Utility. The operation of the valve is to be conducted under the immediate supervision of the E/A's field representative.
 - c. Water for the Work shall be metered and furnished by the Contractor in accordance with of the Standard Contract Documents.
 4. Wet Connections to Existing Water System
 - a. The Contractor shall make all wet connections called for by the Contract or required to complete the Work. Two connections to an existing line performed during the same shutout, at the same time and at a distance less than 50 linear feet apart, will be considered one wet connection. Two connections to an existing line performed during the same shutout, at the same time and at a distance equal to, or greater than 50 linear feet will be considered two wet connections. A wet connection shall include draining and cutting into existing piping and connecting a new pipeline or other extension into the existing pressure piping, forming an addition to the water transmission and distribution network.
 - b. The Contract price for wet connections shall be full payment for all necessary shutoffs, excavation, removing plugs and fittings, pumping water to drain the lines, cutting in new fittings, blocking and anchoring piping, bedding and backfilling, placing the lines and service and all site cleanup.
 - c. No water containing detectable amounts of chlorine may be drained, released, or discharged until specific planning and appropriate preparations to handle, dilute and dispose of such chlorinated water are approved in advance by the Utility and the disposal operations will be witnessed by an authorized representative from the Utility.
 5. Pressure Taps to Existing Water System **(Note: Pressure taps can only be performed by NBU pre-approved Contractors.)**
 - a. The Contractor shall make all pressure taps called for by the Contract Documents or required to complete the Work. A pressure tap shall consist of connecting new piping to the existing water system by drilling into the existing pipe while it is carrying water under normal pressure without taking the existing piping out of service.

- b. Unless otherwise provided by the Contract, the Contractor shall, at his expense, perform all necessary excavation, furnish and install the tapping sleeve, valve and accessories, provide the tapping machine, drill the tap and shall block, anchor and backfill the piping, valve and all accessories, place the new piping in service and perform all site cleanup. When NBU makes the tap, NBU crews will tap the main and install the service to the property line. In this case, the Contractor must pay for the tap in advance at NBU's Service Center located at 355 FM 306.
- c. If a private Contractor makes the tap, a Utility Inspector must be present. "Size on size" taps will not be permitted, unless made by use of an approved full circle gasket tapping sleeve. Concrete blocking shall be placed behind and under all tap sleeves 24 hours prior to making the wet tap.

6. Service Connections

- a. Service connection taps into PVC, AC, CI, or DI pipe 16 inches or smaller shall be made using either a service clamp or saddle or a tapping sleeve as recommended by the pipe manufacturer and as approved by the E/A. Direct tapping of these pipes will not be permitted.
- b. All water service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.
- c. Precautions should be taken to ensure that the tapping saddle or sleeve is placed on the pipe straight to prevent any binding or deformation of the PVC pipe. The mounting chain or U-bolt strap must be tight.
- d. Tapping shall be performed with a sharp shell type cutter so designed that it will smoothly penetrate heavy walled PVC DR14 and 200 psi AC and will retain and extract the coupon from the pipe.

7. Cleanup and Restoration

- a. It shall be the Contractor's responsibility to keep the construction site neat, clean and orderly at all times. Cleanup shall be vigorous and continuous to minimize traffic hazards or obstructions along the streets and to driveways. Trenching, backfill, pavement repair (as necessary), and cleanup shall be coordinated as directed by the Utility. The E/A will regulate the amount of open ditch and may halt additional trenching if cleanup is not adequate to allow for orderly traffic flow and access.
- b. Materials at the site shall be stored in a neat and orderly manner so as not to obstruct pedestrian or vehicular traffic. All damaged material shall be removed from the construction site immediately and disposed of in a proper manner. All surplus excavated materials become the property of the Contractor for disposal at his expense. After trenching, the Contractor shall immediately remove all excavated materials unsuitable for or in excess of, backfill requirements. Immediately following the pipe laying Work as it progresses, the Contractor shall backfill, grade and compact all excavations as provided elsewhere and shall immediately clean up and remove all unused soil, waste and debris and restore all surfaces and improvements to a condition equal or superior to that before construction began and to an appearance which complements the surroundings. The Contractor shall grade and dress the top 6 inches of earth surfaces with soil or other material similar and equal

to the surrounding, fill and smooth any visible tracks or ruts, replace and re-establish all damaged or disturbed turf or other vegetation and otherwise make every effort to encourage the return of the entire surface and all improvements to a pleasant appearance and useful condition appropriate and complementary to the surroundings and equal or similar to that before construction began.

M. Water Main Abandonment

1. Water mains to be abandoned shall be disconnected from pipes that are to remain in service and entirely filled with pumpable grout. All connections to existing mains to remain in service shall be cut or plugged as appropriate and thrust blocks installed as necessary. All valves on the water main shall be abandoned as per the section below. Contractor is responsible for all labor, equipment, and materials required to complete the work.
2. Service lines to be abandoned shall be disconnected at the corporation stop at the main, and all other valves and appurtenances, including the water meter, shall be removed. All meters to be removed shall be returned to NBU.

N. Valve Abandonment

1. Valves to be abandoned shall only occur when an abandoned valve is left on an abandoned water main that is no longer in service. A valve to be abandoned shall have the valve box, casing, and valve stem extension (if present) removed to a minimum of 18-inches below grade. The remaining casing shall be filled with non-shrink grout to the top of the casing.

O. Wastewater Main Abandonment

1. Wastewater mains to be abandoned shall be cleaned and televised per Item No. 315 "CCTV Inspection" to verify all existing laterals have been transferred to another wastewater main.
2. Wastewater mains to be abandoned shall be disconnected from pipes or manholes that are to remain in service and entirely filled with pumpable grout. All connections to existing mains to remain in service shall be cut or plugged as appropriate. Contractor is responsible for all labor, equipment, and materials required to complete the work.
3. Wastewater manholes to be abandoned shall be abandoned per NBU Standard No. 340 "Abandoned Manhole."

510.6 Measurement

Pipe will be measured by the linear foot for the various types, sizes and classes. Parallel lines will be measured individually.

Pipe to be abandoned shall be measured by the cubic yard of pumpable grout required to completely fill the pipe.

Where a line ties into an existing system, the length of the new line will be measured from the visible end of the existing system at the completed joint. Unless otherwise indicated, the length of water and wastewater lines will be measured along pipe horizontal centerline stationing through fittings, valves, manholes, and other appurtenances.

Unless otherwise provided, ductile iron fittings 24-inch and smaller will be measured by the ton and paid for in accordance with the schedule in Standard Product List. Unless otherwise provided, fittings larger than 24-inch sizes will be subsidiary to the pipe. These will be subsidiary to the bid item Pipe.

Excavation and backfill, when included under pipe installation will not be measured as such but shall be included in the unit price bid for constructing pipe and measured as pipe complete in place including excavation and backfill.

When pay items are provided for the other components of the system, measurement will be made as addressed hereunder.

510.7 Payment

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot for the various sizes of pipe, of the materials and type indicated, unless unstable material is encountered or trench excavation and backfill is bid as a separate item.

A. Pipe

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot complete-in-place as designed and represented in the Drawings and other Contract documents. Unless otherwise provided herein, as separate pay item(s), subsidiary items to the bid price per linear foot of pipe shall include:

1. Clearing
2. Constructing any necessary embankment
3. Excavation
4. Disposal of surplus or unusable excavated material
5. Furnishing, hauling and placing pipe
6. Fittings larger than 24 inch
7. Field constructed joints, collars, temporary plugs, caps or bulkheads
8. All necessary lugs, rods or braces
9. Pipe coatings and protection
10. Connections to existing systems or structures, concrete blocking and thrust blocks and restrained joints
11. Preparing, shaping, pumping for dewatering, and shoring of trenches
12. Bedding materials
13. Backfill materials
14. Hauling, placing and preparing bedding materials
15. Particle migration measures
16. Hauling, moving, placing and compacting backfill materials
17. Temporary and permanent pavement repairs and maintenance

18. Temporary and permanent removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction
19. Cleanup
20. Vertical stack on deep wastewater services
21. All other incidentals necessary to complete the pipe installation as indicated

B. No separate payment will be made for thrust restraint measures.

C. Wet Connections to Water Mains

When called for in the bid, wet connections will be paid at the unit price bid per each, complete in place, according to the size of the main that is in service and shall be full compensation for all Work required to make the connection and place the pipe in service.

D. Fittings

Cast iron and ductile iron fittings of the class indicated, furnished in accordance with these specifications will be paid for at the unit price bid per ton, complete in place, according to scheduled weights for mechanical joint fittings furnished, including glands, bolts and gaskets, as published in the following standards:

1. AWWA C153 for all fittings 4-inch through-24 inch sizes, regardless of whether AWWA C110 or AWWA C153 fittings are furnished or the type of end connections supplied.
2. AWWA C110 for all fittings larger than 24-inch size.

E. Pressure Taps

Pressure taps will be paid for at the unit price bid, complete in place, according to the size tap made and the size main tapped and shall be full payment for furnishing all necessary materials, including tapping sleeve and valve, making the tap, testing and placing the connection in service.

F. Trench Safety Systems

When called for in Bid, Trench Safety Systems shall conform to Item No. 121, "Trench Safety Systems".

G. Water Main Abandonment

Water main abandonment shall be paid for at the unit price bid, complete in place, according to the size of the main to be abandoned, and shall be full payment for furnishing all labor, equipment, and materials necessary to fill the existing main with pumpable grout. Unless otherwise provided herein, as separate pay item(s), subsidiary items to the bid price shall include:

1. All excavation required to access the existing main
2. Installation of plugs or caps
3. Installation of thrust blocks
4. Backfill, compaction, and restoration
5. Temporary and permanent pavement repairs and maintenance
6. Disposal of surplus or unusable excavated material

7. Removal and legal disposal of existing water main
8. Temporary and permanent removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction
9. Cleanup

H. Water Service Abandonment

Water service abandonment shall be paid for at the unit price bid, complete in place, according to the size of the service to be abandoned, and shall be full payment for furnishing all labor, equipment, and materials necessary to plug or cap the connection to the existing main and remove all existing valves and appurtenances. Unless otherwise provided herein, as separate pay item(s), subsidiary items to the bid price shall include:

1. All excavation required to access the existing main
2. Installation of plugs or caps
3. Backfill, compaction, and restoration
4. Temporary and permanent pavement repairs and maintenance
5. Disposal of surplus or unusable excavated material
6. Removal and legal disposal of existing service materials
7. Delivery of water meters to NBU storage facilities or inspection personnel, as directed
8. Temporary and permanent removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction

I. Wastewater Line Abandonment

Wastewater line abandonment shall be paid for at the unit price bid, complete in place, according to the size of the main to be abandoned, and shall be full payment for furnishing all labor, equipment, and materials necessary fill the existing line with pumpable grout. Unless otherwise provided herein, as separate pay item(s), subsidiary items to the bid price shall include:

1. Cleaning and televising the existing main
2. All excavation required to access the existing main
3. Installation of plugs or caps
4. Installation of thrust blocks
5. Backfill, compaction, and restoration any required excavation
6. Temporary and permanent pavement repairs and maintenance
7. Removal and legal disposal of surplus or unusable excavated material
8. Removal and legal disposal of existing sewer materials
9. Temporary and permanent removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction
10. Cleanup

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Specifications

Payment, when included as a Contract pay item, will be made under one of the following:

Pay Item: Pipe, ___Dia. ___ (all depths), including Excavation and Backfill	Per Linear Foot
Pay Item: Pressure Taps, ___ Dia. x ___ Dia.	Per Each
Pay Item: Wet Connections, ___ Dia. x ___ Dia.	Per Each
Pay Item: Ductile Iron Fittings 4 inch through 24 inch	Per Ton
Pay Item: Abandon and Grout Fill, ___ Dia. Water Main	Per CY
Pay Item: Abandon and Grout Fill, ___ Dia. Wastewater Main	Per CY

End