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Lee A. Norman, M.D., Secretary

Laura Kelly, Governor

June 18, 2019

Ms. Leslie Corcelli
U.S. Environmental Protection Agency
Clean Water State Revolving Fund
Office of Water, Office of Wastewater Management
1200 Pennsylvania Avenue, NW (Mailcode 4204M)
Washington, DC 20460

Re: Pomona, Kansas
KWPCRF Project No.: C20 2014 01
Sanitary Sewer System Improvements
American Iron and Steel

Dear Ms. Corcelli:

The "Consolidated Appropriation Act of 2014" includes an "American Iron and Steel" (AIS) requirement requiring Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Loan Fund (DWSRF) assistance recipients to use specific domestic iron and steel products produced in the United States if the project is funded through an assistance agreement executed after January 17, 2014, such as the Pomona Sanitary Sewer System Improvement project. Following the U.S. Environmental Protection Agency (EPA) guidelines, this office has reviewed the City of Pomona Sanitary Sewer System waiver request for a non-domestic AIS product. This non-domestic AIS product is required to prevent unwanted water to enter at service line connections and appears to one of a kind using bentonite sealant. The PVC coated steel bars are not made in the United States. This office has reviewed the recipient's consultant's application for the waiver and have determined the application provides the necessary information for a waiver.

Should you have any questions, please contact me by email at Frank.Weinhold@ks.gov or by voice phone at 785.296.5530.

Sincerely yours,

Frank R. Weinhold, P.E.
Municipal Programs Section
Bureau of Water

Attachments: AIS Applicable Components

pc: The Honorable Marie Seneca, Mayor - City of Pomona
BG Consultants, Inc. – Manhattan (Craig Ronnebaum)
William Carr
Wade Keitel
2.1 File w/attachments

SECTION 33 31 13

PUBLIC SANITARY UTILITY PIPING

PART 1 – GENERAL

1.01 SCOPE OF WORK

A. This work shall consist of the construction, installation and testing of gravity and pressure sanitary sewer lines all other appurtenances as are necessary to complete the work in accordance with the Drawings and the specifications.

1.02 SECTION INCLUDES

A. Sanitary Sewer gravity and pressure piping, fittings and accessories

B. Steel Casing

C. Pipe embedment.

D. Acceptance Testing

1.03 RELATED WORK

A. Section 31 20 00 Earth Moving

B. Section 03 41 00 Precast Structural Concrete

C. Section 03 30 00 Cast-In-Place Concrete

D. Section 33 01 30.16 TV Inspection of Sewer Pipelines

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00 – Submittals

B. Product Data for Review
   1. Pipe, pipe accessories, fittings
   2. Manholes, castings, manhole appurtenances
   3. Pressure gauge certification and calibration data

C. Manufacturer’s Installation Instructions: Indicate special procedures required to install products specified.

D. Certificates of conformance shall be furnished with each lot of pipe supplied.

PART 2 – PRODUCTS

2.01 PIPE MATERIALS

A. Ductile Iron Pipe: All Ductile Iron Pipe for this project shall have the following minimum pressure class ratings: Class 250 for 4”-12”; Class 200 for 24”; and Class 150 for 30”-64” pipe conforming to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51 specifications *unless otherwise noted in the Drawings*.

1. Joints

a. All buried pipe, gravity or pressure-rated, shall have standardized mechanical joint or push-on joint ends manufactured in accordance with ANSI/AWWA C110/A21.10 and C111/A21.11.

b. Gaskets for mechanical or push-on joints shall be neoprene or synthetic rubber.

c. Furnish restrained mechanical joints where indicated to offset internal pipeline forces. Restrained mechanical joints shall utilize a follower gland incorporating individually activated wedges, with a rated working pressure of 350 psi. The restraining gland shall be capable of full mechanical joint deflection during assembly, and flexibility shall be maintained after burial. Torque-limited twist-off nuts shall be used to ensure proper actuation of the restraining wedges. Restraining glands shall be EBAA Iron Megalug Series 1100 or Approved Equal.

d. All interior and exposed exterior pipe shall be flanged unless otherwise indicated or specified. Pipe flanges shall be ductile iron, conforming to ANSI B16.1 and shall be drilled Class 125.

e. Bolts for flanged joints shall be steel in conformance with ASTM A307 Grade B. Nuts shall be ASTM A307 steel with ANSI/ASME B.18.2.2 heavy semifinished pattern. *All bolting inside wetwells and vaults shall be stainless steel.*

f. Gaskets for flanged joints shall be 1/8" thick, full faced synthetic Rubber conforming to Appendix B of ANSI/AWWA C111/A21.11.

g. Sleeved or coupled joints shall be provided where indicated. Furnish pipe ends suitable for installing style of sleeve or coupling indicated or specified. Provide anchor couplings where restraint is required to withstand specified operating or hydraulic test pressure and where indicated.

2. Fittings

a. Ductile iron fittings shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53-88 and shall be designed for a

minimum pressure rating of 350 psi. Compact fittings conforming to ANSI/AWWA C153/A21.53 shall be used in ductile iron piping only where specifically indicated in the Drawings.

b. Fittings for buried gravity pipe shall have standardized mechanical or push-on joints.

c. When specified in the Drawings, fittings for buried pressure or flooded pipe shall have restrained joints or be a restrained fitting by One-Bolt, Inc®.

d. Flanged fittings shall be provided for flanged pipe.

e. Buried ductile iron fittings shall be wrapped in polyethylene conforming to ASTM D1248, Type 1, Class C, Grade E-1

3. Linings and Coatings

a. All pipe and fittings for wastewater applications shall be lined with an amine-cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment by Protecto 401.

b. Lining shall extend from edge of plain end to the gasket seat in the bell socket.

c. Exterior surfaces of all buried or encased ductile iron pipe and fittings shall receive a shop applied one-mil thick asphaltic coating. Asphaltic coating shall conform to AWWA C115, AWWA C110, and AWWA C153 as applicable.

d. Exterior surfaces of all ductile iron pipe and fittings to be located completely or partially inside wetwells, vaults, buildings or in other exposed locations, shall be blast cleaned to near-white metal per SSPC-SP10 and shop coated with a high solids alkyd-phenolic primer to a dry film thickness of 3.0 mils. Shop primer shall be Tnemec Series 37H Chem-Prime H.S. or Approved Equal.

e. Flange faces shall be coated with a rust-preventive compound.

4. Polyethylene Encasement: Buried ductile iron piping shall be encased in polyethylene conforming to ASTM D1248, Type 1, Class C, Grade E-1.

B. Polyvinyl Chloride (PVC) Gravity Pipe, Service Pipe and Fittings: All PVC sewer pipe and fittings, sizes 4-inch through 15-inch, shall conform to ASTM D-3034, SDR 26. All PVC sewer pipe and fittings, sizes 18-inch through 27-inch, shall conform to ASTM F-679, T-1 (SDR 35).

1. Joints: All joints shall be of the bell and spigot type. The bell shall contain a factory installed elastomeric gasket which is positively retained. Joint shall be in conformance with ASTM D3212.

2. Fittings

a. All PVC sewer pipe and fittings shall be made of PVC plastic having a cell classification of 12454-B or 12454-C, as defined by ASTM D1784.

b. Molded fittings shall be supplied with factory-installed gaskets and shall be suitable for use with SDR-26 gravity sewer pipe. Fittings shall not deflect more than the pipe with loaded and bedded in the same manner.

c. All 90° Bends shall be accomplished by using two 45° Bends, unless specifically indicated in the Drawings.

3. Gaskets: All gaskets shall be molded or extruded and spliced from a high-grade, properly vulcanized elastomeric compound, consisting of a synthetic rubber and shall meet the low head requirements of ASTM F-477.

C. Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

The materials of the pipe shall be uniformly blended with unplasticized polyvinyl chloride. Nothing used in its manufacture shall be injurious to humans or animals, nor shall it impart taste or odor to domestic water or in any manner alter the chemical content of waters flowing through the pipe. It shall consist of all new materials, and the manufacturer shall furnish a sworn statement that no reused materials were used in the manufacture of the pipe or fittings. All pipe shall have superior high-tensile strength. Pipe shall conform to all requirements of commercial standards, ANSI, and the following minimum pressure class or *as specified in the Drawings*:

ASTM 2241, Class 160, SDR 26

All plastic pipe shall be approved by and bear the National Sanitation Foundation seal of approval and will comply with the requirements for Class 1245-A or Class 1245-B virgin components as defined in ASTM D1784 with an estimated hydrostatic design basis (HDB) rating of 4000 psi (27.58 Mpa) for liquid at 73.4°F (23°C). Pipe and fittings with elastomeric seal joints shall meet the requirements of ASTM D3139.

1. Joints

a. Shall be push-on type with integral bell and spigot and elastomeric gaskets meeting the requirements of ASTM D-2122. Rubber gasket rings shall be neoprene or other synthetic material and conform to ASTM F-477. Natural rubber gaskets will not be acceptable.

b. Restraint: Clamps for restraining bell and spigot joints shall consist of clamping rings and rods, and shall meet the requirement of Uni-B-13-92. Restraint devices shall be of ductile iron, ASTM A536,

Grade 65-45-12, with connecting bolts of high strength, low alloy metal in accordance with ANSI/AWWA C111-A21.11. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. Bell restraint clamps shall be:

1. Ford Meter Box Series 1350 Uni-Flange Block Buster
2. EBAA Iron Series 6500 for IPS
3. EBAA Iron Series 1500 for C-900
4. Approved Equal

2. Fittings

a. Fittings shall be ductile iron and shall conform to ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53-88.

b. Fittings requiring joint restraint shall have restrained mechanical joints or be a restrained fitting by One-Bolt, Inc®.

c. Buried ductile iron fittings shall be wrapped in polyethylene conforming to ASTM D1248, Type 1, Class C, Grade E-1

3. Gaskets

a. All gaskets shall be molded or extruded and spliced from a high-grade, properly vulcanized elastomeric compound, consisting of a synthetic rubber and shall meet the low head requirements of ASTM F477.

D. HDPE: High Density Polyethylene Pipe shall be as specified in Section 33 90 15 HDPE.

E. Polyvinyl Chloride (PVC) Pressure Pipe (Restrained):

a. Yelomine: Certa-Lok Yelomine® Pipe by CertainTeed shall be as specified in Section 33 90 10 Yelomine Restrained Joint PVC Pipe.

b. C900: Certa-Lok C900/RJ™ by CertainTeed shall be as specified in Section 33 90 05 C900 Restrained-Joint PVC Pipe.

2.02 STEEL CASING

A. Steel Casings for bored or jacked construction shall be steel pipe conforming to ASTM A139 with a minimum diameter as shown on the Drawings.

1. Minimum wall thickness shall be in accordance with the following table:

Diameter of Casing (Inches)	Nominal Wall Thickness (Inches) Under Railroads	All Other Uses
16 or less	0.312	0.188
18	0.312	0.250
20-24	0.375	0.250
26-36	0.500	0.312

2. Steel shall be Grade B under railroads and Grade A on all other uses.

3. Steel pipe shall have welded joints in accordance with AWWA C206.

B. Casing Spacers: Spacers shall be used with all casing. Casing spacers shall have a minimum of four (4) runners or one (1) runner for every diameter inch, whichever is greater and shall hold the carrier pipe in the center of the casing. Casing spacers shall be high-density polyethylene and shall be RACI or Approved Equal.

C. Casing End Seals: Ends shall be sealed with synthetic rubber, wrap-around end seals with stainless steel bands, Cascade Waterworks Mfg. Model CCES or Advance Products & Systems, Inc. Model AW or Approved Equal. Alternative concrete end seal may be used if included in detail drawings.

2.03 PIPE ACCESSORIES

A. Couplings: Couplings shall be provided to transition between all existing-to-proposed connections and/or dissimilar gravity sanitary sewer pipe materials and sizes as required. Couplings shall be synthetic rubber repair couplings with stainless steel clamping ring bands, reinforced with a stainless steel or a PVC shear guard sleeve that will maintain pipe alignment and resist shear stresses through the connection. Coupling by Fernco Strong Back RC Couplings with Stainless Steel Shear Rings, Band-Seal Specialty Couplings by Mission, GPK Indiana seal Shear Guard or Approved Equal.

B. Pipe to Structure Connections: Connectors shall meet or exceed the requirements of ASTM C-923 and be matched to the outside diameter of the carrier pipe. The use of “Structure” includes manholes, valve vaults, wet wells or other sanitary sewer structures.

1. Flexible Entrance Seal: A flexible pipe to structure connector shall be used for *gravity* sanitary and drain pipe penetrations into precast concrete structures only. Flexible Entrance Seals shall be A-LOK Products Inc. A-LOK Connectors.

2. Rigid Entrance Seal: A rigid pipe to structure connector shall be used for field installations of all sanitary *pressure* pipe penetrations into concrete structures including mortared connections to precast or existing structures, field-poured concrete structures, and field-poured collars. *Unless otherwise stated in the Drawings, Rigid Entrance Seals may be substituted for ductile iron wall pipe.* A rigid pipe to structure connector shall also be used for field installations of sanitary *gravity* pipe penetrations into *existing structures only*. The Rigid Entrance Seal shall be synthetic rubber with stainless steel take-up clamps. Rigid Entrance Seals shall be Press-Seal Gasket Corporation WS Series Waterstop Grouting Rings or Approved Equal.

C. Connection Saddles: Saddles for the connection of sewer service lateral pipe to PVC pipe, PVC Fold and Form pipe or Cast In Place Pipe (CIPP) shall be rigid, stainless steel banded, saddle type fittings of PVC plastic with a neoprene or synthetic rubber gasket and hydrophilic rope fabricated specifically to the outer dimension of the sewer main pipe. All saddles shall be GPK Products, Multi-Fittings or approved equal. Short saddle shall be GPK Part #136-0084 and long saddles shall be GPK Part #136-L084. See Drawing Details for installation conditions.

D. Main Line Tapping Sleeve. Tapping sleeves for main lines under pressure shall be stainless steel. Therefore, the body, flange, bolts and nuts shall be made of 304 (18-8) stainless steel. The flange shall be recessed for tapping valve per MSS-SP60 and the flange outlet double welded inside and out. The sleeve will have a brass or stainless steel ¾" NPT test plug for pressure testing and a complete full circle rubber gasket to provide 360° pipe coverage permanently attached to the body. The sleeve shall be able to withstand 150 psi working pressure. All stainless steel tapping sleeves shall be Ford style FTSS, Mueller H-304, Romac style SST, Powerseal Model 3490 or approved equal.

E. Flange Adapters: Flange adapters shall be the cast iron slip-on type retained by set screws. Flange body shall be ductile iron, ASTM A-536, Grade 65-45-12. Set screws shall be manufactured from AISI 4140 steel, heat treated to Rockwell C 42-50 and zinc plated. Set screws shall have break away torque heads. Flange adaptors shall conform to ANSI B16.1 for machining and drilling. Gaskets shall be standard mechanical joint gaskets, EPDM or Buna-N. All non-plated ferrous metal parts shall be shop primed with an epoxy primer, for finish painting in the field. Flange adaptors shall be Ford Meter Box Corporation UNI-Flange Series or Approved Equal.

F. Mechanical Couplings: Mechanical Couplings shall be gasketed, sleeve-type, sized to properly fit the pipes to be joined, with steel or ductile iron middle ring, steel or ductile iron follower rings, and synthetic rubber gaskets. Gaskets shall be SBR, Buna-N, or EPDM. All ferrous metal surfaces shall be shop coated with an epoxy coating for corrosion resistance. All hardware shall be 300 series stainless steel. Mechanical couplings shall be Ford Meter Box Style FC1, FC2a, FC3, or FC23, Dresser Style 38 or 162 or Rockwell 441 or 411.

G. Standard Pressure Gauge: Standard Pressure Gauges shall be installed for all pressure indication locations that are not for process variable measurement or connected to a control system.

1. Dial Size: Nominal 2½ inch diameter
2. Accuracy: 2 percent of span
3. Scale Range: As indicated in the Drawings or such that normal operating pressure lies between 50 and 80 percent of scale.
4. Connection: ¼ inch NPT through bottom, unless otherwise indicated in the Drawings.
5. Manufacturers and Products:
   a. Ashcroft Utility Gauge Series 1005
   b. Marsh Standard Gauge Series
   c. Ametek U.S. Gauge Series P500

d. Acculite Series 2000

H. Pump and Equipment Flexible Connector: The Flexible Connectors shall be expansion/vibration joints of the single arch type of butyl rubber construction with carcass of high grade woven cotton or suitable synthetic fiber and individual solid steel ring reinforcement. Soft rubber fillers shall be integrally cured into the arches to provide a smooth flow path to prevent settling of material into the arch. Joints shall be constructed to pipeline size and to meet working pressures and corrosive conditions similar to the line where installed. Joints shall have full faced fabric reinforced butyl flanges integral with the body.

1. Split steel or ductile iron back-up rings shall be provided to ensure a good joint. Rings shall be designed for mating with ANSI Standard minimum 150 lb flanges. All joints shall be lined with Hypalon unless otherwise indicated.

2. All expansion/vibration joints shall be furnished with control (harness) units. Harness units shall consist of minimum two drilled plates, stretcher bolts and rubber washers backed by metal washers. The stretcher bolts shall prevent over-elongation of the joint. Extra nuts shall be provided on the stretcher bolts on the inside of the plate to prevent overcompression. All nuts, bolts and plates shall be galvanized.

3. The manufacturer of the expansion joints shall be a member of the Rubber Expansion Joint Division of the Fluid Sealing Association. Expansion joints shall be Garloc Style 204, Proco Style 231, Generel Rubber Corp. Style 1025 or Approved Equal.

I. Tracer Wire: Tracer Wire shall be #14 ga. Copper, THWN Insulation (white).

J. Tracer Wire Marker: Markers shall be 72” Trace-O-Flex Markers as manufactured by Carsonite Composites (or approved equal). Markers shall denote with appropriate lettering the proposed utility and have a spacing no greater than 1,000 feet.

K. Pipe Insulation: Where indicated on the plans, pipe shall be encased with Foamglas cellular glass thermal insulation, ASTM C 552, 2” thick, jacketed with Pittwrap-stainless steel jacketing (016 thickness), as manufactured by Pittsburg Corning Corporation or approved equal. Implementation of pipe insulation shall adhere to manufacture’s recommendations.

L. Buried Utility Warning and Identification Tape: Warning Tape shall be detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Tape shall be 6” wide and colored per industry standard with warning and identification imprinted in big black letters continuously and repeatedly over entire tape length. Warning and identification shall denote the proposed utility and read “CAUTION BURIED SEWER LINE BELOW” or similar wording. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

2.04 EMBEDMENT

A. Granular embedment material for gravity sewer shall consist of a durable crushed granular material with a well graded mineral aggregate mixture, which will provide good stability. This bedding shall not contain recycled or manufactured materials. The size range and weight of the aggregate shall conform to ASTM C-33 or ASTM D-448, gradation size #67.

Class 67 Gradation	
Nominal Size	Percent Passing by Weight
3/4	90-100
3/8	20-55
No. 4	0-10
No. 8	0-5

B. Concrete Encasement: Where indicated on the Drawings, concrete encasement shall be provided instead of the pipe embedment classes specified herein. Requirements for concrete encasement are detailed in the Drawings, Concrete and reinforcement shall be as specified in Section 03 30 00.

2.05 BACKFILL

A. Backfill materials shall be as specified in Section 31 20 00 Earth Moving.

2.06 MANHOLES

A. Manhole materials shall be as specified in Section 03 41 00 Precast Structural Concrete Structures

SECTION 3 - EXECUTION

3.01 EXAMINATION

A. Verify that existing conditions are as shown on the Drawings.

3.02 PREPARATION

A. The Contractor shall verify the location and depth of all utilities a minimum of 24 hours prior to construction. The Contractor may utilize the toll free number for the “Kansas One Call System, Inc.” at 1-800-344-7233. This number is applicable anywhere within the state of Kansas. Prior to commencement of work, the Contractor shall notify all those companies which have facilities in the vicinity of the construction.

3.03 PROTECTION

A. Locate, identify, and protect utilities that are not to be removed or replaced from damage. The Contractor shall make every reasonable effort to protect all existing utilities from damage. If any utility is damaged through the carelessness or neglectful actions of the Contractor, the utility shall be repaired by its owner at the Contractor's expense.

B. Relocation of an existing utility which is within the public right-of-way shall be performed by the respective utility owner at no cost to the Contractor. Relocation and protection of an existing utility which is within a utility easement shall be the responsibility of the Contractor.

C. Any private facilities damaged or disturbed by the Contractor's work shall be repaired by the Contractor prior to close of the working day. Repairs shall be made in a manner sufficient to restore utility service to that property.

D. Protect trees, plant growth, and features designated to remain as final landscaping.

E. Protect all property or lot corner pins and stakes from damage or displacement. All property pins removed or damaged are to be reset by a Registered Land Surveyor at the Contractor's expense.

F. Protect from damage or displacement all project benchmarks and existing structures within or adjacent to the construction limits that are not to be removed or demolished.

3.04 SEPARATION OF WATER AND SEWER UTILITIES

A. Gravity Sewer Lines laid Parallel to Water Lines: When potable water pipes and gravity sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet (3.0 m). The distance shall be measured from edge to edge. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the engineer will consult with KDHE to consider equivalent protection by other methods. Equivalent protection may require the sanitary sewer construction with one of the following additional protective features: concrete encasement, vacuum sewers, or jointless pipe such as fused HDPE or cured-in-place pipe liner.

B. Gravity Sewer Lines Crossing Water Lines: When a water pipe and a sanitary sewer cross and the sewer is 2 feet (0.6 m) or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the Engineer will consult with KDHE to consider equivalent protection by other methods. Equivalent protection may require the sanitary sewer to be constructed of one of the following materials (or approved equal) and pressure tested to assure water tightness pursuant to the most recent revision of KDHE's Minimum Standards of Design of Water Pollution Control Facilities:

1. Ductile iron pipe conforming to ASTM A 536 or ANSI/AWWA C151/A21.51 with minimum thickness class 50, and gasketed, push on, or mechanical joints in conformance with ANSI/AWWA C110/A21.10 or ANSI/AWWA C111/A21.11.

2. PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR41, ASTM F679, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.

3. Reinforced concrete pipe conforming to ASTM C76 with gasketed joints in conformance with ASTM C361 or ASTM C443.

   Joints in the sewer pipe shall be located as far as practical from the intersected water main. Joints in the Water pipe shall be located as far as practical from the intersected Sewer main.

   Where a water main is laid across or through an area where there is an existing sanitary sewer that is not constructed of one of the above specified materials and is 2 ft. (0.6 m) or less below the water pipe, the existing sewer shall be encased in concrete with a minimum thickness of 6 inches (15.2 cm) for a 10 ft. (3.0 m) distance on each side of the crossing or the crossed section of sewer replaced to meet the above specified construction requirements. The above requirements shall also apply where a water main must cross under an existing sanitary sewer. In cases where it is not practical to maintain a 2 foot (0.6 m) separation, the contractor shall notify the Engineer, and the Engineer will consult with KDHE to consider equivalent protection by other methods.

C. Pressure Sewer Lines: When sewer force mains run parallel to water lines, the separation distance shall be as far as practical, but at least a 10 foot (3.0 m) horizontal separation shall be maintained. There shall be at least a 2 foot (0.6m) vertical separation at crossings with water main crossing above the sewer force main. In cases where it is not practical to maintain the required vertical or horizontal separation distance between a water line and a sanitary sewer force main, the Engineer will consult with KDHE to consider equivalent protection by other methods.

D. Sewer Connections: There are to be no physical connections between any parts of the potable water system with building sewers, sanitary sewers, or wastewater treatment facilities by means of which it would be possible for sewage, even under exceptional circumstances, to reach the wells, storage reservoirs, or distribution systems.

E. Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole.

F. Storm Sewers: The separation distance between a storm sewer (which is not a combined storm/sanitary sewer) and a water main should be based on geotechnical considerations. Required separation distances between water mains and combined storm/sanitary sewers are equivalent to those for water mains and gravity sanitary sewers.

G. Drains: Underground drains from fire hydrants or valve pits should not be directly connected to sanitary or storm drains.

H. Other Pollution Sources: It is of the utmost importance that potable water lines be protected from any source of pollution. The following shall pertain to instances where septic tanks, absorption fields, waste stabilization ponds, feedlots, or other sources of pollution are encountered.

1. A minimum distance of 25 feet shall be maintained between all potable water lines and all septic tanks or waste stabilization ponds.

2. Under no circumstances shall a water line extend through a septic tank absorption field or feedlot. All water lines shall be located a minimum of 25 feet from the furthest known extent of any sewage contamination. Under no condition will it be considered that encasement of the water main through an area of real or potential pollution would provided the protection needed to the water supply.

3.05 EMBEDMENT

A. Trenching and backfilling shall be performed in accordance with Section 31 20 00 Earth Moving. Blasting will not be allowed unless approval by the Owner and Engineer is given.

B. Granular Bedding: Bottom of trench shall be overexcavated and the pipe shall be bedded with compacted granular material placed on a flat trench bottom and extending to an elevation 12 inches above the top of the pipe. The granular bedding shall have a minimum thickness of 4 inches under the barrel. Embedment over rock shall include an additional 2 inches below the pipe.

C. Place embedment material at the trench bottom with proper allowance for bell joints. Level materials in continuous layers not exceeding 4 inches in compacted depth. Shovel slicing of embedment shall be performed along the sides of the pipe as embedment is placed to consolidate the bedding and haunching below the pipe.

D. Consolidate granular embedment by rodding, spading and compacting as necessary to provide uniform pipe support.

E. Each lift of granular embedment material shall be compacted to a minimum 90% of maximum density as determined by ASTM D-698.

F. Where shown on the Drawings, concrete encasement shall be provided instead of pipe embedment.

3.06 PIPE INSTALLATION

A. All pipe shall be protected during transport, storage and installation from shock and free fall. Pipes shall be installed without cracking, chipping, breaking, bending or damaging the materials. Damaged pipe shall be replaced with new

materials except when repairs are permitted by the Engineer. Use slings, lifting lugs, hooks and other protection devices during handling. A double sling shall be required when handling plastic pipe 10 feet or longer.

B. Install pipe of the size, material, strength class, and joint type as specified or indicated on the Drawings. Clean the interior of all pipe fittings and joints prior to installation.

C. Install gravity pipelines beginning with the lowest point of the pipeline and install pipe with the spigot or tongue end down stream. Install pressure pipelines with the bell ends facing the direction of laying, except when reverse laying is specifically authorized by the Engineer.

D. Laying of Pipe: All pipe shall be laid true to the alignment and grade indicated on the Drawings as staked by the Contractor. Laser Beam equipment is preferred for construction with checks on grade by survey equipment. Each pipe section shall be carefully inspected before it is laid and any section not conforming in all respects to the specifications shall be rejected. Any defective pipe inadvertently laid, shall on discovery at any time, be immediately removed and replaced at the Contractor's expense.

Pipe laying shall proceed up grade beginning at the lower end of the sewer, the earth in the bottom of the trench shall be shaped to the required elevations so that the entire length of the pipe will rest firmly on the required pipeline bedding.

E. Pipe installation shall be in accordance with applicable standards, such as ASTM C-12, D-2321 and ANSI/AWWA C600, except where conflicts with this section occur, in which case this section shall govern.

F. Clean the interior of all pipe fittings and joints prior to installation. Protect pipe against the entrance of debris and foreign matter during discontinuance of installation and at the close of the working day by installing a close fitting plug at the open end. Plugs shall be water tight against heads up to 20 feet of water.

G. The Contractor shall take whatever means necessary to keep the trenches free of water and as dry as possible during pipe installation, bedding and jointing operations. No pipe shall be laid in water or under unsuitable trench conditions. Should unsuitable trench conditions be encountered, the Contractor shall halt work until the Engineer approves continuation of the work or alternate methods for continuation of the work.

H. Dewatering of Trench and Other Excavations: The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavation, trenches and all other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure is to be built, or the pipeline to be installed is completed to the extent that no damage from hydrostatic pressure, flotation or other causes will result. Sewer line in place shall not be used as drainage lines.

I. After each pipe has been brought to grade, aligned and placed in final position, place sufficient embedment material under the haunches and on each side of the

pipe to hold the pipe in proper position during subsequent pipe jointing, bedding and backfilling operations. Compact embedment material to 90 percent maximum density by rodding, spading, or using suitable compaction equipment. Place embedment material uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

J. Pipe cutting shall be performed in a neat and workmanlike manner without damage to the pipe. Main taps for service saddle tees shall be made with a tapping tool specifically designed for that purpose. Cut edges shall be smoothed by power grinding to remove burrs and shape edges.

K. Pipe connection to structures:

1. Gravity Pipe connection to new structures shall be as shown on the Drawings. Where not shown on the Drawings, pipes shall be connected to new structures using flexible entrance seals.

2. Pipe connection to existing structures shall be made with two inches clearance surrounding the pipe or fitting. PVC pipe shall be fitted with a grouting ring. The opening between the pipe and structure shall be filled with non-shrink grout to form a water tight seal.

3. Pipe connections to existing structures shall be made in such manner that the finish work will conform to the essential applicable requirements specified for new structures.

3.07 PIPE JOINTING

A. Locate joints to provide for differential movement at changes in type of embedment, concrete collars and encasement and structures. Sewer main jointing shall be according to the following specifications:

1. Clean and lubricate all joint and gasket surfaces as recommended by the manufacturer.

2. Examine all materials prior to installation for soundness and compliance with specifications.

3. Check joint position and condition after assembly prior to installing additional pipe sections.

4. Check joint opening and deflection for specification limits.

B. Threaded: Pipe threads shall conform to ANSI/ASME B1.20.1, NPT, and shall be full and cleanly cut with sharp dies. Not more than three threads at each pipe connection shall remain exposed after installation. Ends of pipe shall be reamed, after threading and before assembly, to remove all burrs.

1. Threaded joints, in plastic piping, shall be made up with Teflon thread tape applied to all male threads. At the option of the Contractor, threaded

joints in other piping may be made up with Teflon thread tape, thread sealer or a suitable joint compound.

C. Solvent Welded: All joint preparation, cutting, and jointing operations shall comply with the pipe manufacturer's recommendations and ASTM D-2855. Pipe ends shall be beveled or chamfered to the dimensions recommended by the manufacturer. Pressure testing, of solvent welded piping systems, shall not be performed until the applicable curing time, set forth in Table X2.1 of ASTM D-2855, has elapsed.

D. Flanged: Flange bolts shall be tightened sufficiently to slightly compress the gasket and effect a seal, but not so tight as to fracture to distort the flanges. Anti-seize thread lubricant shall be applied to the threaded portion of all stainless steel bolts during assembly. Connecting flanges shall have similar facings, i.e., flat or raised face.

E. Push-on: Gasket installation and other jointing operations shall be in accordance with the recommendations of the manufacturer. Each spigot end shall be suitably beveled to facilitate assembly. All joint surfaces shall be lubricated with a heavy vegetable soap solution immediately before the joint is completed. The interior surface of the bell and the exterior surface of the spigot shall be free of dust, dirt, gravel and other foreign material, both before and after the application of the lubricant sealer. The joint shall be connected by first brushing upon the matting surface the proper lubricant sealer as recommended by the pipe manufacturer, the spigot end shall then be centered on grade into the bell end of the last downstream pipe length and shoved home and properly seated.

3.08 DUCTILE IRON PIPING

A. Handling: Pipe and fittings shall be handled and installed carefully to prevent damage to pipe material, lining and coatings. Hooks placed in ends of pipe or fittings shall have well-padded surfaces. All coatings which are damaged shall be repaired by the Contractor prior to installation, to the satisfaction of the Engineer.

B. Cutting: Pipe shall be shop fabricated to the approximate lengths required. Pipe shall not be cut in the field, except where flange adapters or mechanical couplings are indicated o the Drawings or where allowed by the Engineer. Pipe may be cut with a portable saw, abrasive wheel or oxyacetylene torch. The use of hydraulic squeeze type cutters will not be permitted. Cuts shall be smooth, straight and at right angles to the pipe axis. Cut edges shall be dressed with a file or power grinder to remove all roughness and sharp edges.

C. Flanged Joints: Flange faces shall be machine faced with pipe end, flat and perpendicular to the pipe axis. When bolting flanged joints, care shall be taken to avoid restraint on the opposite end of the pipe or fitting, which would cause unnecessary stress in the flanges. Bolts shall be tightened gradually and uniformly, to ensure uniform compression of the gasket.

D. Mechanical Joints: Mechanical joints shall be assembled according to the manufacturer's recommendations. If the joint does not form an effective seal, the joint shall be completely disassembled, thoroughly cleaned, and reassembled.

Bolts shall be uniformly tightened to the torque values listed in Appendix A of ANSI/AWWA C111/A21.11.

E. When noted in the Drawings, buried ductile iron pipe shall be provided with polyethylene tube protection installed in accordance with AWWA C105, Method A.

3.09 PIPE ACCESSORIES

A. Mechanical couplings: Mechanical couplings shall be carefully installed in accordance with the manufacturer's recommendations. Pipe ends shall be separated by a space of at least ¼ inch but not more than 1 inch. Pipe and coupling surfaces which contact gaskets shall be clean and free from dirt during assembly. Following installation of the coupling, damaged areas of shop coatings on the pipe and couplings shall be repaired.

B. Wall Pipes: Where wall pipes with flanged or mechanical joint ends are installed, the bolt holes in the bell of the wall pipe shall straddle the top centerline of the casting. The top centerline shall be marked on the wall pipe at the foundry.

3.10 STEEL CASINGS FOR BORED OR JACKED CROSSINGS

A. When casing required in open trench for protection or other such use, the Installation shall be performed by a person experienced in such work. Casing shall be installed by lowering into the trench as required to assure the integrity of the casing. Alignment and gradient shall be such that the carrier conduit can be installed to the line and grade shown on the Drawings.

B. A pressure tight continuous circumferential weld shall join steel casing pipe sections. Conformance with welding procedures and work shall be in conformance with AWWA C206 and AWS Standards. All welding shall be done by electric arc welding. The assembly and welding procedures shall not produce objectionable distortions. No fitting up holes shall be used. Assembly devices may be welded to parts to facilitate erection, but must be carefully removed after erection so as not to deface the metal surfaces.

C. After completion of the installation of the casing, the carrier conduit shall be carefully pushed or pulled through the casing in a manner that will maintain proper jointing of the pipe joints and provide the required gradient and alignment. Casing spacers shall be provided.

D. Casing Spacers: Casing spacers shall be provided for all casing pipe. Casing spacers shall be installed as per manufactures instructions and at no time shall exceed spacing as stated in manufacturer's information. The ends of the casing shall be blocked with rubber end-seal or with concrete, as detailed on the project drawings.

3.11 JOINT RESTRAINT FOR PRESSURE PIPING

A. Joint restraint shall be provided for pressure piping. Joint restraint may be provided by concrete thrust blocking as detailed in the Drawings or by

mechanically restrained joints as provided in Section 2.01.C.1.b of this Specification.

3.12 LOW PERMEABILITY TRENCH PLUGS FOR PRESSURE PIPING

A. Low permeability Trench Plugs shall be installed at 400’ intervals along the force main trench to prevent leak migration. The plugs shall be Select Material compacted to Mechanical Tamping standards according to Section 31 20 00 Earth Moving. The plugs shall be 5’ in length centered on the 400’ intervals.

3.13 ASSOCIATED SEWER LINE WORK

A. Tees: All tees shall be installed in the locations shown on the Drawings or directed by the Engineer.

1. For new subdivisions where the lateral connections will be made later, all tees shall be closed by means of suitable stoppers held in place by some means of a watertight material. After tees are laid and before the trench is backfilled, a strip of wood long enough to extend from the top of the ground surface shall be inserted in the trench, secured in an upright position, and nailed to a stake driven into the side of the trench towards which the tee points. Care shall be taken to avoid disturbance of the markers during backfill operations. The Contractor, independent of the Engineer shall complete and submit to Engineer a written or tv inspection record of all tee connections measured to the nearest six (6) inches upstream from the manhole.

B. Tee Branch Risers: In locations as shown on the Drawings or as determined by the Engineer, risers shall be installed. Such risers shall be installed in the trench as vertical risers, in accordance with the drawings. The branch connection shall be set at 45º to the horizontal and a 45º bend shall be placed on the branch. The branch and bend shall be encased in concrete. The riser pipe shall be set into the 45º bend and extended up the trench wall to the appropriate depth. The wall of the ditch shall be recessed to contain at least one-half of the vertical riser pipe. The risers shall be installed in such a manner that: (1) they have solid bearing on undisturbed earth, (2) earth free of large particles shall be compacted around the risers to insure solid support. The top of the riser shall extend to within approximately eight (8) feet of the surface of the ground. Sealing, marking and recording of riser pipe shall be in accordance with that for Tees.

C. Laterals: Sewer laterals shall have a minimum slope of 2%. Laterals shall be connected to existing laterals to the extent shown on the plans. In locations where there are no existing laterals and a new lateral is required, the end of these laterals shall be plugged and a 2 X 4 board shall be installed from the lateral end to three (3) feet above the finished ground. Also, a metal T-Post shall be placed alongside the 2 x 4 and placed 2 inches below the ground. The top of the board shall be painted red.

D. Drop for Manhole: Shall be constructed according to the details and dimensions shown on the drawings. The exterior piping for the drop shall be encased in concrete from the bottom of the manhole base to 6” above the top of the

uppermost pipe. The concrete encasement shall extend horizontally around the drop pipe to a thickness equal to the diameter of the pipe in all directions. Drop manholes shall be built where a line enters a manhole at a greater than two (2) feet above invert of the manhole.

E. Cleanouts: When indicated on the Drawings, cleanouts shall be constructed at the terminating end of certain sewer lines with the cleanout 150' from the manhole or less. Cleanouts shall be constructed in compliance with the dimensions shown on the drawings. The entire cleanout shall rest on firm soil either natural undisturbed material or thoroughly compacted material. In no case shall any part of the cleanout rest on uncompacted fill material.

F. Sheeting and Bracing or Trench Boxes shall be provided in all trenches where required to insure maximum safety of workman. Sheeting may be wood or metal. Sheeting shall be driven to a depth of at least two feet below the pipe. Following installation of the pipe and backfill to at least two feet over the pipe, shoring shall be removed as backfilling procedures progress, but only when banks are stable and safe from caving or collapse. With Engineers approval, wooden sheeting shall be cut off at least two feet below ground level and the remainder left in place.

G. Sewer Line Cover: When the cover over the top of the sewer pipe is less than two and one-half (2½) feet, the sewer pipe shall be encased with concrete or Ductile iron pipe used. The concrete encasement shall be a minimum thickness of six (6) inches from the outside diameter of the pipe.

H. Standard Street Crossing: Whenever an improved driveway or street is crossed the surface shall be replaced after the trench has been backfilled and compacted. In lieu of backfill and compaction, flowable fill may be used as specified in the Drawings. A minimum of eight (8) inches of pavement shall be removed on either side of the trench. The outside pavement cut shall be a true line completed with a power saw. See Drawings for specific instructions at each standard street crossing. If the street or driveway crossing is existing gravel, a minimum thickness of 4” of AB-3 surfacing shall be placed.

I. Infiltration: If, at any time prior to expiration of the guarantee period, infiltration exceeds 250 gallons per inch of nominal diameter per mile of sewer per day, the Contractor shall locate the leaks and make repairs as necessary to control the infiltration.

J. Service Connections for Gravity Sewer Main Replacement: After the replacement pipe has been completely installed and tested, all existing active services as indicated on the Contract Drawings or identified by the Contractor shall be reconnected to the replacement pipe. All pipe that may have service connections shall use in line tees or wyes as shown in the Drawings and specified.

K. Tracer Wire:

1. All underground pipe (Gravity and Pressure) shall be marked by the use of a continuous trench indicator wire. The wire shall run in all locations

and secured at terminating with properly sized wire nuts secured with electrical tape suitable for direct bury.

2. The tracer wire shall be installed directly above and attached to the pipe at a minimum of 3 times per 20' length with 1½" polyethylene tape wrapped twice around the pipe.

3. If pipeline is to be bored under pavement or other areas, the beginning and end of the bored sections shall be marked and the wire installed.

4. Magnetic Warning tape shall be installed at the manufacturers recommended depth but not greater than 24" and shall be detectible at that depth.

5. Maximum distance between terminating points for tracer wire shall be 1,000'.

L. Tracer Wire Markers: Tracer Wire Markers shall be installed at locations indicated in the drawings. Markers shall be installed to a depth of 24". Markers shall be connected with properly sized wire nuts secured with electrical tape suitable for direct bury.

3.14 GRAVITY SEWER ACCEPTANCE TESTING

A. All new sewer segments which extend from manhole to manhole will be subject to acceptance testing under this subpart. Partial sewer main segment replacements and point repairs will not be tested under this subpart.

B. Visual Inspection

1. Clean pipe of excess mortar, joint sealant, dirt and debris prior to inspection.

2. Correct any misalignment, displaces or broken pipe; any visible infiltration or other defects as necessary prior to conducting leakage tests.

C. Air Leakage Test

1. Contractor shall perform air leakage tests for all pipe sizes.

2. Notification: Contractor shall notify Engineer at least 48 hours in advance the scheduled time for testing. Resident Project Representative and/or Engineer shall be present for acceptance testing and approval.

3. Contractor shall furnish all facilities required for performance of the air leakage test, including but not limited to piping connections, pipe plugs with taps, test pumping equipments, pressure gauges, bulkheads and regulators to avoid over pressurization. The equipment and gauges shall meet the minimum specifications set forth in ASTM F-1417 Standard Test Method for Installation Acceptance of Plastic Sewer Lines Using Low-Pressure Air. The air equipment shall consist of necessary valves and

pressure gauges to control an oil-free air source and the rate at which air flows into the test section to enable monitoring of the air pressure within the test section.

4. Gauge certification from the manufacturer and calibration data shall be required for all pressure test gauges, a copy of which will be made available to the Engineer at the time the air tests are performed.

5. Test each reach of pipe between manholes after completion of pipe and appurtenance installation and trench backfill.

6. Plug ends of sewer line at manholes and cap or plug all lateral connections to withstand internal pressure. One plug shall have two taps for connection equipment. After connecting air control equipment to the air hose, begin increasing the air supply within the pipe section, monitoring the air pressure so that the internal pressure does not exceed 6.0 psig.

7. After the internal pressure reaches 4.0 psig, throttle the air supply to maintain between 4.0 and 3.5 psig for at least two minutes in order to reach equilibrium between air temperature and pipe walls. During this time, check all plugs for leaks. If leaks are found, bleed off air, tighten plugs and begin increasing the air supply again.

8. Air testing shall take place by the Time-Pressure Drop Method. Decrease the pressure to 3.5 psig and begin timing to determine the time required to achieve a pressure drop from 3.5 to 2.5 psig. If the time, in seconds, to achieve the 1.0 psig pressure drop is greater than that shown in the following table, the line is presumed free of defects. For pipe sizes and lengths other than those shown in the table below, refer to ASTM F1417.

Pipe Dia. in.	Specification Time for Length Shown, min:s							
	Up to 100 ft.	150 ft.	200 ft.	250 ft.	300 ft.	350 ft.	400 ft.	450 ft.
4	3:46	3:46	3:46	3:46	3:46	3:46	3:42	3:46
6	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41

9. If the air test fails to meet the requirements, repair the defects and retest the line. All constructed sewer lines shall pass the low pressure air test prior to acceptance.

10. In areas where ground water is known to exist, install a one-half inch diameter capped pipe nipple, approximately 10" long, through manhole wall on top of one of the sewer lines entering the manhole. This shall be done at the time the sewer line is installed. Immediately prior to the performance of the line acceptance test, ground water level shall be

determined by removing pipe cap, blowing air through pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to pipe nipple. The hose shall be held vertically and a measurement of height in feet of water shall be taken after the water stops rising in the plastic tube. The height in feet shall be divided by 2.3 to establish the pounds of pressure that will be added to all readings.

D. Deflection Test for Flexible and Semi-RigidSewer Pipe:

1. Prior to final acceptance, the Contractor shall perform a diametrical deflection test on all flexible and semi-rigid pipe (such as PVC, HDPE plastic pipe, and truss pipe), for both open cut and trenchless construction. Tests shall be conducted between manholes for structures. Deflection testing of a segment of sewer shall occur at least thirty (30) days after the pipe has been installed and completely backfilled.

2. A mandrel with a diameter equal to 95 percent of the inside diameter of the pipe to be tested shall be used. The mandrel shall be cylindrical in shape and constructed with nine evenly spaced arms or prongs. Mandrels with fewer arms will be rejected as not sufficiently accurate. The mandrel shall be approved by the Engineer prior to testing pipe of each given size. The Contractor shall furnish proving rings for verifying the mandrel diameter. Contact length between points of contact on the mandrel arm shall be as follows:

Nominal Pipe Diameter inches	Mandrel Length inches
8	8
10	10
12	10
15	12
18	15

3. The maximum allowable deflection shall be five (5) percent of the inside pipe diameter. Allowances for pipe wall thickness tolerances or ovality (from heat, shipping, poor production, etc.) shall not be deducted from the maximum allowable dimension of the mandrel, but shall be counted as part of the five (5) percent or lesser deflection allowance.

4. The mandrel shall be hand-pulled by the Contractor through all flexible sewer lines. Any section of sewer failing the diametrical deflection test shall be repaired or replaced by the Contractor at no cost to the Owner, and retested.

3.15 CLOSED CIRCUIT TELEVISION INSPECTION

A. TV Inspection shall be performed on all Cured in Place Pipe (CIPP) improvements and other sanitary sewer improvements as specified in the Drawings. TV Inspection shall be according to Section 33 01 30.16 TV Inspection of Sewer Pipelines.

3.16 PRESSURE PIPING ACCEPTANCE TESTING

A. All new sewer forcemains and pressure process piping will be subject to hydrostatic pressure testing under this subpart. Forcemains and pressure sewers shall be tested from the point of discharge to the isolation valves in the corresponding lift station(s). New segments of pipelines which will be connected to existing lines shall be pressure tested prior to connection.

B. Notification: Contractor shall notify Engineer at least 48 hours in advance of the scheduled time for testing. Resident Project Representative and/or Engineer shall be present for acceptance testing and approval.

C. Test Conditions:

1. Test procedure shall be according to AWWA C 600 Section 4.1

2. Unless otherwise specified, a test pressure of not less than 1.5 times the normal operating pressure (for the lowest point on the pipe line) but not less than 150 pounds per square inch (psi) or not more than the rated working pressure for the pipe shall be used for testing.

3. The hydrostatic test shall be conducted for a minimum 2-hour duration. Test pressure shall not vary by more than ±5 psi for the duration of the test.

D. Test Materials: The Contractor shall furnish all pumps, piping, labor, plugs, hose, riser pipe, gauges and other materials and services necessary to bring the piping up to the specified test pressure. The contractor shall obtain permission from the Owner for use of City water supply from an existing fire hydrant.

E. Pressurization: Buried pipe in the section to be tested shall be backfilled or center loaded with thrust blocks installed. Interior pipe supports and restraint systems shall be completely installed prior to testing. The section of pipe shall be isolated and slowly filled with water. Before applying the specified test pressure, air shall be expelled completely from the section of piping to be tested. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place as directed by the Engineer. The specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe. Valves shall no be operated in either the opening or closing direction at differential pressures above the rate pressure. The system will be allowed to stabilize at the test pressure before the leakage test is conducted.

F. Examination: All exposed pipe, fittings, valves, hydrants and joints shall be inspected for moisture during the test. All evidence of moisture appearing on the surface of the ground during the test shall be investigated by the Contractor by

excavation where the pipe has been covered with backfill. Evidence of moisture indicates defective materials or installation and shall be repaired or replaced by the Contractor. The test shall be repeated until satisfactory results are obtained.

G. Allowable Leakage – Ductile Iron: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Allowable leakage shall be according to the following equation, per AWWA C 600.

$$Q=SD(P)^{½}/133200,$$

Where
- Q - Total allowable leakage in one hour, gallons.
- S - Length of section tested, feet.
- D - Nominal pipe diameter, inches.
- P - Test pressure, psi

H. Allowable Leakage – PVC: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Allowable leakage shall be according to the following equation, per AWWA C 605.

$$Q=LD(P)^{½}/148000,$$

Where
- Q - Total allowable leakage in one hour, gallons.
- L - Length of section tested, feet.
- D - Nominal pipe diameter, inches.
- P - Test pressure, psi

I. Acceptance of Installation: Acceptance shall be determined on the basis of allowable leakage. If any test of pipe section discloses leakage greater than that specified above, repairs or replacements shall be accomplished in accordance with the specifications. All visible leaks shall be repaired regardless of the amount of leakage. The pressure test shall be repeated after repairing leaks and other defective work until the pipeline installation conforms to specified requirements and is accepted by the Engineer.

3.17 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 – Quality Requirements.

B. Compaction and soil testing will be performed in accordance with Section 31 20 00 – Earth Moving

3.18 BASIS OF PAYMENT

A. General: The amount of completed and accepted work shall be paid for at the contract unit prices bid for the various units of work described in the proposal, which prices shall be full compensation for all labor, materials, equipment, tools and incidentals necessary for the proper and workmanlike completion of the work.

B. Pipelines: Only pipe specified in the Drawings shall be used. Pipelines shall be paid by the Lin. Ft. installed as per the Drawings.

C. Trenching and Backfilling: Trenching and backfilling shall be subsidiary to pipeline installation.

D. Pipe Bedding: Pipe bedding shall be subsidiary to pipelines.

E. Dewatering: Dewatering shall be subsidiary to other bid items.

F. Sanitary Sewer Pipe and Manhole Testing: Sanitary sewer pipe and manhole testing shall be subsidiary to pipelines.

G. Saddles and Tees - Each

H. Cleanouts - Each

I. Sewer Laterals - Sewer laterals shall be paid by the Lin. Ft. installed as per the Drawings.

J. Tracer Wire: Tracer wire shall be subsidiary to the pipeline.

K. Tracer Wire Markers: Markers shall be paid as Each. Which includes all labor, equipment, and materials required for installing the specified marker.

L. Pipe Insulation: Pipe Insulation shall be subsidiary to the pipeline.

M. Detectable Warning Tape: Detectable warning tape shall be subsidiary to pipelines.

END OF SECTION