SECTION 33 10 00 - WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for furnishing and installing water lines, laterals, stubs, and appurtenances for both potable and non-potable water distribution systems. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling, and Compaction

B. Section 31 41 33 Trench Safety

C. Section 32 84 00 Planting Irrigation

1.3 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of these specifications to the extent indicated by reference thereto:

1. American Water Works Association (AWWA)

    a. C 500 AWWA Standard for Metal-Seated Gate Valves for Water Supply Service.

    b. C 900 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4" through 12", for Water Transmission and Distribution.

    c. C 151 AWWA Standard for Ductile Iron Pipe, Centrifugally Cast, for Water

    d. C 110 AWWA Standard for Ductile-Iron and Gray-Iron Fittings.

    e. C 105 AWWA Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

    f. C 104 AWWA Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

    g. C 701-70 AWWA Standard for Cold-Water Meters-Turbine Type, for Customer Service

    h. C 703-70 AWWA Standard for Cold Water Meters Fire Service Type

2. American Society for Testing and Materials Standards (ASTM).

    a. F 645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water-Pressure Piping Systems

3. National Fire Protection Association (NFPA)

a. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances

b. NFPA 70 – national electric code

4. National Sanitation Foundation International (NSF)

a. NSF 14 Plastics Piping System Components and Related Materials

b. NSF 61 Drinking Water System Components - Health Effects

1.4 PROJECT/SITE CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Follow the University of Houston's Plant Operations Planned and Emergency Utility Outage Policy.

B. Do not proceed with interruption of water-distribution service without prior approval and coordination with local municipal water supplier.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

1.6 DEFINITIONS

A. LLDPE: Linear, low-density polyethylene plastic.

B. PE: Polyethylene plastic.

C. PP: Polypropylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements for potable water systems:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Regulatory Requirements for Non-potable water systems

1. The system shall be comprised of purple components. Use purple colored pipe, Pantone 522 embossed or integrally stamped/marked in English and in Spanish “CAUTION RECLAIMED WATER DO NOT DRINK” and “AGUA DE RECUPERACIÓN - NO BEBER”.

2. A minimum of an eight inch by eight inch sign, in English and Spanish, is prominently posted on/in the area that reads “Reclaimed Water – Do not drink” and "AGUA DE RECUPERACIÓN - NO BEBER" on the storage tank of such non-potable system if within the construction site.

C. Piping materials shall bear label, stamp, or other markings of specified testing agency.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

2. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

PART 2 - PRODUCTS

2.1 PIPE

A. For water line construction 9 feet or more from any existing or proposed sanitary sewer, all materials and equipment shall be:

1. New, or best grade and standard manufacture.

2. PVC pipe and joints shall conform to AWWA C-900, latest edition, schedule 40 for 150 PSI rated systems and schedule 80 for 200 PSI rated systems.

3. Ductile iron pipe shall conform to AWWA C 151, pipe class per Table 51.1, latest edition, standard outside coating with cement mortar lining to AWWA C 104 standards. All ductile iron pipe and fittings shall be wrapped with polyethylene per AWWA C 105.

4. Fittings shall conform to AWWA C 110, latest edition, Pressure Rated 150 psi, 250 psi, 350 psi as directed by the engineer wrapped with polyethylene per AWWA C 105.

B. For construction within 9 feet of any existing or proposed sanitary sewer and all water services, all materials and equipment shall be:

1. New, or best grade and standard manufacture.

2. Ductile iron pipe shall conform to AWWA C 151, latest edition, standard outside coating with cement mortar lining to AWWA C104 standards. Wrap pipe with 8 mil polyethylene.

3. PVC pipe and joints shall conform to AWWA C-900 - 200 psi pressure pipe.

4. Fittings shall conform to AWWA C 110, latest edition, Pressure Rated 250 PSI, wrapped with polyethylene per AWWA C 105.

C. For offsets of water mains 6" and larger required to miss conflicts with other lines or objects, steel pipe shall be used meeting the requirements of AWWA 200, Schedule 40.

2.2 VALVES

A. Line Valves:

1. Valves shall have a minimum working pressure of not less than 175 PSI.

2. The operating nut shall be 2-inch square and shall have an arrow, cast in the metal, indicating the counter-clockwise direction of opening.

3. Gate valves shall conform to AWWA C 500, latest edition, standard NRS bronze double disk type.

4. Valves shall have push-on or mechanical joint hubs.

B. Tapping Valves:

1. Tapping valves shall conform to AWWA Standard C 500, latest edition, standard NRS bronze double disc type water works valve.

2. The operating nut shall be 2-inch square and shall have an arrow, cast in the metal, indicating the counter-clockwise direction of opening.

3. Inlet shall be a Class 125 flange with a machined projection.

4. Outlet shall be a standard push-on or mechanical joint.

5. Valves shall have a minimum working pressure of not less than 175 psi.

C. Valves for Meter Installation:

1. Commercial meter valves shall meet the specifications for line valves except that they shall have a handwheel, Class 125 flanges and shall open counter-clockwise.

2. Fire flow meter valves shall be OS&Y double disc valves (line valves only), Fire Marshall approved, clockwise to close with Class 125 flanges.

2.3 VALVE BOXES

A. Valve boxes shall be installed over each line and tapping valve except as otherwise noted.

B. Lids shall be cast with the word "Water".

C. Valve boxes shall be extension type with screw or locking slide adjustment with flapped base.

2.4 FIRE HYDRANTS

A. Fire hydrants shall be as manufactured by Mueller Company, or approved equal, AWWA type, No. A 24015, 3 way 5 1/4 inch valve opening, bury as shown to a depth shown, 6 inch MJ shoe, open left, 1 1/2 inch top operating nut, 2 1/2 inch hose coupling, 4 1/2 inch pumper connection with national standard threads.

2.5 METERS

A. Meters for closed loop chilled water, hot water, condenser solutions for HVAC; process water and water mixtures; and domestic water applications shall be Onicon F-1200 Series Turbine Flow with BACnet option installed (Basis of Design) or approved equal.

B. For general purpose detector situations involving water and wastewater, reclaimed water, bi-directional flow applications, chemical, pharmaceutical, and food and beverage applications, meter shall be Badger Mag Meter M2000 (Basis of Design) or approved equal.

2.6 WATER

A. All water used for testing and sterilizing must be supplied by municipal supplies approved by the state's Department of Health.

PART 3 - EXECUTION

3.1 LOWERING/RELOCATING EXISTING WATER LINES

A. Water lines to be lowered/relocated shall not be shut down without prior approval of the local governing agency.

B. Contractor shall install necessary valves so as not to disrupt service outside limits of water lines to be lowered/relocated whether or not indicated on the plans.

C. Whether or not indicated on the plans, the lowered/relocated water line shall have minimum of four (4) feet of cover. Location shall be a minimum distance from existing location as necessary to facilitate construction.

D. If the lowered/relocated water lines are of potable water systems, they shall be required to meet same hydrostatic and sterilization test results as new water lines.

E. Installation of lowered/relocated water lines shall meet the same requirements of new water lines as in paragraph 3.2 below.

3.2 INSTALLATION

A. The interior of the pipe shall be thoroughly cleaned of all foreign matter before lowered into the trench, and shall be kept clean during these operations.

B. Pipes for potable water lines shall not be laid in water, or when trench or weather conditions are unsuitable for work.

C. For potable water line installation, when work is not in progress, open ends of pipes and fittings shall be securely closed so that water, earth, or other substances will not enter the pipes or fittings.

D. All bends, tees, valves, and plugs shall have thrust blocks installed in accordance with the details on the plans. Thrust blocking will be installed such that joints will be accessible for inspection and repair. Concrete used in thrust blocking shall have a compressive strength of at least 3,000 psi.

E. For potable water line installation, when a water line is to be installed such that it will cross over an existing or proposed sanitary sewer, a section of pipe at least 18' long of either ductile iron or PVC pipe C-900 (200 PSI) shall be installed such that it will be centered over the sanitary sewer. Water lines shall in no case be installed below a sanitary sewer.

F. For potable water line installation, when a water line is being installed parallel to a sanitary sewer, a horizontal distance of separation of nine (9) feet (outside to outside) must be maintained.

G. A minimum clearance of 6" must be maintained between water lines and all other utility lines.

H. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.3 TESTING

A. All water lines to be installed shall be hydrostatic tested and all potable water lines shall also be sterilized.

B. Hydrostatic Test

1. General

a. After the pipe has been laid and initial backfill completed, the water line shall be subjected to a hydrostatic pressure of 150 psi. Joints shall remain exposed during testing whenever possible.

b. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test. The meters used in the testing shall be tested, sealed and approved at the Contractor's expense prior to running any test.

2. Procedures

a. Before applying the specified pressure test, all air shall be expelled from the pipe by slowly filling each valved section of pipe with water and providing taps if necessary to expel trapped air.

b. All pipe, fittings, and joints will be examined during testing.

c. Any defective material shall be replaced with sound material and the test repeated until satisfactorily completed and approved.

d. Allowable leakage shall not exceed 25 gallons per inch of diameter per mile of pipe per 24 hours. Minimum duration of testing for each section shall be 2 hours when joints are exposed and 8 hours when joints are covered.

e. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered, shall be replaced, regardless of total leakage shown.

f. Where practicable, pipe lines shall be tested in lengths between valves or plugs of no more than 1500 feet. Contractor must have written approval for test sections greater than 1500 feet.

C. Sterilization

1. General

a. After approved completion of the hydrostatic tests, the water distribution system shall be sterilized before acceptance for domestic operation.

2. Procedures

a. Distribution system shall be disinfected using chlorine or chlorine compounds added to the water resulting in 50 ppm (parts per million) chlorine.

b. After the water containing this amount of chlorine has been in contact with the pipe and appurtenances at least 24 hours, the water shall be replaced with water to be transported normally, and samples of water taken and tested to assure that the disinfection procedure was effective.

c. No main shall be placed in service or accepted until water samples are approved by applicable regulatory agency.

d. Prepare reports of purging and disinfecting activities.

END OF SECTION

SECTION 33 30 00 - SANITARY SEWER

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for furnishing and placing sanitary sewer pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling and Compaction

B. Section 31 41 33 Trench Safety

1.3 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

A. American Society for Testing and Materials Standards (ASTM).

1. C-478 Specification for Precast Reinforced Manhole Sections.

2. D-3034 Specification for Polyvinyl Chloride (PVC) Pipe.

3. C-76 - Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

4. A-48 - Specification for Gray Iron Castings.

5. C-476 - Specification for Grout for Masonry.

6. A-615 - Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

7. C-443 - Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.

8. D-3212 - Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

9. F-679 Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.

10. F477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

11. A746 Standard Specification for Ductile Iron Gravity Sewer Pipe

12. C150 Standard Specification for Portland Cement

13. C33 Standard Specification for Concrete Aggregates

14. C890 Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures

15. C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals

16. F1417 Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

17. C924 Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

18. C969 Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

B. Texas Department of Transportation 2004 Standard Specifications for Construction of Highways, Street and Bridges (TxDOT).

1. Item 465 Manholes and Inlets

C. American Water Works Association (AWWA)

1. C110 AWWA Standard for Ductile-Iron and Gray-Iron Fittings

2. C111 AWWA Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

3. C105 Polyethylene Encasement for Ductile Iron Pipe Systems

4. C600 Installation of Ductile Iron Water Mains and Their Appurtenances

D. American Concrete Institute (ACI)

1. ACI 318 Building Code Requirements for Structural Concrete

1.4 SUBMITTALS

A. Product Data: For the following:

1. Corrosion proof liner selected for protecting concrete pipe from sewer gases. Contractor shall submit data on the selected liner for approval prior to construction.

2. Any Special pipe fittings as detailed in the drawings.

3. Shop Drawings: For the following:

a. Cast in Place Manholes: Include plans, elevations, sections, details, design calculations, and concrete design-mix report, and frames and covers

4. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

5. Field quality-control test reports.

1.5 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. LLDPE: Linear low-density, polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.6 PROJECT CONDITIONS

A. When working with sanitary manholes new or existing, contractor must keep requirements for confined space entries. In all activities, contractor shall work in a safe manner as required by OSHA and other governing criteria.

B. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Follow the University of Houston's Plant Operations Planned and Emergency Utility Outage Policy.

2. If work requires interference with any public sewer systems within or outside of Public Rights of Way or Easements, contractor must obtain prior approval and coordinate with local municipality before commencing work.

1.7 DELIVERY STORAGE AND HANDLING

A. Contractor is responsible for protecting materials per manufactures recommendations

1. Do not store plastic manholes, pipe, and fittings in direct sunlight.

2. Protect pipe, pipe fittings, and seals from dirt and damage.

3. Handle cast in place manholes according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PIPE

A. PVC pipe, 6" to 10" shall conform to ASTM D3034, SDR 26. PVC pipe 12" and 15" shall conform to ASTM D3034, SDR 35. PVC pipe 18" to 27" shall conform to ASTM F679, SDR 35. All diameters shall use bell and spigot ends for gasketed joints with ASTM F 477 elastomeric

seals. For sewers up to 12” diameter crossing over or under waterlines, provide minimum 150 psi pressure rated pipe conforming to ASTM D2241 with suitable PVC couplings.

B. Ductile iron pipe shall conform to ASTM A746 and cast iron fittings shall conform to AWWA C110. Gaskets shall conform to AWWA C111, rubber. Wrap pipe with polyethylene per AWWA C 105.

C. Reinforced concrete pipe where approved for sanitary sewers shall conform to ASTM C-76 Class as required for laying condition and shall be lined with a corrosion proof liner satisfactory for protecting concrete from sewer gases. Contractor shall submit data on the selected liner for approval prior to construction

2.2 JOINTS

A. PVC pipe joints shall conform to ASTM D3212.

B. Ductile iron pipe joints shall be push-on type unless otherwise indicated on the plans.

C. Reinforced concrete pipe joints shall be "Ram-Nek" flexible plastic gaskets or approved equal per ASTM C 443.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, and the following:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water

a. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

b. Water sources other than the local municipal domestic water supply must be approved by the Owner.

c. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

C. Reinforcement Bars: ASTM A 615, Grade 60 deformed steel.

D. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

    a. Invert Slope: 1 percent through manhole.

2. Benches: Concrete, sloped to drain into channel.

    a. Slope: 8 percent.

E. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.

F. Reinforcement Bars: ASTM A 615, Grade 60 deformed steel.

2.4 MANHOLES

A. Precast concrete manholes shall conform to ASTM C-478.

B. Cast-in-Place-Concrete Manholes: Construct of reinforced-concrete bottom, walls, and top; designed according to ASTM C 890 for A-16 (ASSHTO HS20-44), heavy-traffic, structural loading; of depth, shape, dimensions, and appurtenances indicated. The minimum compressive strength of concrete manhole shall be 4000 psi.

C. Ballast: Increase thickness of concrete as required to prevent flotation.

D. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

E. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

F. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.

G. Manhole Frames and Covers: To meet those detailed in the detail section of the plans as specified with precast concrete manholes

[EDITORS NOTES: ALL NEEDS FOR SEALED OR VENTED MANHOLE COVERS ARE TO BE COVERED IN THE DRAWINGS AND DETAILS. IF ADDITIONAL INFORMTION IS NEEDED PLEASE INCLUDE HERE IN THIS LIST OF ITEMS]

2.5 MORTAR

A. Mortar for flowline directioning in all manholes shall conform to TxDOT Item 465.2B and ASTM C 476.

2.6 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

B. Available Manufacturers:

1. Canplas Inc.
2. IPS Corporation.
3. NDS Inc.
4. Plastic Oddities, Inc.
5. Sioux Chief Manufacturing Company, Inc.
6. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

PART 3 - EXECUTION

3.1 PIPE SEWERS

A. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of the trench has been properly shaped.

B. Batter boards where used shall be placed into position properly. Boards shall be nominal 1 x 4 inch lumber, planed on all four sides to parallel faces. The boards and all location stakes must be protected from injury or change of location.

C. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.

D. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream.

E. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.

F. Before laying pipes a sufficient bed shall be prepared at the grade indicated on the drawings. Backfill shall be placed as outlined in Section 31 23 33.

G. A minimum clearance of six (6) inches must be maintained between the sewer and all other lines. Sanitary sewers shall not be routed over water lines.

H. Sanitary sewers shall not be constructed within nine (9) feet (outside to outside) parallel to a water line. Where sanitary sewers cross under water lines, the pipe material for the sewer shall be an 18' length of ductile iron pipe or PVC schedule 80 pressure pipe, centered on the water line.

I. When trenches exceed five feet in depth Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

3.2 MANHOLES

A. Manholes shall be constructed at locations shown on the plans and to the depth indicated thereon.

B. Manholes may be constructed of concrete or precast concrete sections and in all types shall be constructed to the dimensions shown on the plans. Where concrete or precast concrete sections are used, the interior wall shall be thoroughly coated with coal tar epoxy.

C. Joints between precast concrete sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.

D. The construction of manholes shall be done as soon as practical after sewer lines into or through the manhole are completed.

E. All sewers shall be cut neatly at the inside face of the walls of the manhole and pointed up with mortar.

F. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.

G. The inverts of the sewer line or several sewer lines entering the manhole at or near the flow line elevation of the manhole shall be shaped and routed across the floor of the manhole using mortar to obtain the proper contour.

H. When sanitary sewer pipes enter a manhole two (2) feet or greater above the bottom of the manhole, a drop pipe of equal diameter shall be constructed outside the manhole to the bottom of the manhole per the details on the plans.

I. All Manholes are to be backfilled per article 3.2.C.1 in Specification Section 31 23 33 Trenching, Backfill and Compaction.

[EDITORS NOTES: ALL NEEDS FOR STACKS AND SERVICE LEADS ARE TO BE COVERED IN THE DRAWINGS AND DETAILS. IF ADDITIONAL INFORMTION IS NEEDED PLEASE INCLUDE HERE IN THIS LIST OF ITEMS]

3.3 FRAMES, GRATES, RINGS AND COVERS

A. Casting shall conform to the type shown on the plans and shall be clean castings, free from sand or blow holes or other defects. Materials shall be not less than Class 30B gray iron conforming to ASTM A-48.

B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.

C. Bearing surfaces between manhole rings and covers and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

3.4 FIELD QUALITY CONTROL AND TESTING

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

3. Alignment: Less than full diameter of inside of pipe is visible between structures.

4. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter. (Check to see if this is similar to mandrel test and use it instead)

5. Crushed, broken, cracked, or otherwise damaged piping.

6. Infiltration: Water leakage into piping.

7. Exfiltration: Water leakage from or around piping.

8. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

9. Reinspect and repeat procedure until results are satisfactory.

10. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

11. Do not enclose, cover, or put into service before inspection and approval.

12. Test completed piping systems according to requirements of authorities having jurisdiction.

13. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

14. Submit separate report for each test.

B. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:

1. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.

2. Close openings in system and fill with water.

3. Purge air and refill with water.

4. Disconnect water supply.

5. Test and inspect joints for leaks.

6. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig

C. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, and the following:

1. Option: Test plastic gravity sewer piping according to ASTM F 1417.

2. Option: Test concrete gravity sewer piping according to ASTM C 924.

3. Leaks and loss in test pressure constitute defects that must be repaired.

4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

D. Manhole tests: Test sanitary manholes according to requirements of authorities having jurisdiction, and the following:

1. Option: Vacuum testing:

a. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.

b. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 02533-4, Vacuum Test Time Table.

c. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury (Hg).

2. Option: Perform hydraulic test according to ASTM C 969

3. Leaks and loss in test pressure constitute defects that must be repaired.

4. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION

SECTION 33 34 00 - SANITARY FORCE MAIN

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section specifies the requirements for furnishing and installing sanitary force main and appurtenances. The pipe shall be of the type and size as shown on the plans and constructed in accordance with these specifications.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling and Compaction

B. Section 31 41 33 Trench Safety

C. Section 33 30 00 Sanitary Sewer

1.3 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by reference thereto:

A. American National Standards Institute (ANSI).

1. B16.1 Cast Iron Pipe Flanges and Flanged Fittings, Class 125.

B. American Water Works Association (AWWA).

1. C-111 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

2. C-151 Ductile Iron Pipe, Centrifigually Cast, For Water

3. C105 Polyethylene Encasement for Ductile Iron Pipe Systems

C. American Society for Testing and Materials Standards (ASTM).

1. D-2241 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe

2. D-3139 Push-On Joints for PVC Pipe.

D. American Society of Mechanical Engineers (ASME)

1. A112.1 4 Backwater Valves

1.4 SUBMITTALS

A. Product Data: For the following:

1. Corrosion proof liner selected for protecting concrete pipe from sewer gases. Contractor shall submit data on the selected liner for approval prior to construction.

2. Any special pipe fittings as shown in the drawings.

3. Backwater valves.

B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewerage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

C. Field quality-control test reports.

1.5 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. LLDPE: Linear low-density, polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Follow the University of Houston's Plant Operations Planned and Emergency Utility Outage Policy.

2. If work requires interference with any public sewer systems within or outside of Public Rights of Way or Easements, contractor must obtain prior approval and coordinate with local municipality before commencing work.

1.7 DELIVERY STORAGE AND HANDLING

A. Protect pipe, pipe fittings, and seals from dirt and damage.

1.8 PERFORMANCE REQUIREMENTS

A. Force-Main, Pressure-Piping Pressure Rating: At least equal to system operating pressure but not less than 50 psig or as directed by the engineer's drawings

PART 2 – PRODUCTS

2.1 PIPE

A. All materials and equipment shall be new, of best grade and standard manufacture.

B. Ductile iron pipe shall conform to AWWA C151, latest edition. Wrap pipe in polyethylene per AWWA C 105.

C. PVC pipe shall conform to ASTM D-2241 - SDR 21.

2.2 FITTINGS

A. All materials and equipment shall be new, of best grade and standard manufacture.

B. Cast iron fittings shall conform to ANSI B16.1, latest edition, Class 125, when using Ductile Iron Force Main.

C. Cast iron fittings shall conform to AWWA C 111 when using PVC force main.

D. Wrap cast iron fittings with polyethylene per AWWA C 105.

2.3 VALVES

A. Gray-Iron Backwater Valves: ASME A112.1 4.1, gray-iron body and bolted cover, with bronze seat.

1. Manufacturers:

a. Josam Company.

b. Smith, Jay R. Mfg. Co.

c. Wade Div.; Tyler Pipe.

d. Watts Industries, Inc.

e. Watts Industries, Inc.; Enpoco, Inc. Div.

f. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

2. Horizontal Type: With swing check valve and hub-and-spigot ends.

3. Combination Horizontal and Manual Gate-Valve Type: With swing check valve, integral gate valve, and hub-and-spigot ends.

4. Terminal Type: With bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

1. Manufacturers:

a. Canplas Inc.

b. IPS Corporation.

c. NDS Inc.

d. Plastic Oddities, Inc.

e. Sioux Chief Manufacturing Company, Inc.

f. Zurn Light Commercial Specialty Plumbing Products; Zurn Plumbing Products Group.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The interior of the pipe shall be kept relatively cleaned of all foreign matter before lowered into the trench, and shall be kept clean during these operations.

B. Pipe shall not be laid in water, or when trench or weather conditions are unsuitable for work.

C. Install piping with a minimum of 4 feet of cover.

D. When work is not in progress, open ends of pipes and fittings shall be securely closed so that water, earth, or other substances will not enter the pipes or fittings.

E. All bends, tees and plugs shall have thrust blocks installed where applicable.

F. Air release valves and cleanouts shall be installed at intervals as indicated on the plans. These fixtures shall be sufficient to withstand 200 psi surge in pressure.

3.2 FIELD QUALITY CONTROL AND TESTING

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.

2. Defects requiring correction include the following:

a. Alignment: Less than full diameter of inside of pipe is visible between structures.

b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.

c. Crushed, broken, cracked, or otherwise damaged piping.

d. Infiltration: Water leakage into piping.

e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.

4. Reinspect and repeat procedure until results are satisfactory.

B. The sanitary force main to be installed shall be hydrostatic tested as per this specification.

1. General

a. After the pipe has been laid and initial backfill completed, the force main shall be subjected to a hydrostatic pressure of 150 psi.

b. The Contractor shall furnish, install, and operate, at his expense, the necessary connections, pumps, meters, and gauges necessary to conduct the test.

2. Procedures

a. Before applying the specified pressure test, all air shall be expelled from the pipe.

b. All pipe, fittings, and joints will be examined during testing.

c. Any defective material shall be replaced with sound material and the test repeated until satisfactorily completed and approved.

d. Allowable leakage shall not exceed 25 gallons per inch of diameter per mile of pipe per 24 hours.

e. All visible leaks at exposed joints and all leaks evident on the surface where joints are covered, shall be replaced, regardless of total leakage shown.

END OF SECTION

SECTION 33 40 00 - DRAINAGE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section specifies the requirements for furnishing and placing drainage pipe, laterals, stubs, and appurtenances. The pipe shall be of the size, type and location, and to the lines, grades and elevations shown on the plans and constructed in accordance with these specifications.

1.2 APPLICABLE PUBLICATIONS

A. The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto.

1. American Society for Testing and Materials Standards (ASTM).

a. A 48 Specification for Gray Iron Castings.

b. A 615 Specification for Deformed and Plain Carbon -Steel Bars for Concrete Reinforcement.

c. C 32 Specification for Sewer and Manhole Brick (Made from Clay or Shale)

d. C 76 Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

e. C 443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

f. C 476 Specification for Grout for Masonry

g. C 478 Specification for Precast Reinforced Manhole Sections.

h. C 1433 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers.

i. D 3034 Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

j. D 3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

k. F 679 Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

l. F 758 Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport and Similar Drainage.

m. A 746 Specification for Ductile Iron Gravity Sewer Pipe.

2. Texas Department of Transportation 2004 Standard Specifications for Construction of Highways, Streets and Bridges (TxDOT).

    a. Item 460 Corrugated Metal Pipe.

    b. Item 462 Concrete Box Culverts and Sewers.

    c. Item 465 Manholes and Inlets

    d. Item 466 Headwalls and Wingwalls

    e. Item 467 Safety End Treatment

    f. Item 476 Jacking, Boring or Tunneling Pipe or Box

    g. Item 479 Adjusting Manholes and Inlets

3. American Water Works Association (AWWA)

    a. C 110 AWWA Standard for Ductile-Iron and Gray-Iron Fittings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Section 31 23 33 Trenching, Backfilling and Compaction

B. Section 31 41 33 Trench Safety

1.4 PROJECT CONDITIONS

A. When working with storm manholes new or existing, contractor must keep requirements for confined space entries. In all activities, contractor shall work in a safe manner as required by OSHA and other governing criteria.

B. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Follow the University of Houston's Plant Operations Planned and Emergency Utility Outage Policy.

C. If work requires interference with any public drainage systems within or outside of Public Rights of Way or Easements, contractor must obtain prior approval and coordinate with local municipality before commencing work

1.5 SUBMITTALS

A. Product Data: For the following as used on the project:

1. Pipe material

2. Special pipe fittings, special fittings between dissimilar pipe materials, pressure type fittings, etc.

3. Backwater valves.

4. Drains.

5. Channel drainage systems.

6. Storage and leaching chambers.

B. Shop Drawings: For the following:

1. Cast in place manholes, inlets and catch basins: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report

2. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.

C. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

D. Profile Drawings (if not already shown in the plans): Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

E. Field quality-control test reports.

1.6 QUALITY ASSURANCE (NOT USED)

1.7 DEFINITIONS

A. LLDPE: Linear low-density, polyethylene plastic.

B. PE: Polyethylene plastic.

C. PP: Polypropylene plastic.

D. PVC: Polyvinyl chloride plastic.

PART 2 - PRODUCTS

2.1 PIPE

A. Reinforced concrete pipe shall conform to ASTM C-76, wall “B” thickness for, Class III and Class IV as shown on the plans or as necessary to meet ASTM cover design requirements.

B. Corrugated metal pipe shall conform to TxDOT Item 460 specifications.

C. Polyvinyl Chloride (PVC) pipe 4 inch in diameter shall be DR 18 and conform to AWWA C900. PVC pipe 6” to 10” shall be SDR 26 and conform to ASTM 3034. PVC pipe 12 to 15 inch diameter shall be SDR35 and conform to ASTM D3034. Polyvinyl chloride pipe 18 to 36 inches shall be SDR35 and conform to ASTM F679.

D. Precast box culverts shall conform to ASTM C 1433 and TxDOT Item 462.

E. Polyvinyl Chloride Perforated pipe and fittings shall conform to ASTM F758.

F. Ductile Iron Pipe (DIP) shall be Class 51 and conform to ASTM A-746.

2.2 JOINTS

A. Reinforced concrete pipe joints shall conform to ASTM C-443 Rubber Gaskets or approved equal.

B. PVC pipe joints shall conform to ASTM D-3212 and ASTM F477 specifications.

C. DIP pipe joints shall conform to AWWA C110, latest edition.

2.3 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, and the following for manholes and inlets:

1. Cement: ASTM C 150, Type II.

2. Fine Aggregate: ASTM C 33, sand.

3. Coarse Aggregate: ASTM C 33, crushed gravel.

4. Water

a. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

b. Water sources other than the local municipal domestic water supply must be approved by the Owner.

c. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

B. Portland Cement Design Mix: 4000 psi minimum in 28 days, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Bars: ASTM A 615, Grade 60 deformed steel.

2.4 BRICK

A. Sewer brick for manholes, inlets and junction boxes shall be clay and shale masonry units that conform to ASTM C-32 grade MM. Compressive strength: 2200 psi min for individual brick; 2500 psi average for five bricks.

2.5 MORTAR

A. Mortar for brick drainage structures and manholes shall conform to TxDOT Item 465.2(B) and ASTM C 476.

2.6 RIMS, GRATES AND FRAMES

A. Castings for manhole and inlet rims, grates and frames shall conform to ASTM A 48, Class 35B gray iron or better quality.

2.7 SAFETY END TREATMENTS

A. Safety End Treatments shall conform to the products and installation requirements listed in TxDOT Item 467.

2.8 HEADWALLS AND WINGWALLS

A. Headwalls and Wingwalls shall conform to the products and installation requirements listed in TXDOT Item 466

PART 3 - EXECUTION

3.1 PIPE SEWERS

A. Open Trench Construction

1. No pipe shall be installed in the trench until excavation has been properly constructed per the plans and details to at least two (2) pipe lengths beyond the section of pipe being installed and the bottom of trench has been properly shaped.

2. Batter boards where used shall be placed into position properly. Boards shall be nominal 1 x 4 inch lumber, planed on all four sides to parallel faces. The boards and all location stakes must be protected from injury or change of location.

3. Pipe shall be so laid that after the sewer is completed the interior surface shall conform accurately to the grades and alignments fixed and given in the Plans.

4. All sewers must be laid accurately to line and grade, with tongue or spigot end downstream.

5. Pipes shall be fitted together and matched so that when laid, they form a sewer with a smooth and uniform invert.

6. When trenches exceed five feet in depth the Contractor shall utilize trench safety measures per Section 31 41 33 Trench Safety.

7. Outfall pipes shall be as detailed on the drawings. Before laying pipes a sufficient bed shall be prepared at the grade indicated on the drawings. Backfill shall be placed as outlined in Section 31 23 33 Trenching, Backfill and Compaction.

B. Boring, Jacking or Tunneling Construction

1. Suitable pits shall be constructed for the boring, jacking or tunneling operations. Excavations greater than 5 feet in depth shall be protected as specified in Section 31 41 33 Trench Safety.

2. Construction operations shall be done in such a manner that the operation and structural integrity of the road or other area over the bore is not weakened or damaged in any way nor operations interfered.

3. Pits shall be filled immediately upon completion of the pipe installation.

4. Jacking operations shall meet the requirements of TxDOT Item 476.3(A and D).

5. Boring operations shall meet the requirements of TxDOT Item 476.3(B and D)

6. When pipe sizes are sufficient for tunneling methods, contractor may tunnel and jack pipe. When this method is used, special safety precautions shall be used to protect the workers involved. Any over excavation shall be filled with drilling mud after the pipe is installed. Tunneling operations shall meet the requirements of TxDOT Item 476.3(C)

3.2 MANHOLES, JUNCTION BOXES AND INLETS

A. Manholes, junction boxes and inlets shall be constructed at locations shown on the plans and to the depth indicated thereon.

B. Manholes, junction boxes and inlets may be constructed of brick, Class “A” concrete or precast concrete sections and in all types shall be constructed to the dimensions shown on the plans.

1. Brick Inlet walls shall be a minimum eight (8) inches thick and shall have ½” mortar on inside face.

2. Floor slabs and beams for inlets shall be Class “A” concrete.

C. Inlets and junction boxes shall be constructed in accordance with the details shown on plans.

D. Joints between precast concrete manhole and inlet sections shall be made by uniformly placing "Ram-Nek" flexible plastic gaskets or approved equal on all faces of the lower part of the joint and lowering the upper ring evenly into place to produce uniform bearing and compression on the sealer.

E. The construction of manholes, junction boxes and inlets shall be done as soon as practical after sewer line into or through the manhole, junction box or inlet locations are completed.

F. All sewers shall be cut neatly at the inside face of the walls of the manhole, junction box or inlet and pointed up with mortar.

G. After the masonry work has been completed to the proper elevation, the cast iron manhole cover frame shall be set in a full mortar bed and adjusted to the elevation established on the drawings.

H. The inverts of the sewer line or several sewer lines entering the manhole or junction box at or near the flow line elevation of the manhole or junction box shall be shaped and routed across the floor of the manhole or junction box using mortar to obtain the proper contour.

I. Adjusting Manholes and Inlets shall conform to specifications in TxDOT Item 479.

J. All Manholes, junction boxes and inlets are to be backfilled per article 3.2.C.1 in Specification Section 31 23 33 Trenching, Backfill and Compaction.

3.3 FRAMES, GRATES, RINGS AND COVERS

A. Castings shall conform to the type shown on the plans and shall be clean substantial castings, free from sand or blow holes or other defects.

B. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth.

C. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

D. Castings in pavement areas or areas designated to receive traffic loading shall be a heavy duty type capable of H-20 loading.

3.4 UNDERDRAIN SYSTEMS

A. Pipe shall be laid per paragraph 3.1 and per the details on the plans.

B. Prior to placing granular backfill and bedding, line trench with drainage fabric according to the details. The drainage fabric shall be Supac 4NP or approved equal.

C. Granular bedding shall be prepared to a depth of 2 to 4 inches below the pipe invert. The pipe shall be laid with the perforations facing down. The granular backfill shall then be placed to the depth shown on the details. The filter fabric shall then be wrapped around the granular material with a minimum overlap at the top of 6 inches.

D. Where vertical pipe risers penetrate the granular backfill to the surface, the drainage fabric shall be cut in an 'X' to accommodate the pipe penetration and then the fabric shall be sealed with a heavy duty tape to the pipe in the manner to insure the integrity of the filter fabric.

END OF SECTION