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