SECTION 2570

SANITARY SEWERS

PART 1: GENERAL

1.1 Related Requirements Specified Elsewhere

A. Trenching, Backfilling and Compacting: Section 2221.

B. Pipe Boring and Jacking: Section 2224.

1.2 Product Delivery, Storage and Handling

A. Store materials to prevent physical damage.

B. Protect materials during transportation and installation to avoid physical damage.

1.3 General Description of Work Covered

Furnish and install all sewer pipe, fittings and structures, and accessories required for sanitary sewer construction as indicated.

1.4 Quality Assurance

Comply with latest published editions of American Society of Testing and Materials (ASTM) Standards:

A. ASTM C478 - Concrete Pipe Manholes.

B. ASTM D1784 - Rigid Poly (vinyl chloride) (PVC) Compounds and Chlorinated Poly (vinyl chloride (CPVC) Compounds.

C. ASTM D2321 - Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.

D. ASTM D2564 - Solvent Cements for Poly Plastic Pipe and Fittings.

E. ASTM D3212 - Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals.

F. ASTM D3034 Type PSM - PVC Sewer Pipe and Fittings.

PART 2: MATERIALS AND EQUIPMENT

2.1 General Requirements

A. Pipe furnished shall be PVC for sanitary sewer construction unless shown otherwise on plans or bid forms.

B. All pipe shall be marked in accordance with applicable standard specification under which pipe is manufactured unless otherwise specified.

2.2 Delivery, Storage and Handling

Certificates of Compliance with the Specifications shall be required for all materials used on the Project. All materials shall be protected during transportation, storage, handling, and installation to avoid physical deterioration due to sun and weather. The ECUA reserves the right to reject material which in any way does not meet the requirements of these Specifications.

2.3 Sewer Mains

2.3.1 Polyvinyl Chloride Plastic Pipe (PVC)

A. Comply with ASTM D3034 for pipe using material conforming to ASTM D1784 for pipe and fittings.

B. Use single elastomeric gasket push-on joints complying with ASTM D3212.

C. Provide pipe and fittings with minimum SDR-35 dimension ratio.

D. SDR 35 shall be used for service laterals.

E. Pipe shall be color coded by one of the following methods:

1. 3 green stripes (½ inch high) with permanent ink along the entire length, evenly spaced around the pipe, with the word "Sewer" in ¾-inch letters every 21 inches along each stripe.

2. Use pipe pigment to color code pipe green.

2.2.1 Glass Fiber Reinforced Thermosetting Resin Pipe

A. Acceptable for lines l8 inches diameter and larger.

B. Use pipe to comply with AWWA C950 (Latest Edition).

C. Use minimum pipe stiffness: 36 psi.

D. Use joints per AWWA C950 (Latest Edition).

E. Pipe shall be color coded by one of the following methods:

1. 3 green stripes (½ inch high) with permanent ink along the entire length with ¾-inch letters every 21 inches along each stripe designating "Sewer".

2. Use pipe pigment to color code pipe green.

2.4 Structures and Pipe Accessories

2.4.1 Fittings

A. Fittings shall be allowed only on service laterals and drop manholes.

B. Fittings shall equal or exceed quality and strength of pipe.

C. Wyes shall be long bell type.

2.4.2 Manholes & Sections

A. Construction shall be precast reinforced concrete capable of sustaining an H-20 loading.

B. Manholes shall be constructed in accordance with ASTM C-478, using Type II or Type III Portland Cement.

C. Leakage shall not exceed 1 gallon per day per vertical foot of manhole.

D. Manholes shall have a minimum I.D. of 48 inches, unless otherwise noted on plans.

E. Base section shall be monolithic to a point 6" above the crown of the incoming pipe with minimum thick bottom section and 5" wall section and made in accordance with ASTM C-478.

F. Pipe holes shall be properly located and either cast in place with appropriate boot or required shape, or core drilled after concrete has set. Minor field adjustments may be made with approval of ECUA. The invert of the lowest pipe shall be a minimum of 4" above the inside floor of the base section.

G. Cone (top) sections shall be eccentric narrowing from 48" to 24" I.D., unless otherwise noted on plans.

H. Flat top sections shall be used in place of cone sections for manholes less than 5 feet deep. The access hole shall be offset to allow easy access to steps (if used) and shall be reinforced to support an H-20 loading.

I. Shallow manholes less then 3 feet deep shall be constructed according to ECUA detail drawing.

J. The joints between sections shall be one of the following:

1. Lap joint design with the upper lip inside and suitably shaped to accommodate a bitumastic joint sealer,

2. Rubber "O" ring gasket.

K. Pipe to manhole seals shall be made utilizing one of the following or approved equivalent.

1. Kore-N-Seal or, Lock-Joint, with stainless steel bands and screws.

2. A-LOK.

L. Brick manholes shall only be used with consent of ECUA.

2.4.3 Manhole Accessories

A. Manhole Lid and Cover

1. Gray cast iron, with nominal opening of 24 inches.

2. Cover shall be embossed with "SANITARY SEWER" as shown on detail drawings.

3. The lifting holes shall not extend through cover.

4. Use Vulcan Model VM-37, USF 170E or approved equivalent for lids not requiring bolting features.

5. Use Vulcan Model VM-360WT or approved equivalent for bolted covers.

6. Use Vulcan Model VM-50 or approved equivalent for specified flood areas.

7. Use Certain Teed RE 85 R3 FD with Anti-theft locking key (RE 80 K9 FD) for lids requiring locking features.

B. Manhole Coating

1. Apply two coats of a foundation coating or approved equivalent to the interior and to the exterior.

2. Manholes receiving discharges from force mains, and at a minimum the next two manholes downstream of the receiving manhole, shall be lined with an ECUA approved HDPE or polypropelene liner. Additional manholes shall be lined if required by ECUA. Other liners may be installed if approved by ECUA in writing.

3. Manholes housing force main air release valves shall be lined with an ECUA approved HDPE liner. Other liners may be installed if approved by ECUA in writing.

C. Steps

1. Shall be embedded in the concrete by the manhole manufacturer at 12” on center spacing from the top of the manhole cone to bench.

2. Steps shall be grade 60 steel bar reinforced ABS plastic, with non-slip rungs, guaranteed for use in sewers.

PART 3: EXECUTION

3.1 General

Provide all labor, equipment and materials and install all pipe, fitting, specials and appurtenances as indicated or specified.

3.2 Pipe Installation

A. Handling

1. Handle and store pipe in a manner to insure installation in sound and undamaged condition, and in accordance with pipe manufacturer’s requirements.

a. Do not drop, bump, roll or drag.

b. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements, and coatings.

2. Ship, move and store with provisions to prevent movement or shock contact with adjacent units.

3. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

B. Installation

1. Utilize equipment, methods, and materials insuring installation to lines and grades as indicated.

   a. Do not lay on blocks unless pipe is to receive total concrete encasement.

   b. Use calibrated laser or minimum of 3 batter boards for control of line and grade.

2. Install pipe of size, material, strength class, and joint type with embedment shown for plan location.

3. Insofar as possible, commence laying at downstream end of line and install pipe with bell ends in direction of laying (upstream). Sewer pipe shall have spigot ends in direction of flow. Obtain approval for deviations therefrom.

4. Clean interior of all pipe, fittings and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.

   a. Close open ends of pipe with watertight plugs at the end of each work day.

   b. Do not let water enter trench. Pipe shall be laid in a dry trench. Include provisions to prevent pipe flotation and displacement should water control measures prove inadequate.

   c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap or plugs.

5. Inspect pipe prior to installation to determine if any pipe defects are present.

6. Brace or anchor as required to prevent displacement after establishing final position.

7. Perform only when weather and trench conditions are suitable.

8. Observe extra precaution when hazardous atmospheres might be encountered, especially when connecting to existing, active sanitary sewers.

9. Separation Of Sanitary Sewer Lines and Potable Water Lines.

   a. When a gravity sewer line must cross under a water line with less than 18-inch vertical clearance, one of the following methods may be used:

      1) Fully encase sewer line with a minimum of 4 inches of concrete (2500 psi) for a minimum distance of 10 feet either side of the point of crossing, which must be at least 5 feet from a water line joint. If the crossing is other than at right angles, increase the

length of encasement so that the end of the encasement will be at least 12 feet from a water line joint.

2) Use equally rated pressure pipe for the sewer lines with no joints closer than 12 feet apart and at least 6-inch vertical clearance.

3) Install sewer pipe into at least a 20-foot section of steel casing (casing I.D. slightly larger than sewer pipe bell OD) and center over crossing so that end of casing will be at least 12 feet from water line joint. Seal the ends of the casing with non-shrink grout.

b. When a gravity sewer line must cross over a potable water line, regardless of clearance, because the water line cannot be relayed above sewer, use method 2) or 3) in subsection a. Concrete encasement will not be allowed.

c. When a sanitary force main must cross under a potable water line with less than an 18-inch vertical clearance, or over the water line, use a higher rated pressure pipe as in method 2) or 3) in subsection a.

d. When the water line being crossed in a, b or c is a house or building service lateral, 2-inch or smaller and the service lateral is a continuous piece of PE DR9 tubing, then the above rules do not apply; but locate so that the distance to a sewer or force main joint is as great as possible.

e. When a gravity sewer line must run parallel to and less than 18 inches below a potable water line and:

1) 6 to 10 feet apart for less than 40 feet, use method 1), 2) or 3) in subsection a.

2) 6 to 10 feet apart for over 40 feet, use method a. 2) and stagger joints.

3) 3 to 6 feet apart for any distance, use a higher rated pressure pipe as in method a. 2).

f. When a sanitary force main must run parallel to and less than 18 inches below a potable water line and:

1) 6 to 10 feet apart for any distance, use a higher rated pressure pipe as in method a. 2).

2) 3 to 6 feet apart, use a higher rated pressure pipe for both water and force main. Example: If force main is PC160 PVC DR26, and water line is C-900 DR25; then force main should be PVC DR21 and water line should be DR21, using extreme care to have both properly color-coded.

10. Auger or jack casing in place where shown on plans.

11. Maintain minimum of 30 inches of cover unless directed by Engineer.

12. Encase sewer pipe in steel casing or use ductile iron pipe when crossing under pipe, conduit, or structure of 24 inches in diameter or greater when a 6-inch

separation distance cannot be maintained. This protection shall extend a minimum of 5 feet beyond crossed structure.

C. Jointing

General Requirements

1. Perform in accordance with manufacturer's recommendations.

2. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

3. Utilize methods and equipment capable of fully homing or making up joints without damage.

4. Check joint opening and deflection for specification limits.

D. Closure Pieces

1. Connect two segments of pipelines or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

2. Observe specifications regarding location of joints, type of joints and pipe materials and strength classifications.

E. Temporary Plugs

1. Furnish, install and secure water tight temporary plugs at each end of work for removal by others when completed ahead of adjacent contract or where indicated.

2. Remove from pipe laid under separate or prior contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this contract.

3. Permanent Plugs

a. Use test plugs as manufactured by pipe supplier, or

b. Fabricate by Contractor of substantially same construction.

c. Must be watertight against heads up to 20 feet of water.

d. Secure in place in a manner to facilitate removal when required to connect pipe.

3.3 Manhole Installation

A. Precast Bases

1. Place on 12-inch layer of compacted sand, gravel or sandy material as approved by Engineer.

2. Base shall be leveled prior to installation of manhole sections.

B. Cast In Place Bases

1. Cast on 12-inch layer of compacted sand, gravel or sandy material as approved by Engineer.

2. Manhole bases and channel inverts may be constructed integrally.

C. Manhole Sections

1. Use precast sections unless cast-in-place manholes approved by Engineer.

2. Precast sections may be installed after base concrete has attained 75% of design strength.

3. Full circumference seals between manhole sections shall use one of the following or approved equivalent.

   a. Bitumastic Seal (Kent No. 2, Ram Neck)

   b. Rubber "O" ring gasket

D. Invert Channels

1. Form invert channel as indicated.

2. Alternate invert and shelf may be constructed of mortar over concrete fill with approval of Engineer.

3. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits.

4. Make changes in size and grade smoothly and uniformly.

5. Slope shelf of manhole adjacent to channels, toward the channels, and rough broom finish to provide a non-slip surface.

6. Finish channel bottom smoothly without roughness, irregularity, or pockets.

7. On straight through single pipe manholes, half sections of same pipe may be used with mortar and concrete with approval of Engineer.

8. Precast inverts in base sections are acceptable with approval from ECUA Engineering Department.

E. Pipe Connection Into Manholes

1. Make watertight.

2. Use specified pipe to manhole seals or other as approved by ECUA.

F. Field applied coatings shall be applied after Engineer's approval of structure.

3.4 Service Connections

A. Service lines shall be located in accordance with requirements in the ECUA Code. Refer to the Code for clarification of availability of facilities and responsibilities of customer for the installation of service lines.

B. Install service connections to each residential lot or individual business lot or property, or as directed by Engineer.

C. Services wyes: install long bell type wyes, 4-inch branch diameter unless shown otherwise on plans. See ECUA standard detail, "Typical Service Connection".

D. Risers: may be used with wyes for service connections where invert of sewer is 7 feet or more below ground surface or where shown on plans. Terminate each connection as shown on plans or as directed by Engineer. Glued 45 degree bends may be used on end of lateral, within grassy, or unpaved, areas.

E. Glue cap on end of stub out.

F. Backfill trench only after recording exact location and depth of service connection.

G. Street crossings shall have a minimum of 2 feet of cover to subgrade unless approved by Engineer.

H. Drive a ½-inch metal rebar adjacent to each service connection, with top of post 1 foot below ground surface.

3.5 Connection of Service Lines and Sewer System Facilities

A. Existing Service Lines and New Sewer Main:

Connect existing sanitary service lines which cross new sewer line through equal sized wye.

B. New Service Line Connections to Existing Manholes:

1. Insert new sewer pipe flush with inside of manhole.

2. Connect new lines to existing manholes. Seal new pipe in place to be watertight.

3. Reconstruct manhole channel and shelf to suit new connection.

4. All debris to be removed.

C. Connections to Existing Sewer

1. Build new manhole around existing sewer.

2. Break out existing sewer inside of manhole and construct channel and shelf to suit new connection.

PART 4: ACCEPTANCE

4.1 Acceptance Tests for Sewer Pipelines and Manholes

A. Infiltration Testing

1. General

a. Maximum infiltration for each section of sewer pipe shall not exceed 25 gal/mile/day/ inch of pipe diameter.

b. Infiltration, exfiltration or air test may be used to prove compliance with infiltration requirement.

c. Acceptance of air test or exfiltration results will not preclude rejection of work if infiltration is measured and exceeds limitation.

d. Maximum infiltration for each manhole shall not exceed 1 gallon per vertical foot per 24 hours.

e. All tests to be witnessed by ECUA.

2. Air Test

a. Furnish all facilities required including:

1) Necessary piping connections.

2) Test pumping equipment.

3) Pressure gauges or manometers.

4) Bulkheads.

5) All miscellaneous items required.

b. Obtain approval from Engineer of equipment and methods proposed for use.

c. Test pipe in sections determined by Contractor and approved by Engineer.

d. Plug ends of line and cap or plug all connections to withstand internal test pressures.

e. Introduce low pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe. (Add 0.43 psi for each vertical foot of ground water over the top of pipe.)

f. Allow two minutes for air pressure to stabilize.

g. Time required for pressure to decrease from 3.5 to 2.5 psi greater than average back pressure of any ground water above pipe shall not be less than time in following table for given diameters.

Pipe Diameter	
(Inches)	Minutes
6	3.0
8	4.0
10	5.0
12	5.5
15	7.0
18	8.5
21	10.0
24	11.5
27	12.75
30	14.0
36	17.0

h. Repeat test as necessary after all leaks and defects have been repaired.

B. Exfiltration Test

1. Furnish all facilities required to plug pipe sections and fill with water to attain a minimum elevation of water in upstream manhole two feet higher than top of pipe in line being tested, or two feet above existing ground water in trench, whichever is higher elevation.

2. Maintain water level in manhole at start of test period for one hour.

3. Water added to maintain level (water lost) shall not exceed the following amounts:

a. 8" pipe - 0.63 gallon per 100 feet.

b. 10" pipe - 0.79 gallon per 100 feet.

c. 12" pipe - 0.95 gallon per 100 feet.

d. 15" pipe - 1.19 gallon per 100 feet.

e. 18" pipe - 1.42 gallon per 100 feet.

f. 21" pipe - 1.66 gallon per 100 feet.

g. 24" pipe - 1.90 gallon per 100 feet.

Allowable leakage may be increased by 5% for each foot of head above water elevation indicated above.

C. Infiltration Test

1. May be used in lieu of air test or exfiltration test if contractor can prove that ground water conditions are such that crown of pipe is covered with not less than two feet of water at highest point in section being tested. The test head shall be maintained for not less than 24 hours before a weir measurement is made.

2. Infiltration shall be measured with weir at manhole and shall not exceed amounts stated in paragraph B. 3., Exfiltration Test.

3. Engineer will require exfiltration or air test if contractor cannot prove to satisfaction of Engineer that ground water conditions are satisfactory.

PART 5: MEASUREMENT AND PAYMENT

5.1 Sewer Pipe

A. Measure in lineal feet by specified pipe size along centerline of pipe with no deduction for manholes, wye connections or riser connections.

B. Includes furnishing, handling, laying pipe materials and specified bedding materials; trench excavation, backfill and compaction; dewatering; sheeting, shoring and bracing; testing; utilities repair and relocation; providing all labor, tools, equipment and miscellaneous associated work necessary to complete item.

C. Payment: unit price per lineal foot.

5.2 (Standard) (Drop) (Shallow) Manholes

A. Includes furnishing and placing all precast and cast in place materials; excavation, backfill and compaction; frame and lid; stub pipes; providing all labor, equipment, tools and miscellaneous associated work needed to complete item.

B. Payment: unit price for each manhole.

5.3 Wye Connections

A. Measure each as installed by nominal pipe size.

B. Includes additional cost of wye over straight pipe, joints, stoppers and one 1/8 bend sweep.

C. Payment: unit price per each.

5.4 Riser Connections

A. Measure each connection installed by nominal pipe size.

B. Includes furnishing and installing wye or tee connection, elbows, concrete work, extra excavation, backfilling and compaction, stoppers and providing labor, equipment and miscellaneous associated work needed to complete item. Does not include straight pipe used for riser.

C. Payment: unit price per each.

5.5 Riser Pipe

A. Measure in lineal feet of straight pipe from fitting joints at upper and lower extreme of riser.

B. Includes furnishing and installing pipe materials, bracing; supports; excavation, backfill and compaction; providing labor, equipment and miscellaneous associated work needed to complete item.

C. Payment: unit price per lineal foot.

5.6 Service Connection Lateral Pipe

A. Measure in lineal feet by nominal pipe size as installed.

B. Includes furnishing, handling, laying pipe materials; trench excavation, backfill and compaction; dewatering; utilities repair; providing all labor, equipment and miscellaneous associated work needed to complete item.

C. Payment: unit price per lineal foot.

5.7 Clean Outs/Lamp Holes

A. Includes furnishing and placing all clean outs; excavation, backfill and compaction; stub pipe; frame and lid; providing all labor, equipment, tools and miscellaneous associated work needed to complete item.

B. Payment: unit price for each clean out.