

SECTION 33 30 00 – SANITARY UTILITY SEWERAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section:
 - 1. Sanitary pipes, joints, structures, bedding.
- B. Related Sections:
 - 1. 31 00 01 "SITE PREPARATION AND GENERAL SITE WORK" for layout and construction staking.
 - 2. 31 22 00 "EARTHWORK" for trench excavation; trench safety; pipe bedding, backfill and compaction.

1.2 REFERENCE SPECIFICATIONS AND DOCUMENTS

- A. When specified, the work for this section per the applicable portions of the following standard specifications:
 - 1. ANSI - American National Standard Institute.
 - 2. ASTM - American Society for Testing and Materials.
 - 3. DOT - Local Department of Transportation.
 - 4. NCPI - National Clay Pipe Institute.

1.3 DEFINITIONS

- A. Lateral: A lateral is an extension from a building drain to a public sewer. A lateral is less than an 8 inches in diameter, does not contain manholes, may contain cleanouts and is less than 250 feet in length.

1.4 SUBMITTALS

- A. Product information including installation instructions: for all material including but not limited to pipes, joints.
- B. Shop Drawings: for all fabricated structures, appurtenances.
- C. Reports:
 - 1. Submit a complete field report of the location of all wyes, risers and building leads to the Owner's Representative at the end of each sewer section installed or on the last day of each week, whichever occurs first.
 - 2. The complete field report includes witnessing by the contractor of the ends of all building leads placed. Witnessing consists of recording three horizontal distances to the nearest foot from the end of the building lead to three permanent structures, with the lines of

measurement at minimum angles of 45 degrees with respect to one another. Witnessing also includes recording of the depth to nearest one-half foot from the invert at the end of the lead to the finish ground above the end of the lead. No payment will be made for un-witnessed installation or for improper witnessed installation.

3. Submit two copies of the laboratory test reports required to the Owner's Representative.

D. As-built drawings:

1. Furnish a set of record "as-built" prints of all portions of the built sanitary sewer systems. The "as-built" record drawing shall include:
 - a. Horizontal location of all manholes, pipes, laterals, clean outs, etc. as built.
 - b. All vertical information regarding the sanitary sewer as-built such as tops of all structures, invert elevations, location and differential vertical location at crossings with storm sewer, water, gas and all other utility lines.
2. The record as-built drawings shall be an accurate representation of the built sanitary sewer system.

1.5 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. Materials, construction, and testing shall be per the applicable requirements of utility owners, and state and local authorities having jurisdiction and shall take precedent over these specifications if in conflict.

1.6 DELIVERY STORAGE AND HANDLING

A. Storage of Materials

1. Do not stack sanitary sewer piping material higher than four feet. Suitable racks, chairs, and other supports shall be provided to protect preformed pipe mating surfaces from damage. Store bottom tiers off the ground. Alternate tiers and chock tier ends.
2. All joint and sealing materials used in the sanitary sewer system shall be protected from sunlight and stored in a cool, clean place until ready for installation.

B. Handling of Material

1. Load and unload piping using suitable hoists, skids, etc. Do not drop or allow impact to piping. Damaged piping will be rejected by the Owner's Representative and shall be removed from the site.
2. Lifting devices shall be suited to the work and shall protect surfaces from damage.

PART 2 - PRODUCTS

2.1 PIPE SYSTEMS

- A. PVC Gravity Pipe, unless otherwise shown, shall comply with the following:
 - 1. PVC pipe and fittings are **SDR-35** per ASTM D3034. Sizes over 15" in diameter are per ASTM F679.
 - 2. Joints shall be water tight, push-on type, and made using flexible elastomeric gaskets per ASTM D3212. Gaskets are per ASTM F477.
- B. Ductile Iron Pipe, unless otherwise shown, shall comply with the following:
 - 1. Ductile iron pipe for sizes 3 to 18 inch diameter, is per AWWA C151 / ANSI A21.51, Pressure Class **350** or Thickness Class **50**.
 - 2. Ductile iron pipe shall be furnished in nominal lengths of 18 to 20 feet and with a bituminous outside coating.
 - 3. For underground piping applications, joints are push-on type conforming to AWWA C111.
 - 4. Pipe and fittings are cement-mortar lined per AWWA C104 / ANSI A21.4, standard thickness.

2.2 CLEANOUTS

- A. Unless otherwise provided on the plans, cleanouts where shown shall meet the following:
 - 1. Cast iron cleanout flush with finish grade with a countersunk brass plug.
 - 2. Center the cleanout in a 4 inch depth concrete pad. Minimum size of concrete pad shall be sufficient to provide 6" of clearance from the edge of cleanout to the edge of concrete, but not less than 18" x 18". Construct the concrete pad with a 1/4" to 3/8" radius rounded edge.

2.3 MANHOLE STRUCTURES

- A. Sanitary sewer structures
 - 1. Clay brick per ASTM C32, Grade MS, recessed and/or cored as reviewed by the Design Professional.
 - 2. Pre-cast Concrete Units
 - a. Pre-cast concrete units per ASTM C478, circular with steel reinforcement. Unless otherwise shown on the Plans: wall thickness is 5 inches for stack depth sections up to 32 feet; Base slab is 8 inches thick for depths up to 25 feet and 12 inches for depths greater than 25 feet.
 - b. Pre-cast doghouse sections shall be used for existing sewer lines 15 inches in diameter and smaller on straight-through runs for a depth up to 20 feet and on right angle runs, with a maximum of four cutouts, for depths up to 12 feet. Cast openings in pre-cast doghouse sections before curing. No breaking or chipping of sections are allowed after the pipe has cured.

- c. Pre-cast bottom sections: bottom end is flat to provide bearing of the full wall thickness. Cast the openings of sewer pipe in the manhole and the bottom section by the manufacturer.
 - d. Utilize flexible resilient joint seals for pipe connections to manholes per ASTM C-923. Approved manufacturers include: Press Seal Corporation, Trelleborg Kor-N-Seal, A-lok.
 - e. Riser sections of a manhole shall have modified grooved tongue joints with rubber gaskets per ASTM C443.
 - f. Cone sections of a manhole shall have modified tongue joints with rubber gaskets per ASTM C443 and be provided with four stud inserts cast in the top. Provide a smooth finish to the top.
 - g. Concrete grade rings: provide smooth finished top and bottom surfaces with rubber gaskets per ASTM C443.
- B. Manhole steps
 - 1. Types and sizes comply with Occupational Safety and Health Standards.
 - 2. Unless otherwise shown, cast iron manhole steps per ASTM A48, Class 30, gray iron with a minimum cross sectional dimension of one inch in any direction.
 - 3. Unless otherwise shown, steel reinforced plastic steps shall be of an approved co-polymer polypropylene conforming to ASTM D4101, Type II, Grade 49108 with a minimum 3/8" diameter deformed reinforcing bar conforming to ASTM A615, Grade 60.
- C. Manhole Frames and Covers
 - 1. Manhole frames and covers per ASTM A48, Class 30, gray iron. Fabricate the castings free from cracks, cold sheets, holes and other defects. Grind surfaces of castings to assure proper fit and to prevent rocking. Manhole frames and covers comply with Utility Owner criteria.

PART 3 - EXECUTION

3.1 EXCAVATION AND BEDDING

- A. Prior to the installation of any sanitary sewer piping, structures, and materials, examine all trenches and other excavations for the proper grades, lines, levels and clearances required to receive the new work. Ensure that all excavation bottoms, compacted subgrades and pipe beddings are adequate to receive the sanitary sewer materials to be installed. Correct all defects and deficiencies before proceeding with the work.

3.2 PIPE CLASS AND JOINTS

- A. Prior to the installation of any sanitary sewer piping, ensure that the class of pipe, joint material and bedding are as specified herein and as indicated on the plans.

3.3 PREPARATION

- A. Clean the outside surface of the spigot ends and the inside surface of the bell end and ensure that they are free of any foreign material, other than sealant recommended by the manufacturer, prior to installation.
- B. Carefully examine all pipe, frames, covers, accessories, and appurtenances for damage and other defects immediately before installation. Clearly mark defective or damaged material and remove from the site as soon as possible, unless otherwise approved for use by the Design Professional.

3.4 INSTALLATION- GENERAL

- A. Install each section of pipe to grade and line with bearing on the trench bedding throughout its length.
- B. Cut pipe with approved tools and by approved methods suitable for the pipe material. Employ pipe cutting methods that produce a smooth, square-cut end without damage to the pipe and that minimize airborne particles and in accordance with recommendations of the manufacturer for the type of pipe materials being cut and according to the best trade practices. When cutting pipe or fittings, take care to prevent damage to the lining and the exterior surface. Damage to either may be cause for rejection of that section.
- C. Maintain the trench free of water and sewage during the preparation of the pipe bedding and until the trench has been satisfactorily backfilled. Provide and maintain a de-watering system.
- D. Sanitary sewers- unless otherwise shown, all sewers are:
 - 1. 8" diameter ductile iron pipe.
 - 2. Minimum longitudinal slope of 0.4%.
- E. Sanitary laterals- unless otherwise shown, all laterals are:
 - 1. 6" diameter ductile iron pipe when below pavement, 6" diameter PVC outside of pavement areas.
 - 2. Minimum uniform slope of laterals is 1%.

3.5 PIPE LAYING

- A. Ductile Iron Pipe
 - 1. Install rigid pipe per ASTM C12. Lay all pipe to the line and grade called for on the plans. Check each pipe with grade pole or laser system to ensure that this result is obtained. When employing a laser system, the Contractor shall have an alternate and independent means of checking the line and grade. Finished work shall be straight and shall be sighted through between manholes.
 - 2. Typically begin construction at the outlet end and proceed upgrade with spigot ends pointing in direction of flow. Excavate bell holes so that the full length of the barrel will bear uniformly on the subgrade.

3. Join all pipe by means of a resilient gasket. Lubricate and install resilient gasket to form a watertight joint between the bell and spigot of the pipe. Center the pipe in the bell or groove. After the spigot is set into the bell and the gasket is fully compressed and brought to final shape, check the gasket for proper position around the full circumference of the joint. Complete installation by pushing the pipe tightly together to form a smooth and continuous invert.
 4. Utilize mechanical means for pulling together all pipe where manual means will not result in pushing and holding the pipe together. Mechanical means may consist of a cable placed inside of the pipe with a suitable winch, jack, or come-along for pulling the pipe together and holding the pipe in position.
 5. Protect installed pipe to not disturb its line and grade. Relay any pipe found off grade or out of line.
 6. When adapters are required to properly connect new pipe to an existing pipe of other materials or manufacture, the nominal inside diameter of adapters shall be the same size as the nominal pipe diameter to which it is to be connected.
- B. PVC / ABS Pipe
1. Install of flexible pipe per ASTM D2321.
 2. Except as otherwise specified herein, install ABS and PVC piping in accordance with the published installation guide of the manufacturer.
 3. Form joints for ABS pipe by first applying a coat of primer to the inside of the socket and to the outside of the spigot end of the pipe. Without delay, apply a coating of cement to the same surfaces in sufficient quantity so that when the spigot is fully inserted into the socket, a bead of excess cement will form around the complete circumference of the outside junction of the spigot and socket. Remove the excess cement and allow the assembly to cure 24 hours.
 4. Joints for PVC pipe shall be made by using a lubricant immediately before joining. Apply lubricant only on the spigot, coating the entire circumference of the spigot bevel plus one inch behind the taper. Insert lubricated spigot into the bell and, using normal force, insert spigot until insertion stripe mark is flush with the bell entrance.
 5. When jointing ABS or PVC pipe, rotate the pipe when inserting it approximately 1/4 to 1/2 turns.
 6. Taps to ABS and PVC pipes, where fittings are not provided, are made with chemically welded saddle fittings. Cut holes for saddle by mechanical hole cutters, or by keyhole saw or saber saw. Holes for saddles shall be laid out with a template and de-burred and beveled to provide a smooth hole shaped to conform to the fitting. After the cement saddle has been fixed to the pipe surface, quickly install band clamps each side of the saddle and tighten.

3.6 PIPE BEDDING

- A. Conform to the individual requirements for the pipe material being used.
- B. Ductile Iron Pipe:

1. Unless otherwise shown, use Class "C" bedding. Excavate bell holes. When excavation is carried below or beyond that required, fill the space with suitable Native Material and compact.
- C. Plastic (PVC or ABS) Pipe:
 1. Unless otherwise shown, use Class "B" bedding.
 - a. Class "B" Bedding: Provide minimum 4" depth of Crushed Stone Bedding all along the trench bottom and along both sides of the pipe up to the one-quarter point of the pipe diameter. Excavate the bottom of the trench flat at a minimum depth shown on the construction details below the bottom of the pipe barrel. Place and compact bedding material to proper grade. Then place bedding by hand and compact to provide full support under and up to centerline of pipe.
 - b. Class "C" Bedding: Excavate the bottom of the trench flat at a minimum depth shown on the construction details below the bottom of pipe barrel. Place and compact bedding material up to one fourth of outside diameter of pipe above the invert.
- D. In areas of rock excavation, and where needed in other areas, provide crushed stone bedding for all pipes. Provide this bedding over the full width of the excavation, minimum 8" depth under the pipe.
- E. Whenever the sub-grade is unstable or too soft to provide a satisfactory pipe foundation for any pipe, undercut or subexcavate the trench and backfill with crushed stone. Compact and bring to proper grade the material so as to create a firm, unyielding foundation.

3.7 SANITARY SEWER MANHOLES

- A. Construct sanitary sewer manhole structures to the grades, lines and levels indicated on the Plans, or as specified. Structures shall be complete with concrete bases, reinforcing, frames, covers, and adjustment rings, as shown and as required for a complete installation. Sanitary manholes shall carry a stub opening as specified herein. Wye openings in manholes are prohibited unless indicated on Plans.
- B. Unless otherwise shown on the Plans, construct outside drop connections at all structures where the invert in elevation is greater than 2.0 feet above the invert out elevation.
- C. Install manholes and have ready for final inspection either before 600 feet of additional sewer construction is completed or within one week after the manhole is constructed, whichever comes first. Install manholes as follows:
 1. Brick
 - a. Prior to laying, thoroughly wet all brick and the surfaces allowed to dry only sufficiently to prevent slippage on the mortar.
 - b. Do not use broken or chipped brick on the face of the structure.
 - c. Lay brick in neat, even consecutive courses with full and close mortar joints. Courses shall be level throughout, except as

- shown or otherwise required. Stagger joints in adjoining courses by one-half a brick as nearly as practical. At least one course in every seven shall be stretcher course with intervening courses laid as headers. Length of brick closure pieces are not less than the width of one whole brick and, wherever practical, closures as headers, are made from whole brick.
- d. Unless otherwise indicated, maximum joint width is 1/2-inch. Construct joints of uniform thickness throughout the structure. Exposed surfaces shall be true and smooth. Rake all joints to receive plaster coat.
 - e. Prior to applying plaster coat, wet bricks with water and allow surface to dry sufficiently for proper bonding.
- 2. Construct pre-cast concrete units as detailed on the plans. Where pre-cast doghouse sections cannot be used, manhole shall be brick to eight inches above top of highest pipe.
 - 3. Apply cement mortar plaster coat to the exterior surfaces of the brick sections of all manholes. Plaster coat shall be 1/2-inch thick.
 - 4. Install all iron covers, frames, adjusting rings, and anchors to the elevations indicated on the Plans, or as specified herein. Set castings on 1" diameter rubber "O" ring gasket, resting on adjustment rings. Anchor casting to the pre-cast concrete cone section.
 - 5. Install steps at the plant by the manufacturer of pre-cast units. Install steps for structures of the types and in the locations indicated on the Plans.
 - 6. Inlet and Outlet Pipe
 - a. Connect pipes to manholes using an approved resilient joint. Properly support the pipe with compacted sand backfill from undisturbed ground so that any settlement will not disturb the connection.
 - 7. Flow Channel
 - a. Construct concrete flow channels in each manhole. For manholes with outlet pipe diameter of 24" or less, the concrete flow channel shall be constructed up to the spring line of the pipe, with a 3/4 inch to 1-1/4 inch gap provided at the pipe ends to maintain joint flexibility.

3.8 TESTING- QUALITY ACCEPTANCE

- A. All tests and inspections shall comply with Utility Owner requirements. All tests and inspections shall be performed in the presence of Utility Owners Representative or Governmental Inspector.
- B. First Inspection
 - 1. The underground portion of the sewer system shall ready for the first inspection within two weeks after the completion of each 2000-foot section of sewer installed.
 - 2. The first inspection shall consist of a visible and audible check of the sewers and manholes to ascertain that the manhole steps have been placed, all lift holes jointed, the channeling of the manhole bottoms completed, all visible or audible leaks stopped, all pipe has been placed straight and true to the proper grades and elevation, the

required adjusting rings and frame and cover properly installed, all trenches and structures backfilled in a workmanlike manner and that the system has been thoroughly cleaned.

3. The first inspection shall be considered complete when all the repairs have been made and the system is ready for television inspection.

C. Testing

1. Notify Owner's Representative or Governmental Inspector at least two working days in advance of all testing.
2. The procedure for air testing of sewers shall be in accordance with the NCPI Publication titled "Low Pressure Air Test for Sanitary Sewers" and as follows:
 - a. Plug and block all laterals to withstand the air pressure. Test the sewer line in increments between manholes. Clean and plug the line at each manhole. Such plugs shall be designed to hold against the test pressure and shall provide an airtight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. Connect an air supply line to the orifice and fit with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer. The pressure gauge shall have a minimum diameter of 3 1/2" and range of 0-10 PSIG. The gauge shall have minimum divisions of 0.10 PSIG and an accuracy of +/- 0.04 PSIG.
 - b. Pressurize the sewer to 4.0 PSIG greater than the greatest back pressure caused by groundwater over the top of the sewer pipe. Allow at least two minutes for the air pressure to stabilize between 3.5 and 4.0 PSIG. If necessary, add air to the sewer to maintain a pressure of 3.5 PSIG or greater.
 - c. After the stabilization period, close the air supply control valve so that no more air will enter the sewer. The sewer air pressure shall be noted and timing for the test begun. The test shall not begin if the air pressure is less than 3.5 PSIG, or such other pressure as is necessary to compensate for groundwater level.
 - d. The time required for the air pressure to decrease 1.0 PSIG during the test shall not be less than the time shown in the tables listed in the NCPI Publication titled "Low Pressure Air Test for Sanitary Sewers".
 - e. Manholes on sewers to be subjected to air tests shall be equipped with a 1/2" diameter galvanized capped pipe nipple extending through the manhole wall, three inches into the manhole and at an elevation equal to the top of the sewer pipe. Prior to the air test, the groundwater elevation shall be determined by blowing air through the pipe nipple to clear it and then connecting a clear plastic tube to the pipe nipple. The tube shall be suspended vertically in the manhole and the groundwater elevation determined by observing the water level in the tube. The air test pressure shall be adjusted to compensate for the maximum groundwater level above the top of the sewer pipe to be tested. After the test are performed and the sewer is ready for final acceptance, the pipe nipple shall be removed and the hole in the manhole wall shall be plugged with hydraulic cement.

- f. If a sewer fails to pass any of the previously described tests, the Contractor shall determine the location of the leaks, repair them and retest the sewer. Repeat the test until satisfactory results are obtained.

END OF SECTION 33 30 00