SECTION 02561

SANITARY SEWERS AND SANITARY HOUSE CONNECTIONS

02561.01 GENERAL

A. Description

Sanitary sewer and sanitary house connection installation shall include, but not necessarily be limited to furnishing and installing gravity pipe, fittings, and appurtenances of the size and type shown on the Plans, installed on firm foundation true to line and grade and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.

2. Trench excavation, backfill, and compaction; Section 02250.

3. Sanitary sewer manhole installation; Section 02562.

4. Connection to existing sanitary sewer facilities; Section 02564.

C. Quality Assurance

1. Materials

   a. The Engineer will inspect all materials before and after installation to ensure compliance with the Contract Documents. When specific materials tests are called for in the referenced standards and specifications, the Engineer will have the option of requiring that any or all of these tests be performed for materials furnished for a specific project. When testing is required, it will be specified in the "Special Provisions".

   b. Polyvinyl chloride (PVC) pipe and fittings shall be homogeneous throughout and free from visible cracks, bubbles, blisters, holes, foreign inclusions, cuts, or scrapes on inside or outside surfaces or imperfections which may impair the performance or life of the pipe. Each pipe shall be straight to within 1/16 inch per foot of length when uniformly supported along its entire length, and shall have a true circular cross-section to within ±1/64-inch.

   c. Reinforced concrete pipe (RCP) and fittings shall be free from fractures or cracks that extend through the wall of the pipe or fitting, surface defects indicating honeycombed or open texture, damaged or cracked ends where such damage would prevent making a satisfactory joint, or any continuous crack having a surface width of 0.01 inch or more and extending for a length of 12 inches or more.

Materials and finished product testing shall be in accordance with ASTM C 76, as detailed in ASTM C 497, and as specified herein. Acceptability of pipe through 54-inch diameter and classes produced in accordance with design tables found in ASTM C 76, or the modified and special designs permitted therein, shall be determined by results of a three-edge bearing test for a load to produce a 0.01-inch crack. If the load exceeds the requirements before the 0.01-inch crack is reached, the load may be relieved and the pipe accepted for use. For pipe 60-inch diameter and larger, acceptance will be based on materials tests specified in ASTM C 76.

d. Ductile iron pipe (DIP), and ductile iron fittings shall be sound and without defects that might impair its service. Defective or damaged lining areas may be repaired by cutting out the defective or damaged lining to the metal so that the edges of the lining not removed are perpendicular or slightly undercut. The cutout area and the adjoining lining shall be thoroughly wetted, and a stiff mortar applied and troweled smooth with the adjoining lining. After any surface water has evaporated, but while the patch is still moist, it shall be cured by the application of a seal coat.

2. Field Tests

a. General

1) After installation, sanitary sewers and sanitary house connections will be initially inspected for conditional acceptance by the Engineer and Contractor tested for compliance with these Specifications. Initial inspections and tests will not be conducted until at least 15 days after the section of pipeline being inspected and tested has been backfilled in accordance with Section 02250.03 and any dewatering pumps removed from the area.

2) The Contractor shall schedule all tests with the Engineer at least 48 hours in advance of the test, and shall conduct all acceptance testing in the presence of the Engineer. On County Capital Projects, the County will witness one test at no cost to the Contractor. If the project is released for service following conditional acceptance tests, the County will perform a final inspection if required at no cost to the Contractor. Should the pipeline fail the first County witnessed test, the Contractor shall reimburse the County for all costs resulting from such additional tests so required until the pipeline passes the test(s). The Contractor shall also reimburse the County for the cost of inspection if the Contractor is not prepared for any test, or for additional tests required following the final inspection of released projects.

b. Visual Inspection

All equipment necessary for the inspection will be furnished by the County, however, the Contractor shall provide assistance as may be required to enable the County to perform the inspection.

The Engineer will inspect all sanitary sewers for alignment, grade, leakage, and condition. The inspection may be conducted by crawling or walking through the pipeline, using mirrors to reflect light through the pipeline, or closed circuit television equipment.

1) If a mirror test is used, the pipe alignment will be acceptable if it is sufficiently true and straight to allow passage of the reflected light with an image of a "full moon".

2) The pipeline shall be installed on a continuous grade so it does not pond or trap water anywhere along the line.

3) No visible infiltration will be allowed. Any water leakage into the system sufficient to constitute any noticeable trickle or dribble shall be corrected and eliminated.

4) The pipeline shall not contain any debris, silt, earth, gravel, rock, or other foreign material. Should the pipeline require flushing, it shall be done in a manner to prevent debris or flushing water from entering the existing sewer and before inspection by the Engineer.

c. Acceptance Testing

1) General

a) The Contractor shall furnish all labor, tools, materials, and equipment (except timers which will be furnished by the County) necessary to perform the specified tests. Testing shall be conducted only after the section of sewer in question has passed the visual inspection.

b) Generally sewers will be tested from manhole to manhole or from manhole to terminus of the pipeline if there is no manhole at the other extremity. Testing shall be by low-pressure air and/or infiltration/exfiltration as specified herein and/or as determined by the Engineer.

c) If the sanitary sewer or sanitary house connection fails any test specified herein, the Contractor shall, at his own expense, repair or replace any defective component and retest the failed section or component until all requirements are met. Repairs to defective material are to be made in accordance with the manufacturer's recommendation.

2) Low Pressure Air Test

Sanitary sewers 24-inch diameter and smaller and attached sanitary house connections shall be tested with low-pressure air in accordance with the air test tables in the Standard Details and the following procedures:

a) Test plugs shall be supplied and installed by the Contractor within the pipeline at each manhole. Each plug shall be securely braced.

b) If the pipeline to be tested is expected to be below the ground water table, the Engineer may visually inspect the trench prior to backfilling to determine the elevation of the groundwater table. In lieu of this, the Contractor shall either install a small diameter perforated vertical pipe from the invert elevation of the sewer to the surface before backfilling or shall insert a pipe probe by boring or driving into the backfill material adjacent to the invert elevation of pipe and determine the depth of the ground water level above the pipe invert immediately before air testing the sewer. All gauge pressures for the test shall be increased by an amount to provide 4 psig above the back pressure due to ground water submergence over the end of the probe to a maximum of 6 psi in the pipe system to be tested except as required by Paragraph 2)h) below. After the pipeline has passed the low pressure air test, the small diameter vertical pipe shall be either withdrawn, filling the hole with concrete while removing the pipe; or abandoned in place by filling with concrete or bentonite and cutting the pipe off at least 2 feet below the finished surface.

c) If the air pressure required for the test is greater than 6 psig at the downstream end, the pipeline shall not be air tested, but rather shall be tested for infiltration in accordance with method indicated in Paragraph 3) which follows.

d) The Contractor shall add air slowly to the portion of the pipeline under test until the internal pressure is raised to 4.0 psig greater than the average backpressure of any groundwater above the pipe's invert.

e) The Contractor shall not allow personnel in manholes after the air pressure is increased in the sewer. If the test plug is suspected of leaking, the Contractor shall first relieve the pressure before any adjustments are made to eliminate air leakage at the plug. The Contractor may precoat the plug with a soap solution to check for leakage.

f) The Contractor shall allow the air temperature to stabilize for at least 2 minutes by adding only the amount of air required to maintain 4.0 psig above groundwater backpressure. After this 2 minute period, the Contractor shall completely disconnect the hose and compressor from the section being tested to assure no additional air is added to the pipeline.

g) The time required for the pressure to drop 1 psig will be observed and recorded. Pipelines which fail to maintain the stipulated pressure for a period equal to or greater than the holding time shown in the tables at the end of this Section shall be deemed to have failed the low pressure air test and will not be accepted by the County.

h) Where there are potable water wells within 50 feet of the sewer being tested, the test will be conducted at 10 psig and no pressure drop will be allowed over a 5 minute test period.

3) Infiltration/Exfiltration Tests

Sanitary sewers 27-inch diameter and larger and sewers which cannot be air tested in accordance with Paragraph 2, Item C, 2) of this Article shall be subjected to either infiltration or exfiltration tests as determined by the Engineer. Testing may be conducted from manhole to manhole, or between more than two manholes, however, the length to be tested shall not exceed 700 feet. Minimum test duration shall be 24 hours. Testing shall be conducted in accordance with ASTM C 969 as modified herein.

a) Infiltration test shall be made by measuring the amount of water infiltrating into the pipeline section at the lower end of the section being tested by means of a weir installed in the pipe or by other measurement method approved by the Engineer.

b) Exfiltration test shall be made by plugging the lower manhole, filling the pipeline section with water to a level of at least 2 feet above the crown of the pipe at the upstream end of the section being tested or 2 feet above groundwater level whichever is greater and measuring the quantity of water added to maintain the prescribed level during the test period. Concrete pipeline shall be filled with water for at least 20 hours immediately before the test.

c) Test Criteria

Unless otherwise noted, no leakage shall be allowed in the completed sewer.

4) Deflection Testing

In addition to other tests detailed in this Section, all PVC sanitary sewers shall be tested for deflection (reduction in vertical inside diameter). Testing shall be performed by passing a 5% undersized GO/NO-GO mandrell or sewer ball through the pipeline or measuring deflection continuously by using a deflectometer. Maximum allowable deflection shall be 5%.

D. Submittals

1. Shop Drawings

Shop drawings shall be submitted as specified in the "General Provisions" for the following materials, and shall include the following information:

a. Polyvinyl chloride (PVC) pipe and fittings: product information and dimensions; storage, handling, installation recommendations, and recommendations for field repairs.

b. Reinforced concrete pipe and fittings: concrete compressive strength; wall, joint, gasket, and reinforcing dimensions; reinforcing, joint, and special fitting details; and pipe Class when indicated on the Plans.

For pipe designated on the Plans by D loads, calculations signed by a Professional Engineer registered in the State of Maryland shall be furnished.

c. Ductile iron pipe and fittings: product information and dimensions; storage, handling, and installation recommendations.

d. Pipeline plugs and adapters: product information and installation guides.

2. Certificates of Compliance

Certificates of compliance shall be submitted in accordance with the "General Provisions" for the following materials stating the item supplied is in accordance with the requirements specified herein:

a. Polyvinyl chloride (PVC) pipe and fittings

b. Reinforced concrete pipe and fittings

c. Ductile iron pipe and fittings

3. Certified Test Results

Certified test results shall be submitted as specified in the "General Provisions" for the following:

a. Polyvinyl chloride (PVC) pipe and fittings

b. Reinforced concrete pipe and fittings

c. Ductile iron pipe and fittings

02561.02 MATERIALS

A. Materials Furnished by the County

1. The County will not furnish any materials for sanitary sewers and sanitary house connections.

2. The Contractor may obtain potable water from the County's potable system for flushing the pipelines and exfiltration testing. The Contractor shall contact the Bureau of Utilities, Meter Section, for requirements.

B. Contractor's Options

1. The Contractor may furnish Polyvinyl chloride (PVC), or ductile iron pipe (DIP) for sewers smaller than or equal to 15-inch diameter unless otherwise noted.

2. The Contractor may furnish Polyvinyl chloride (PVC) up to a 27-inch diameter, reinforced concrete pipe (RCP) – only with DPW approval,, or ductile iron pipe (DIP) unless otherwise noted, for sewers greater than 15-inch diameter.

3. Prestressed concrete pipe and fittings may be furnished in lieu of reinforced concrete pipe as specified herein provided it meets the specified design, quality control, test requirements and approved for the specific use by the DPW. Contractor may furnish polyvinyl chloride (PVC) fittings for sanitary house connections within the public right-of-way, unless otherwise noted. Sanitary house connections are to be constructed of PVC regardless of sewer main pipe material.

C. Detailed Material Requirements

1. Portland cement concrete for pipe cradle and encasement shall be Mix No. 1 as specified in Section 03310.02.

2. Polyvinyl Chloride (PVC) Pipe and Fittings

   a. For pipe depths less than 20 feet from top of pipe: Polyvinyl chloride (PVC) pipe and fittings 4-inch through 15-inch diameter shall meet the material requirements of ASTM D 3034, wall thickness classification SDR-35 or ASTM F 789, wall thickness T-1. Pipe and fittings 18-inch through 27-inch

diameter shall meet the material requirements of ASTM F 679, wall thickness T-1.

b. For pipe depths, greater than or equal to 20 feet of cover over top of pipe, the use of PVC for deep gravity sewers is at the discretion of DPW. Typically, DIP is used for deep gravity sewers, however, PVC SDR-26 may also be acceptable with prior approval from DPW.

c. Joints shall be elastomeric gasketed.

3. Reinforced Concrete Pipe (RCP) and Fittings: NOTE: subject to DPW approval

The minimum pipe diameter for this pipe material is greater than 15-inches. Circular reinforced concrete pipe and fittings shall meet the material requirements of ASTM C 76 as modified herein. For design purposes, bedding shall be Class "D" bedding as defined by the American Concrete Pipe Association. Maximum trench widths shall be as indicated in the Standard Details. The pipe class, when designated on the Plans, is in accordance with ASTM C 76 and indicates the external load crushing strength.

a. Portland cement shall be Type II in accordance with ASTM C 150.

b. Coarse aggregate for concrete shall consist of hard, durable particles of crushed limestone which shall conform to the requirements and tests specified in ASTM C 76.

c. No elliptical reinforcement will be permitted.

d. Longitudinal reinforcing steel shall extend to within 3/4 inch of the terminal faces of the pipe, whether barrel, bell or spigot. Longitudinal bars shall be bent or crimped to provide full cover at the bell.

e. Minimum concrete cover over all reinforcement shall be 3/4 inch, except where the groove intrudes into the spigot.

f. The circumferential steel shall terminate in at least one full circular ring of the same size as is in the barrel of the pipe at both ends of pipe; viz. in both bell and spigot. This hoop shall be no more than 1 inch from the terminal face of the pipe unit. Spacing of circumferential steel in bell and spigot ends shall not be more than 1 inch.

g. Pipe shall have bell and spigot ends with rubber gasket joints meeting material requirements of ASTM C 361. Joints may be either steel and rubber or concrete and rubber. For pipe 24-inch and larger with steel and rubber joints, the outside of the joint shall be protected by use of a diaper filled with cement grout or other protective methods approved by the Engineer and the inside of the joint filled with mortar or other approved material.

h. Rubber gaskets, whether used in conjunction with steel joint rings or concrete ends, shall be the sole element depended upon to make the joint watertight under all conditions, including movement due to expansion, contraction, and normal settlement. Joints shall be made according to the manufacturer's recommendations.

i. Concrete Y-branches or tee fittings and bends shall be fabricated and assembled in the manufacturing plant. The fabrication of Y-branches or tees and bends shall be to the angle and radius shown and the interior shall permit the smooth and even flow of liquid.

j. Pipe and fittings shall be furnished with an exterior coating(s) of a flexible two part coal tar epoxy waterproofing coating having a finished thickness of at least 26 mils and suitable for field repair if damaged. The waterproofing coating shall be Bitumistic 300-M as manufactured by Koppers Company, Inc. or approved equal. Coating shall be applied in accordance with the manufacturers recommendations.

k. Concrete pipe manufactured by the dry cast (packerhead) process is not acceptable.

4. Ductile Iron Pipe (DIP) and Fittings

a. Ductile iron pipe (DIP) and fittings shall be as specified in Section 02551.02 except the minimum working pressure specified therein will not apply. Pipe class to be as shown on the Plans.

b. Ductile iron pipe and ductile iron shall be cement-lined in accordance with AWWA C 104, double thickness. This lining shall be sealed with a bituminous seal coat. The outside surfaces shall be bituminous coated.

5. Pipeline Plugs

Pipeline plugs shall be rubber gasketed or ribbed, watertight, airtight to the extent required by air testing requirements of this Section, cannot be dislodged by hydrostatic pressure (internal or external), and of an approved design.

6. Controlled Settlement Joint for cleanout

Construct per County standard details. Manufactured by Plastic Trends or equal, meeting ASTM D 3034 and ASTM F 1336.

02561.03 EXECUTION

A. Preparation

1. Trench excavation, backfill, and compaction, and pipe bedding and haunching shall be as specified in Section 02250.

2. The pipeline trench excavation shall be dewatered sufficiently to allow pipe joints to be made under dry conditions. No joint shall be made under water.

3. No pipe shall be laid upon a foundation into which frost has penetrated, nor at any time when there is danger of ice formation or frost penetration at the bottom of the excavation. In freezing weather, open trench length shall be kept to a minimum and the excavation promptly backfilled after the pipe has been installed.

4. Each pipe shall be bedded on a solid foundation acceptable to the Engineer. Bell holes shall be dug sufficiently large to insure that joints are properly made and the pipe is firmly bedded for the full length of the barrel.

B. Pipe Installation

1. All pipe shall be installed in accordance with the recommendations of the pipe manufacturer and as specified herein. These recommendations shall include maximum trench width, if more restrictive than that shown in the Standard Details; bedding requirements; backfill material and compaction, where applicable. In addition, the following shall apply unless otherwise noted:

    a. Polyvinyl chloride (PVC) pipe shall be installed in accordance with the Standard Details.

    b. Reinforced concrete pipe (RCP) shall be installed in accordance with the Standard Details and the recommendations of the Concrete Pipe Association.

    c. Ductile iron pipe (DIP) shall be installed in accordance with the Standard Details the recommendations of the Ductile Iron Pipe Research Association.

2. Proper and suitable tools and appliances for safe and convenient handling and joining of pipes shall be used.

3. Pipe shall be carefully handled and lowered into the trench. Pipe shall be installed with special care to insure that each length abuts against the next to produce no shoulder or unevenness of any kind along the inside bottom half of the pipeline. No wedging or blocking will be permitted in installing any pipe unless directed by written order or permission in writing is obtained from the Engineer.

4. No pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place. Care shall be used to assure watertightness and prevent damage to, or disturbing of, the joints during the refilling process. After pipes have

been installed and joints have been made, there shall be no walking on or working over the pipe, except as may be necessary in tamping the backfill material, until the backfill is at least 2 feet over the top of the pipe.

5. The pipes shall be thoroughly cleaned before being installed and shall be kept clean until acceptance of the completed work. Open ends of all pipelines shall be provided with a stopper carefully fitted to keep dirt and other substances from entering. This stopper shall be kept in the end of the pipeline at all times when installation is not in progress.

6. Whenever a pipe requires cutting, to fit into the line or bring it to the required location, the work shall be done in a manner that leaves a smooth, square end. Cut PVC pipe ends shall have burrs removed and the end beveled to match factory bevel. Field spigots shall be stop-marked with a felt tip marker or wax crayon for the proper length of assembly insertion.

7. Jointing Pipe

   a. Before any joints are made in the trench, the Contractor shall demonstrate to the Engineer by making a sample joint that methods he will employ conform with the Specifications, will secure a watertight joint, and that the workmen whom he intends to use for this work are familiar with the requirements for making proper joints.

   b. Other methods of jointing pipe will be given consideration by the Engineer, provided the Contractor furnishes evidence that the proposed method is equal to or better than the specified methods, and further, provided that the proposed method has been successfully used and that the joint has previously been manufactured by the company from whom the Contractor proposes to purchase pipe.

C. Sanitary Sewer Abandonment

Sanitary sewers will be abandoned according to Chapter 7 of the Design Manual and Anne Arundel County Standard Details for Sewer Construction.

D. Sanitary House Connections

1. Sanitary house connection branch fittings shall be located where designated by the Engineer. Short pieces of sewer pipe shall be field-cut to meet this condition. The Contractor shall have available at the construction site factory approved equipment to machine and adapt the field-cut end to standard couplings and jointing materials.

2. Concrete for the support of Y-branches and bends shall be placed as shown in the Standard Details, or as directed.

3. All sewer house connections shall be installed at a 2% grade unless otherwise directed.

4. Sewer house connections shall be constructed to terminate at a right angle to the property line unless otherwise noted on the Plans. Ends at lots shall terminate in a standard cleanout as shown on the Standard Detail and shall be plugged, braced, and marked at ground surface by a board extending from the house connection pipe to 3 feet, more or less, above finished grade in accordance with the Standard Detail. Cleanouts at undeveloped lots shall be protected with orange safety fencing (1.5 feet in all directions, with cleanout in center of square) and provided with a watertight plug. The location shall be marked at the ground surface by a 2" x 6" board extending 3 feet, more or less, above finished grade in accordance with the Standard Detail. Plugs shall be watertight and braced so as not to be dislodged.

5. Abandonment of Existing Sanitary Service Connections

   a. Sewer connection not used must be abandoned as close to the main as possible to avoid future damage. Dig down at lateral connection, cut lateral, cap end at main and encase cap with 6-inches of concrete. Form a box around the concrete and embed in bentonite. Refer to Standard Details for abandonment detail.

   b. Cut cleanout 2-feet below grade and place a concrete plug.

02561.04 METHOD OF MEASUREMENT

A. Sanitary Sewers

Measurement for furnishing and installing sanitary sewers will be made horizontally along the centerline of the pipe for each size and type of pipe without deduction for wye or drop connections. The inside lengths of manholes and junction chambers will be deducted.

B. Sanitary House Connections

Measurement for furnishing and installing sanitary house connections will be made horizontally along the centerline of pipe for each size and type of pipe from the centerline of the sewer to the end of the house connection without deduction for wyes, bends, cleanouts, plugs, or other fittings.

02561.05 BASIS OF PAYMENT

A. General

1. Payment will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to complete

the work as shown, and specified, in strict accordance with the Contract Documents, and accepted by the Engineer.

2. The price(s) bid for furnishing and installing sanitary sewers and sanitary house connections shall include trench excavation, backfill, compaction, and incidental items as specified in Section 02250.

3. Payment will be made for contingent items when ordered by the Engineer. Payment will be as specified in Sections 02951, 02952, 02953, 02954, 02955, 02956, and 02957.

B. Sanitary Sewers

Payment for furnishing and installing sanitary sewers, complete and operational, will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include furnishing and installing of all pipe, fittings, plugs, stoppers, and jointing materials; connection to existing pipelines, structures, or manholes; testing; and all other incidental items of work necessary to satisfactorily complete and make the sanitary sewers operational.

C. Sanitary House Connections

Payment for furnishing and installing sanitary house connections, complete and operational, will be made per linear foot of the size and type of pipe installed. The price(s) bid shall include furnishing and installing all pipe, fittings, cleanouts, plugs, and safety fencing; connection to sewer branch fittings; testing; and all other incidental items of work necessary to satisfactorily complete and make the sanitary house connection operational.