

SECTION 33 31 11

SANITARY SEWER GRAVITY MAINS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section Includes Installation of:
 - 1. Pipe and fittings for sewer gravity mains.
 - 2. Gasket materials, couplings and other gravity main appurtenances.

- B. Related Requirements:
 - 1. CFPUA Material Specification Manual (MSM).
 - 2. Section 01 50 00 – Bypass Pumping.
 - 3. Section 03 05 00 – Concrete.
 - 4. Section 31 23 34 – Excavation, Trenching, Dewatering and Backfilling.
 - 5. Section 33 01 12 – Identification for Utilities Piping
 - 6. Section 33 14 22 – Testing of Gravity Sewer Mains and Manholes.
 - 7. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.
 - 8. Section 33 05 07.13 – Utility Horizontal Directional Drilling.
 - 9. Section 33 05 07.23 – Jacking and Boring Pipe Construction.

1.2 REFERENCE STANDARDS

- A. American Water Works Association:
 - 1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 2. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 3. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - 4. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings.
 - 5. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.
 - 6. AWWA C153 – Ductile-Iron Compact Fittings.
 - 7. AWWA C600 – Installation of Ductile Iron Mains and Their Appurtenances.
 - 8. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
 - 9. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution.
 - 10. AWWA C906 – Polyethylene Pressure Pipe and Fittings, 4-In. Through 65-In. for Waterworks.

- B. ASTM International:
 - 1. ASTM D698 – 12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 2. ASTM D1557 – 12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 3. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

4. ASTM D2241 – Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
6. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Section 01 30 00 – Administrative Requirements
- B. Coordination:
 1. Coordinate Work of this Section with connection to CFPUA and trenching.
 2. The existing system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Wastewater Collections ORC, Utility Services Division for removing from service those mains that will be affected.
 3. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
 4. The Contractor shall, at least two (2) business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.
 5. Bypass pumping and hauling operations may be required to interrupt service. A bypass pumping plan shall be submitted in accordance with Section 01 50 00 – Bypass Pumping. Shutdowns must be held to a minimum in both number and duration.

1.4 SUBMITTALS

- A. Section 01 33 00 – Submittals: Requirements for submittals.
- B. Product Data/Source Quality:
 1. Manufacturer's literature and specifications, as applicable, for products specified in this Section.
 2. Shop test results and inspection data, certified by manufacturer.
- C. Testing Procedures:
 1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER's approval prior to commencing testing.
- D. Manufacturer Instructions:
 1. Submit manufacturer's instructions for handling, storing, and installing pipes and appurtenances.
- E. Manufacturer Certificates:
 1. Certificates of compliance with referenced standards, where applicable, including those of AWWA and others required by Engineer.
- F. Field Quality Control Submittals:
 1. Results of Contractor furnished testing and inspections.

1.5 CLOSEOUT SUBMITTALS

- A. 01 70 00 – Execution and Closeout Requirements
- B. Project Record Documents:
 - 1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.
 - 2. Record actual locations and elevations of piping mains, valves, hydrants, manholes, service laterals, cleanouts, connections, thrust restraints, and other utilities found and not indicated on design plans.
- C. Operations and Maintenance Data:
 - 1. Furnish in operations and maintenance manuals complete data for materials in accordance with 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

- A. Qualifications: Company specializing in manufacturing products specified in the CFPUA Materials Specification Manual.
- B. Perform Work according to AWWA and PVC Pipe Association standards.
- C. The bell ends of pipe shall face the direction of laying unless otherwise directed by the Engineer, for lines on appreciable slope, the Engineer may require that bell ends face upgrade.
- D. All stainless-steel fasteners shall be 316.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 – Product Requirements.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Storage:
 - 1. Store materials according to manufacturer instructions.
 - 2. Block individual and stockpiled pipe lengths to prevent moving.
 - 3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
 - 4. Store PE and PVC materials out of sunlight.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.8 SITE CONDITIONS

- A. Field Measurements:
 1. Verify field measurements prior to fabrication.
 2. Indicate field measurements on Shop Drawings.
 3. A minimum of ten-foot utility easement must be provided along the frontage of all lots and as shown for new developments.

1.9 WARRANTY

- 1. Section 01 70 00 – Execution and Closeout Requirements.

PART 2 PRODUCTS

2.1 CFPUA MATERIALS SPECIFICATION MANUAL

- A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

| MSM Section | Material |
|--------------------|-----------------------------------|
| A | Pipe |
| B | Fittings and Accessories |
| C | Joint Restraints |
| I | Castings & Aluminum Access Covers |
| K | Miscellaneous |
| L | Electrical |
| M | Coatings and Sealants |
| N. | Concrete |

2.2 MATERIALS & ACCESSORIES

- A. Bedding, Cover, and Backfill:
 1. As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.
- B. Manholes:
 1. As specified in Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 70 00 – Execution and Closeout Requirements.
- B. Identify required lines, levels, contours, and datum locations.

- C. Determine exact location and size of water mains, valves, hydrants, and appurtenances from Drawings.
- D. Verify location and elevation of existing facilities prior to excavation and installation of proposed gravity sewer mains and services.

3.2 PREPARATION

- A. Section 01 35 00 – Special Procedures
 - 1. Pre-construction Site Audio/Video Inspections and Photography:
 - 2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.
- B. Section 01 70 00 – Execution and Closeout Requirements.
- C. All materials, unless otherwise directed, shall be unloaded as nearby as possible to the location of installation by the Contractor. Materials shall be handled with care to avoid damage.
- D. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.
- E. All PVC pipe, upon delivery to the site and until such time as it is placed in the trench, shall be shielded from the weather and direct sunlight to prevent pipe deterioration.
- F. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.
- G. Pipe Cutting:
 - 1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
 - 2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
 - 3. Grind edges smooth with beveled end for push-on connections.
- H. Remove scale and dirt on inside and outside before assembly.

3.3 INSTALLATION

- A. Placement: As specified in Section 31 23 34.01 – Trenching, Excavation, Dewatering and Backfilling.
 - 1. All mains shall be laid and maintained at the required lines and grades with fittings and appurtenances at the described locations. All pipe shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty-six (36) inches unless otherwise shown or approved by engineer. Grade lines shall be set by the Contractor. Realignments must be approved by the

Engineer. The Contractor shall have suitable survey equipment on the site at all times.

2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

B. Pipe and Fittings

1. Handle and assemble pipe according to manufacturer instructions.
2. Install pipe and fittings in strict conformance with AWWA C600 and C605.
3. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600, C605 or AWWA Manual of Practice M23.
4. Prevent foreign material from entering pipe during placement and Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
5. Allow for expansion and contraction without stressing pipe or joints.
6. Solvent epoxy cementing, electro-fusion couplings and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.

C. Push-On Joints

1. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
2. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
3. The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
4. When deflection is required the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.

D. Mechanical Joints

1. The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.
2. The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.

3. The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.
- E. Polyethylene Encasement
1. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:
 2. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
 3. Comply with AWWA C105.
- F. Transition from One Type of Pipe to Another
1. Provide necessary adapters, special, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
 2. Sewer service laterals shall be connected in accordance with Cape Fear Public Utility Authority Standard Drawing Details.
 3. No flexible couplings shall be used.
- G. Pipe Restraint
1. Provide restraint on ductile iron piping systems where shown or indicated in the Contract Documents below but not limited to:
 - a. All ductile iron pipe aerial crossings and carrier pipes with any joints supported on pier or inside an encasement pipe shall require the use of a rigid joint restraint.
 - b. All ductile iron pipe carrier pipes installed with joints inside an encasement pipe must utilize rigid restrained joints.
- H. Service Connections
1. In new sewer construction, PVC service connections shall be made by means of a wye, DIP service connections shall be made by means of a wye or a tee. All joints connected to the wye unit shall remain flexible.
 2. Service pipe for all properties shall be laid to the property line and plugged, as shown on the Standard Details. All sewer services shall be installed perpendicular to the main and terminate at the Right-Of-Way line. Sewer services in Cul-De-Sacs are required to be perpendicular or must originate in end of line manhole and terminate at Right-of-Way, no acute angles to downstream main.
 3. All services tying into ductile iron mains shall be constructed of class 50, DIP with Protecto 401 ceramic epoxy lining.
 4. Cleanouts shall be located a minimum of 6 feet from all property corners. Water meter boxes are to be a minimum of 5 feet from the property corner.
 5. In cases of extra depth where service pipe cannot be laid on a continuous grade to the property line, the Contractor shall construct risers as shown on the Plans. When pipe cannot be adequately supported on undisturbed earth, it shall be supported on a concrete cradle.
 6. Trench and backfill or bore to install lateral. Bore shall accommodate pipe without void around pipe. Bore shall be at least 5' from the edge of pavement or back of curb on either side of the roadway unless approval to the contrary is given by the engineer.
 7. Connect lateral with wye.

8. Install sewer lateral with plug and one-way clean-out. Clean-out shall consist of a ¼ bend long sweep, with the necessary vertical 4" Schedule 40 PVC/DWV pipe stack. The clean-out plug shall be installed into a cast iron box and cover.
- I. Service Reconnections
 1. Service reconnections require adapters for all joints that will not connect properly with ordinary factory joints. Approved pipe cutting methods shall be used to cut any pipe required for the connection. No mortar or collars shall be used on reconnections unless specifically approved by the Engineer.
 2. No flexible couplings shall be used.
 - J. Joining New Pipe to Old Pipe
 1. Joining PVC pipe to existing vitrified clay pipe requires an adapter approved in the Cape Fear Public Utility Authority's Materials Specification Manual for all joints that will not connect properly with ordinary factory joints. Approved pipe cutting methods must be used to cut any pipe required for the connection. No mortar or collars shall be used for such connections unless approved by the Engineer.
 2. No flexible couplings shall be used.
 - K. Joining Pipe to Manholes or Other Structures
 1. All manhole connection holes shall be core drilled with a maximum hole diameter not to exceed one and a half times the pipe diameter.
 2. Approved standard groutable PVC-to-manhole fitting approved in the Cape Fear Public Utility Authority's Materials Specification Manual, or a flexible rubber boot may also be used at the manhole connection. The connection at the manhole wall shall be flexible and watertight. Any annular space inside the manhole at the connection shall be filled with approved caulking material or joint filler.
 3. Pipe connections to existing manholes shall be made so that finished work will conform, as nearly as possible to the essential requirements for new manhole construction, as specified above. Drop connections on existing manholes shall be strengthened by use of eight #6 pins, placed around the drop elbow and tee, or inside PVC drops may be used.
 4. Provide a minimum of six (6) inches of separation between edge of manhole core holes and manhole barrel joints. Provide a minimum six (6) inches separation between edges of core holes. Coring the manhole cone section is not allowed.
 - L. Sewer Manhole Inserts
 1. Sewer manhole inserts are required at all manholes. Stainless steel sewer manhole inserts are required at manholes located in traffic areas.
 - M. Pipe Markers: According to CFPUA Details and Material Specification Manual.

3.4 FIELD QUALITY CONTROL

- A. Section 01 70 00 – Execution and Closeout Requirements.
- B. Section 33 14 22 – Testing of Sanitary Sewer Mains and Manholes.

END OF SECTION