SECTION 02731

GRAVITY WASTEWATER SEWER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wastewater Sewer Gravity Pipelines.

B. Service Connection Piping.

C. Pipeline Testing.

1.02 RELATED SECTIONS

A. Trenching Backfilling and Compacting: Section 02221.

B. Cast-In-Place Concrete: Section 03300.

C. Grout: Section 03600.

1.03 QUALITY ASSURANCE

A. Source Quality Control:
   1. Shop Tests and Inspection:
      a. All material furnished by the Contractor shall be certified by the supplier for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by the supplier or the Contractor.

B. Disposition of Defective Material: All material found during the progress of the work, either before or after installation, to have cracks, flaws or other defects will be rejected by the Authority. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

C. All products installed within PennDOT (PDT) right-of-way shall be certified in accordance with PDT Publication 35 (Bulletin 15).

1.04 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A21.4, Cement-Mortar Lining for Cast Iron and Ductile-Iron Pipe and Fittings for Water.
   2. ANSI A21.10, Gray-Iron and Ductile-Iron Fittings, 2 through 48 inches, for Water and Other Liquids.
   3. ANSI A21.11, Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
   4. ANSI A21.50, Thickness Design of Ductile-Iron Pipe.
   5. ANSI A21.51, Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.

B. American Society for Testing and Materials (ASTM):
   1. ASTM D2321, Underground Installation of Flexible Thermoplastic Sewer Pipe, Rec. Practice for.
   2. ASTM D2564, Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
   3. ASTM D3034, Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings, Spec.
   4. ASTM D3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals, Spec. for.
   5. ASTM F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe, Spec. for.
   6. ASTM F679, Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

C. American Water Works Association (AWWA):
   1. AWWA C600, Installation of Gray and Ductile Cast-iron Water Mains and Appurtenances.

D. Federal Specifications:
   1. Fed. Spec. SS-S-210A, Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.05 SUBMITTALS

A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cut or other data as required to provide a complete description of piping and piping specialties.

B. Certificates:
   1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.

2. Manufacturer's sworn certification that pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Transport, handle and store pipe materials and other Products specified herein in a manner recommended by the respective manufacturers to prevent damage and defects.

1.07 SITE CONDITIONS

A. Environmental Requirements:
   1. Keep trenches dewatered until pipe joints have been made and concrete cradle or encasement, if any, have cured.
   2. Under no circumstances lay pipe in water or on bedding containing frost.
   3. Do not lay pipe when weather conditions are unsuitable, as determined by the Authority, for pipe laying work.

PART 2 - PRODUCTS

2.01 SEWER PIPE AND FITTINGS

A. For pipe joints, use rubber gaskets suitable for conveying domestic sewage.

B. Ductile Iron (DIP): Use only where approved by Authority.
   1. Pipe: ANSI A21.50 and ANSI A21.51.
   2. Wall Thickness Class (Buried): Class 52.
   3. Cement Mortar Lining: Conforming to ANSI Specification A21.4 or AWWA C104, Latest Edition, except the thickness of linings should not be less than the following:
      a. 3" through 12": 1/8"
      b. 14" through 24": 3/16"
   4. Fittings: Gray iron or ductile iron ANSI A21.10. Fittings larger than 48 in. AWWA C100 Class B.
   5. Joints:
      a. Rubber-Gasket Joints (Buried): ANSI A21.11.
         1) For buried pipe installation, provide push-on joints except where other types of joints are required by the Authority.
   6. Pipe and Fittings Coating: Factory coated inside and out with bituminous material; minimum 1 mil dry thickness. Bituminous material and finished coat conforming to seal coat requirements in ANSI A21.4.

C. Polyvinyl Chloride Pipe (PVC):
   1. Pipe: Type PSM SDR-35, ASTM D3034 or ASTM F679 for pipe over 15" diameter.
   2. Fittings: Conforming to same applicable ASTM Specification requirements for pipe.
   3. Joints: Push-on with elastomeric gasket, ASTM D3212; and ASTM F477 for gasket specifications.

D. PVC Waterstop for connection to existing manhole: Gasket type waterstop composed of virgin polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter.

E. Pipe Couplings: Solid sleeve couplings shall be used wherever possible. Flexible couplings of clamped design with virgin PVC coupling and two type #305 stainless steel bands, such as manufactured by Fernco Joint Sealer Co. may be used in lieu of solid sleeve couplings only as necessary and with approval of the Authority. Use for repairs to existing sanitary sewers.

2.02 SERVICE CONNECTION PIPE AND FITTINGS

A. Ductile Iron Pipe (DIP): As specified for Sewer Pipe and Fittings; 6-inch diameter.

B. Polyvinyl Chloride Pipe (PVC): As specified for Sewer Pipe and Fittings; 6 inch diameter.

C. Saddles (PVC): Correctly contoured for outside diameter of pipe and incorporating ring gasket bell outlet.
   1. Wye or tee saddle of same material as specified previously for Sewer Pipe.
   2. Solvent Cement: ASTM D2564.

D. Pipe Plugs: Designed for permanent installation and removable. Obtain Plugs for various types of pipe used from the respective pipe manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Earthwork: Perform earthwork for sewer installation as specified in Trenching, Backfilling, and Compacting: Section 02221.

3.02 PIPE LAYING

A. General: All pipe shall be laid to a uniform line and grade between manholes, socket ends upgrade, with a firm and even bearing along the barrel of the pipe, close joints and smooth invert. The spigot end of the pipe is to be centered in, shoved tight and secured against the bell or socket of the previously laid pipe. The interior of each pipe shall be cleaned of all excess joint and foreign material before the next pipe is laid. The pipe shall be laid in the bedding materials as specified in Section 02221. Pipe-laying shall commence at the lowest point and proceed upgrade. At the close of each day's work, and at such other times when pipe is not being laid, the open end of the pipe shall be protected with a close fitting stopper.

B. Joints: Make joints in joining of pipe materials specified under PART 2 and not specifically covered for installation under PART 3 of this Specification, in strict accordance with manufacturer's installation instructions.

C. Laying Specified Types of Plastic Pipe: Installation and joint assembly according to ASTM D2321.

D. Laying Ductile Iron Pipe: Installation and joint assembly according to AWWA C600, and as follows:
   1. Where necessary to field cut pipe use approved pipe cutter, milling cutter or abrasive wheel saw.
   2. Make joints as specified previously under "Joints."

E. Construction Control: The trench and every pipe laid shall be tested as to grade and alignment. The use of laser equipment is required. Contractor shall provide verification of grade as work progresses. Unless otherwise approved by the Authority, the pipe grade for laterals shall be a minimum of 1/4 inch per foot. Pipe not laid to proper line and grade will be removed and reconstructed at the Contractor's expense.

F. Variations: The Authority reserves the right to vary the line and/or grade from that shown on the drawings for pipe lines and manholes when such changes may be necessary or advantageous.

G. Handling of Sewer Line Materials into Trench: Proper implements, tools and facilities satisfactory to the Authority shall be provided and used by the Contractor for the safe and convenient prosecution of the work. All pipe, fittings, jointing materials, etc. shall be carefully lowered into the trench piece-by-piece by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to sewer line materials and/or workmen. Under no circumstances shall such materials be dropped or dumped into the trench.

H. Pipe Clearance in Rocks: Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below and on each side of all pipe and fittings. The specified minimum clearance is the minimum clear distance, which will be permitted between any part of the pipe and/or fitting being laid and any part, projection or point of such rock, boulder or stone.

I. Connections to Existing Manholes or Structures: Cut required opening or openings by core boring so as to prevent cracking and spalling concrete. Make openings of sufficient size to accommodate pipe with PVC Waterstop installed and one inch of annular grout space. Grout annular space using Non-Shrink and Non-Metallic Grout. Make connection watertight. Form a new invert channel in the existing manhole base to properly conduct the flow through the existing manhole. Do not permit ground water, surface water or debris to enter the existing facilities through the new connection.

J. Drop Connections: Make drop connections where indicated on the Drawings, where drop in invert is two feet or more or as required by the Authority. Use same pipe material used to construct the main from which the drop connection is made. Construct drop connection in accordance with design shown on the Standard Details.

K. Concrete Cradle and Encasement:
   1. Preparation: Prior to the formation of cradle or encasement, if any, temporary supports consisting of timber wedges and solid concrete bricks or cap blocks shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at not more than two locations, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.
   2. Placing: After jointing of the pipe has been completed, concrete shall be uniformly poured beneath and on both sides of the pipe. Placement shall be done by the use of suitable equipment. The concrete shall be wet enough during placement to permit its flow, without excessive prodding, to all required points around the pipe surface. The width of cradle shall be such as to fill completely the trench width. In case of extremely wide trenches, concrete encasement may be confined above the top of the pipe to a narrower width but in no case shall it be less than the width of trench required for the size of pipe being used. Before depositing concrete, the space within the limits of the pour shall have been cleared of all debris and water. Water shall not be allowed to rise adjacent to, or flow over, concrete deposited for less than 24 hours. Concrete shall be protected from the direct rays of the sun and kept moist, by a method acceptable to the Authority, for a period of seven days or until backfilling is begun. In no case shall backfilling begin within 24 hours of the time of placing and the Authority shall have strict control of the rate of backfilling.
   3. Concrete: 3000 psi per requirements of Section 03300.

3.03 SERVICE CONNECTIONS

A. Fittings (Wyes and Tee-Wye branches, risers and bends) and service pipe shall be provided in strict accordance with these specifications and any and all practices and precautions required for the sewer main are equally applicable to the service connections from the sewer to the right-of-way line, or to a location designated by the Authority. The Contractor shall place a 2" x 2" wooden marker at the end of each sewer lateral. The marker shall be one piece and may not be constructed from two or more smaller pieces. The marker shall extend from the lateral invert to 12" above grade.

B. The Contractor shall submit to the Authority, at the Project completion, all as-built information which shall include: manhole run, station from downstream manhole, length from centerline of sewer, invert elevation at the termination point of lateral and the lot number, address or property owner's name for whom the lateral is provided.

C. If rock is encountered during the installation of the lateral, the Contractor shall extend the lateral to the required distance as specified elsewhere in these specifications, and he shall provide a minimum "rock-free" distance of one foot beyond the end of the lateral. No lateral shall be "butted" against rock.

D. Plugs: Close free ends of branches and service connections with a carefully fitted plug. Type of plug used and method of installation to Authority's approval. Installed plugs shall successfully pass Line Acceptance Tests.

E. The Authority may require the installation of underground electronic marker balls at the end of laterals. Such marker balls will be provided to the Contractor by the Authority. Contractor shall be charged a fee for each marker ball at the Authority's actual cost per ball.

3.04 TESTS

A. Deflection Test
   1. Deflection tests shall be successfully performed on all PVC pipelines by means of a mandrel test.
   2. The Contractor shall utilize a 5% deflection mandrel to ensure that PVC pipe allowable deflection during installation has not been exceeded. Mandrel test shall be conducted no earlier than 30 days after compaction of backfill of the test section of pipe.
   3. Mandrel Test Procedure
      a. Completely flush the line making sure the pipe is clean of any mud or debris that would hinder the passage of the mandrel.

b. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line. (A nylon ski rope is recommended).
c. After the rope is threaded through the line, connect the pull rope to the mandrel and place the mandrel in the entrance of the pipe.
d. Connect a retrieval rope to the back of the mandrel to pull it back if necessary.
e. Remove all the slack in the pull rope and place a tape marker on the rope at the ends of the pipe.
f. Draw mandrel through the sewer line. If any irregularities or obstructions are encountered in the line, corrective action shall be taken as required.
g. If a section with excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage; if any damaged pipe is found, it shall be replaced at the Contractor's expense; if pipe is not damaged, replace and thoroughly tamp the haunching and initial backfill; replace remainder of backfill.
h. Re-test this section for deflection.

B. Leakage Tests:
1. Air Testing: The Contractor shall test each section of sewer between manholes and all laterals to the limit of this contract using low-pressure air. Testing shall not be performed for a period of thirty (30) days after backfilling has been completed, and not prior to completion of construction of all other utilities within the cartway**.** The Contractor may, at his option, test the section of sewer for his own purposes, prior to that time; however, the requirements of this subsection shall not be deemed to be completed until the lines have been fully tested as per this section.
2. A minimum of two minutes shall be provided to allow equilibrium of the air temperature with pipe wall before test readings shall commence. The rate of air loss shall be determined by measuring the time interval required for the average internal pressure to decrease by 1.0 psig.
3. The initial test pressure to be developed in the sewer and laterals shall be 5 psi.
4. The pipe shall be considered acceptable if the air loss rate does not decrease 1.0 psig over a minimum test period of 4 minutes.
5. If the above rate of leakage is exceeded, the Contractor shall, at his expense, determine source of leakage and make all necessary corrections and retest.
6. The Contractor shall submit to the Engineer for approval the detailed test procedure and list of test equipment he proposes to use prior to testing.

C. Infiltration:
1. After the air testing described in the preceding paragraph has been completed by the Contractor, regardless of any indications of the test results made by the Authority, the Authority reserves the right to perform field investigations, prior to final written acceptance of each sewer run by the Authority during the maintenance period specified elsewhere in these specifications, to establish the leakage of groundwater into the sewer and laterals constructed under this contract.

2. Should the leakage exceed 100 gallons per day per inch diameter per mile of pipe for any section, the Contractor shall, at the direction of the Authority, and at no cost to the Authority, perform any additional testing or corrective work required to reduce the infiltration in each manhole run from those lines installed by the Contractor to less than 100 gallons per day per inch diameter per mile of pipe. This leakage applies to each manhole run separately and should not be construed to mean total leakage in the total system. The scope of this corrective work shall include, but not be limited to, cleaning, televising and testing the sewer and laterals to the limits installed by the Contractor, to include testing and grouting of joints, excavation and replacement of faulty or damaged portions of the work, and all final restoration.

D. Closed Circuit Television Inspection

1. The Township will perform closed circuit television (CCTV) inspection of the sanitary sewer lines no sooner than 30 days after successful completion of mandrel and air testing and after completion of base paving and roadway stabilization is obtained.
2. Any deficiencies noted during the CCTV inspection shall be corrected by the Contractor.
3. The Authority/Township reserve the right to conduct any and all required tests, including mandrel and air tests, to determine that corrective measures taken as a result of deficiencies noted during the CCTV inspection meet these standard specifications.
4. The Township reserves the right to perform CCTV inspection again at the end of the 18-month maintenance period.
5. The Authority will charge an hourly rate of $230.00 for Closed Circuit TV and High Pressure Jetting (CCTV/HPJ) services. The CCTV/HPJ hourly rate shall include two operators, all necessary equipment, and a 5% administrative processing fee. The service will require a two (2) hour minimum charge per site visit, with charges beginning at time of arrival on site to departure from site. Should work be required beyond normal business hours of 8:00AM and 4:00PM - Monday through Friday, the hourly rate will increase to $285.00 to cover labor overtime costs only. In the event traffic control services are required to conduct the CCTV inspection in accordance with PADOT publication 213 “Temporary Traffic Control Guidelines”, the Owner/Developer will be responsible for the full cost of flagging services.

E. Acceptance: Observation of successful testing of manholes and sewers by the Authority does not constitute acceptance of the system or any portion thereof. Only upon final inspection by the Authority, and upon written acceptance of same will the system or portion thereof be considered substantially completed. Upon such acceptance, the warranty period as specified for the manholes and sewers will commence.

1. If, during this final inspection, any irregularities are observed, the condition must be corrected at the Contractor’s expense prior to acceptance.

END OF SECTION