

**GREATER HAZLETON JOINT SEWER AUTHORITY**  
**STANDARD CONSTRUCTION SPECIFICATIONS**

**Intent of Specifications:** The specifications are for the purpose of illustrating the general character and extent of the work and are subject to such modifications as may be found necessary or advisable either before or during the prosecution of the work, and the Authority shall conform to and abide by whatever supplementary drawings and explanations may be required by the Greater Hazleton Joint Sewer Authority (hereinafter "Authority") for the purpose of illustrating the work. Should any incidental work or materials are necessary for the proper carrying out of the intent of the specifications, either directly or indirectly, the Authority agrees to perform all such work and furnish and install all such materials as if the same were fully specified.

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## SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING

### PART 1 - GENERAL

#### 11 SECTION INCLUDES

- A. Trench Excavation.
- B. Bedding and backfilling.
- C. Surface Restoration.

#### 12 DEFINITIONS

- A. Subgrade: Trench bottom prepared as specified to receive pipe bedding, concrete cradle or concrete encasement or the bottom of excavations prepared to receive pipe line structures.
- B. Bedding: That stone material placed under the pipe.
- C. Haunching: That stone material placed from pipe bottom to the pipe centerline.
- D. Initial Backfill: That stone material from the pipe centerline to twelve (12) inches above top of pipe.

#### 13 REFERENCES

- A. American Association of State Highway and Transportation Officials:
  - 1. AASHTO T99 - Moisture-Density Relations of Soils, Using a 5.5 lb. Rammer and a 12 in. Drop.
  - 2. AASHTO T191 - Standard Method of Test for Density of Soil In-Place by the Sand Cone Method.
- B. The "PennDOT Sections" noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408 latest version. The references pertain only to materials, construction equipment, methods and labor. The payment provisions do not apply to work to be performed under this Contract.
- C. All workmanship, materials and contractor's responsibility for all work in and adjacent to PennDOT right-of-way shall be in compliance with PennDOT regulations, specifications and requirements. Where information in the specification is contradictory to current PennDOT requirements, PA requirements shall govern.

- D. Commonwealth of Pennsylvania Department of Transportation Specifications.
  - 1. PennDOT 408, Section 703 Aggregates.
- E. State Code: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 459, Occupancy of Highways by Utilities, July 1989 (PennDOT Chapter 459).
- F. State Publication: Commonwealth of Pennsylvania, Pennsylvania Code, Title 67, Transportation, Department of Transportation, Chapter 203, Work Zone Traffic Control (PennDOT Chapter 203).

## PART 2 - PRODUCTS

### 21 MATERIALS

- A. Select Backfill: Excavated material free of cinders, ashes, refuse, vegetable or organic material, boulders larger than 6", rocks, stone, or other material which, in the opinion of the Authority, is unsuitable. If the excavated material is found to be unsuitable, the Contractor is required to backfill with suitable material at his expense.
- B. Aggregate Backfill, Bedding and Haunching: Fine aggregates and coarse aggregates conforming to AASHTO and PennDOT requirements, see plan for dimensions.
- C. Classification of Backfill, Bedding and Haunching Materials:
  - 1. Aggregate Backfill of trench bottoms over-excavated at direction of Authority to correct unstable trench bottom conditions: PennDOT 2A or as directed.
  - 2. Pipe Bedding and Haunching:
    - a. AASHTO M43 Gradation No. 7 or 8.
  - 3. Initial Backfill:
    - a. AASHTO M43 Gradation No. 7 or 8.
  - 4. Final Backfill:
    - a. Select Backfill: Unless otherwise noted on drawings.
- D. Underground Warning Tape:
  - 1. Printed polyethylene tape, three inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.
  - 2. Non-magnetic for ductile iron pipe.
  - 3. Magnetic for PVC and HDPE pipe.
  - 4. Provide for:

- a. Electric Power Lines, Cables, Conduit and Lighting Cables – RED
- b. Gas, Oil, Steam, Petroleum, or Gaseous Materials – YELLOW
- c. Communications, Alarm or Signal Lines, Cables or Conduit – ORANGE
- d. Potable Water – BLUE
- e. Reclaimed Water, irrigation, and Slurry Lines – PURPLE
- f. Sewers and Drain Lines – GREEN
- g. Sludge – BROWN

### PART 3 - EXECUTION

#### 31 TRENCH PREPARATION AND EXCAVATION

- A. The Contractor shall notify PA One Call (1-800-242-1776) in accordance with the regulations of the Act.
- B. General: Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated on the drawings and specified herein.
  - 1. Excavation shall be made by open cut, unless written permission to tunnel or bore is given by the Authority or is specifically outlined in the Specifications or shown on the Drawings.
  - 2. Trenches may be excavated and backfilled either by machinery or by hand as the Contractor may elect, provided, however, the Contractor shall use hand excavation where necessary to protect existing structures, utilities, or private or public properties and provided, further, that backfilling shall be done by hand to the extent hereinafter specified.
- C. Stripping, Storing and Restoring Surface Items: The Contractor shall remove all topsoil, paving, sub-paving, curbing, gutters, brick, paving block, granite curbing, flagging or other similar materials, and grub and clear the surface over the area to be excavated. He shall properly store and preserve such materials that may be required for future use in restoring the surface. The Contractor shall be responsible for any loss or damage to said materials because of careless removal or neglectful or wasteful storage, disposal, or use of the materials. Any excavated materials not required for backfill or restoration shall be disposed of by the Contractor at his expense.
  - 1. All materials which may be removed, including rock, earth and sand taken from the excavation, shall be stored, if practical, in the roadway or right-of-way or such other suitable place and in such manner as the Authority will approve.
  - 2. If more materials are removed from any trench than can be backfilled over the completed pipe or stored in the street, leaving space for traffic, the excess materials shall be removed and stored at a suitable site provided by the Contractor.
  - 3. The Contractor shall, at his own expense, bring back as much of the approved materials so removed as may be required to properly refill the trench or excavation.
  - 4. When directed by the Authority, the Contractor shall furnish such other suitable materials as may be necessary to properly refill the trench.

5. The Contractor shall restore all shrubbery, fences, poles or other property and surface structures, removed or disturbed as a part of the Work, to a condition equal to that before the Work began, furnishing all labor and materials incidental thereto, without any additional cost to the Authority.
6. The Authority may mark certain trees, shrubs, or other items that are not to be disturbed or damaged. In the event such items are disturbed or damaged, they shall be replaced or compensated for at the Contractor's expense.
7. Any tree which is approved by the Authority for removal shall be cut into four foot lengths and become the property of the Contractor and shall be removed from the site.

D. The Contractor must work around existing utilities. If the Contractor must repair or replace any damaged utilities, he must do so at his own expense.

E. Width of Trench: Pipe trenches shall be sufficiently true in alignment to permit the pipe to be laid in the approximate center of the trench. The trench shall be wide enough to provide a free working space on each side of the pipe.

F. Length of Trench:

1. No trench shall be opened more than 100 feet in advance of the pipe lines laid. Contractor shall provide all safety items such as sheeting, shoring and bracing.
2. The Contractor shall limit all trench openings to a distance commensurate with all rules of safety and the Erosion and Sedimentation Control Plan.
3. If the Work is stopped either totally or partially by his own accord or the direction of others, the Contractor shall refill the trench and temporarily repave or restore over the same at his expense and the trench shall not be opened until he is ready to proceed with the construction of the pipeline.

G. Pumping and Draining: The Contractor shall remove by pumping, draining, or otherwise, any water which may accumulate in the trenches and other excavations and shall build all dams and do all other work necessary to keep the trenches or other excavations as free from water as possible. All pumping operations are subject to Erosion and Sedimentation Control measures.

1. Where it is impractical to completely drain the trench, special pipe of jointing materials may be authorized at no additional expense to the Authority.
2. While the pipelines are being laid, the Contractor shall have sufficient pumping machinery ready for immediate use.
3. All surface waters shall be prevented from entering the open ditches or excavations by proper grading of the surface in the vicinity of the excavation.
4. Sediment laden water will be pumped to an appropriately located "Dirtbag" as shown on Erosion and Sedimentation Control Drawing.

H. Accommodations of Drainage: The Contractor shall keep gutters, sewers, drains and ditches open at all times so that the flow of storm or other waters shall not be obstructed. If

the material excavated from the trenches must temporarily extend over gutters or other waterways, it shall be the duty of the Contractor to plank or bridge over the gutters, without extra compensation, so that the flow of water is not impeded.

I. Protection of Utilities, Property and Structures: The existence and location of underground utilities as indicated on the Drawings is presented merely to serve as a notification that such utilities do exist in the general proximity of the work. Any utilities not shown, or not located as shown, shall not be cause of the Contractor to deny responsibility for their

protection and/or repair during construction.

1. The Contractor shall notify all utility companies in advance of construction, to include requesting the companies to establish location of their utilities, in accordance with Pennsylvania Act 287/172, as amended. Cooperate with agents of these companies during the progress of the work. Procedures for emergency action and repairs to utilities shall be established with the utility company prior to commencement of the work. During the course of his work, if the Contractor damages any of the aforementioned utilities, he shall immediately follow the procedure of emergency action and repair as established at their own expense. The Contractor shall determine the location of all utility lines on private property, with the assistance of the utility Authority when on private property.
2. Whenever the Contractor, during the progress of the excavation, shall uncover service pipes or lines, which because of injury or age are in poor condition, he shall immediately notify the proper authority in order that steps may be taken for replacement or repair. Locations of repairs, and the procedures of repairs that have been made shall be recorded by the Contractor.
3. The Contractor shall, at his own expense, sustain in their places, and protect from direct or indirect injury, all pipes, conduits, existing sewerage systems, septic tanks, tile fields, and other structures or property in the vicinity of his work, whether above or below the ground, or that may appear in the trench. He shall at all times have a sufficient quantity of repair pipe, timber and plank, chains, ropes, etc., on the ground and shall use them as necessary for sheeting his excavations and for sustaining or supporting any structures that are uncovered, undermined, endangered, threatened, or weakened, whether such structures are or are not shown on the Drawings.
4. Pipes and underground conduits exposed as a result of the Contractor's operations shall be adequately supported along their entire exposed length by timber or planking, installed in such manner that the anchorage of the supporting members will not be disturbed or weakened during the backfilling operation. Backfill of selected material shall be carefully rammed and tamped under and around the supports and all supports shall be left in place as a guard against breakage of the supported structure due to trench settlement. No additional payment will be due to the Contractor for material left in place nor for the labor of installing and maintaining supports.

J Where lines are to be constructed on rights-of-way or easements in open areas, the maximum width of trench at the top specified hereinbefore may be exceeded only if the construction is kept entirely within the limits of the right-of-way or easements and can be carried on without damage to adjoining property. The angle of slope shall be the angle at which the trench bank will stand without sliding.

K. In locations other than rights-of-way or easements, the Authority may, as warranted by working conditions, and where permitted by the Pennsylvania Department of Labor and Industry requirements, waive the requirements that the maximum width of trench at the top shall not exceed the dimensions specified hereinbefore.

### 3.2 PIPE BEDDING AND TRENCH BACKFILL

- A. Bedding and Haunching: The trench shall be excavated to a depth of six inches below the outside diameter of the pipe barrel, or deeper if so specified. The resultant subgrade shall be undisturbed, or compacted as approved by the Authority if disturbed. The bedding and haunching shall then be prepared by placing thoroughly compacted aggregate, shaped to conform to the bottom portion of the pipe or compacted against the bottom portion of

the pipe, to a vertical distance of three inches above the lowest outside surface of the pipe. Contractor is required to properly haunch the pipe before any additional backfilling is allowed.

**B Special Bedding:**

- 1 Concrete Cradle and Concrete Encasement: if concrete cradle and/or encasement is indicated on the Drawings or required by the Authority, the trench shall be excavated to a depth of twelve inches below the outside of the barrel of pipes. All of this excavation may be done by machine.
- 2 Unstable Subgrade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type or refuse, vegetable, or other organic material, or large pieces or fragments of inorganic material, which, in the opinion of the Authority, should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth recommended by the Authority.
  - a. Before pipe is laid, the subgrade shall be made by backfilling with aggregate material, as directed by the Authority, in six inch (compacted thickness) layers thoroughly tamped and the bedding prepared as hereinbefore specified.
- 3 Special Foundations: Where the bottom of the trench at the subgrade is found to consist of material which is unstable to such a degree that, in the opinion of the Authority, it cannot be removed and replaced with an approved material thoroughly compacted in place to support the pipe properly, the Contractor shall construct a foundation for the pipe, consisting of piling, timbers or other materials, in accordance with plans prepared by the Authority.

**C. Backfilling Methods:**

1. General: Backfilling shall not be done in freezing weather except by permission of the Authority, and it shall not be done with frozen material. Do not backfill when the material already in the trench is frozen.
  - a. Where Aggregate Backfill is not indicated on the Drawings or specified herein, and in the opinion of the Authority should be used in any part of the Work, the Contractor shall furnish and backfill with aggregate as directed.
2. In or adjacent to state highways all backfill shall be in accordance with PennDOT requirements.

1 Initial Backfill: Following placement of bedding and haunching material, initial backfill shall be placed to a depth of twelve (12) inches over the crown of the pipe. Compact the initial backfill in maximum twelve (12) inch (compacted thickness) layers. Use vibratory compactors of such size that will not damage the pipe or manual compaction methods as approved by the Authority. Bring the backfill up both sides of the pipe simultaneously to prevent displacement of the pipe.

D. Aggregate Backfill to Restoration Depth (within State Highway or as directed by the Authority): From six inches above the top of the pipe to Restoration Depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be aggregate backfill material subject to limitations specified and consolidated by compacting in six inch layers. Any consolidation method utilizing water such as jetting or puddling will not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching.

E. Select Backfill to Restoration Depth: From twelve (12) inches above the top of the pipe to restoration depth, the trench shall be backfilled by hand or by approved mechanical methods. Backfill in this section of the trench shall be excavated material subject to limitations specified and consolidated by tamping in eight inch layers or other approved mechanical methods. Any consolidation method utilizing water, such as jetting or puddling will not be permitted. Consolidation shall proceed from the center of the trench to the sides to prevent arching. If the backfill contains too much moisture for optimum compaction, the Contractor shall dry the common backfill or provide aggregate backfill.

1 Compacted layers may exceed eight (8) inches provided the Contractor can demonstrate that the compaction results as described in the follow sub-section (Compacting and Compaction Tests) are being obtained throughout the lifts of backfill.

F. Underground Warning Tape: For the purpose of early warning and identification of buried pipes during future trenching or other excavation, provide continuous identification tapes in trenches. Install in accordance with printed recommendations of the tape manufacturer, and as modified herein. Bury tape at a depth of 12 inches below grade; in pavements, measure 12 inches down from subgrade of pavement. Tape to be installed along all mains, and laterals.

G. Compacting and Compaction Tests:

1. The Contractor will be required to perform a sample backfilling of a pipe segment early on in the construction, adequately justifying to the Authority that his backfill and compaction operations are adequate to obtain the desired compaction results.

2. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density of backfill in each layer of not less than those specified below as a percentage of maximum standard density determined in accordance with AASHTO T99 or PennDOT requirements.

- a. Areas subject to vehicular traffic: 100%.
- b. Grassed areas: 95%.

3.

During the course of backfilling and compacting work, the Authority may, at any location or depth of trench, require the Contractor to make tests to



determine whether the Contractor's compaction operations are sufficient to meet specified requirements, at the Contractor's expense. The Contractor will retain the services of an independent agency approved by the Authority for all compaction tests. Contractor will be required to repair all backfill that does not conform to the compaction requirements at no additional cost to the Authority. The Contractor shall provide ample notice to assure all soil testing is done.

### 3.3 RESTORATION AND CLEAN-UP OF SURFACE

#### A. Restoration by Contractor:

1. The Contractor shall restore all driveways, parking lots, sidewalks, curbing, gutters, shrubbery, guiderail, fences, mailboxes, light standards, poles, sod or other property and surface structures removed or disturbed as a part of the Work to a condition equal to that before the Work began, furnishing all labor and materials incidental thereto.

#### B. Clean-up and Maintenance of Surfaces:

1. General: During construction, the surfaces of all areas including, but not limited to, roads, streets, and driveways shall be maintained on a daily basis to produce a safe, desirable, and convenient condition. Streets shall be swept and flushed after backfilling, and recleaned as dust, mud, stones and debris caused by the Work, or related to the Work again accumulates. Failure of the Contractor to perform this work may be cause for the Authority to order the work by others, and backcharge all costs to the Contractor.
  - a. All surplus materials furnished by the Contractor and temporary structures shall be removed from the site by the Contractor.
  - b. All dirt, rubbish and excess earth from the excavation shall be disposed of by the Contractor in a manner and place acceptable to all governing agencies.
  - c. The construction site shall be left clean at the end of each working day to the satisfaction of the Authority.
  - d. All surplus materials furnished and delivered by the Contractor will be removed by the Contractor.
2. Repair or Correction of Unsatisfactory Conditions: All unsatisfactory conditions resulting from the work shall be corrected.
  - a. Any hazardous condition caused by the Work, on any surface, shall be repaired or corrected within two hours of observance or notification of its existence. If repairs or corrections are not made within this period, the Authority will have the work completed with the resulting cost subtracted from the Contractor's next monthly Application for Payment. Any such costs shall be deemed a reduction in the total amount due to the Contractor under the Contract and no subsequent reimbursement shall be made to the Contractor by the Authority for these costs.
  - b. There will be no additional payment made for maintenance work.

END OF SECTION 0222

SECTION 02605 - MANHOLES

PART 1 - GENERAL

11 SECTION INCLUDES

- A. Precast concrete manholes.

12 RELATED SECTIONS

- A. Gravity Wastewater Sewer: Section 02731.
- B. Cast-in-Place Concrete: Section 03300.

13 REFERENCES

- A. American Society for Testing and Materials:
  - 1. ASTM A48 - Gray Iron Castings.
  - 2. ASTM A307 - Carbon Steel Externally Threaded Standard Fasteners.
  - 3. ASTM A615 - Deformed and Plain Billet-steel Bars for Concrete Reinforcement.
  - 4. ASTM C139 - Concrete Masonry Units for Construction of Catch Basins and Manholes.
  - 5. ASTM C270 - Mortar for Unit Masonry.
  - 6. ASTM C361 - Reinforced Concrete Low Head Pressure Pipe.
  - 7. ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
  - 8. ASTM C478 - Precast Reinforced Concrete Manhole Sections.
  - 9. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
  - 10. ASTM D2146 - Propylene Plastic Molding and Extrusion Materials.
- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.
- C. American Water Works Association:

- 1 AWWA C302, AWWA Standard for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed.

D. Federal Specifications:

- 1 FS SS-S-210A, Sealing compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

1.4 SUBMITTALS

A. Shop Drawings and Product Data:

1. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.
2. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

B Certificates:

- 1 Manufacturer's certification that components and products will be manufactured in accordance with specified reference standards for components and products.

1.5 QUALITY ASSURANCE

A. Shop Inspection:

- 1 All materials 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 Field Inspection:

- 1 All materials shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Authority.

C. Source Quality Control:

1. Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete manholes.
2. Obtain certificate of construction compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer. Submit same certificate as part of required submittals.

- D. Initial Manholes: Construct first manhole in the Project to demonstrate the following, and serve as the minimum acceptable conditions of construction through the Project. No additional compensation allowed for initial manhole requirement.

- 1. Demonstrate manhole base construction methods.
- 2. Demonstrate manhole component sealing in the case of precast reinforced concrete manholes.
- 3. Demonstrate manhole stop alignment.
- 4. Demonstrate pipe opening sealing.
- 5. Demonstrate method of adjustment of manhole frame and cover to grade and manhole frame and cover attachment.
- 6. Demonstrate successful manhole acceptance test.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Transport and handle precast reinforced concrete manhole components and other products specified herein in a manner recommended by this respective manufacturers of such to prevent damage and defects. Through-wall lifting holes are not permitted in manhole component construction.
- B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified products as recommended by the respective manufacturers.

## 1.7 SITE CONDITIONS

- A. Environmental Requirements: In no instance set or construct manhole base on subgrade containing frost.

## PART 2 - PRODUCTS

### 21 BASIC MATERIALS

- A. Cast-in-Place Concrete: Meet requirements of Section 03300.
- B. Waterproofed Mortar: Material composition meeting requirements of ASTM C270, Type M with waterproofing admixture included.
- C. Concrete Masonry Units for Manholes: Commercially manufactured solid precast segmental concrete masonry units meeting requirements of ASTM C139.

D Manhole Steps:

1. Material: Aluminum alloy 6061-T6, with standard mill finish or, polypropylene coated.
2. Type: Drop-front design with non-slip serrated step surface.
3. Coating: Coat portion of step which will be embedded in concrete with high-build bituminous paint.

E Manhole Frame and Cover: Gray iron castings conforming to ASTM A48, Class No. 30, designed for AASHTO Highway Loading Class HS-20. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion or other defects. Covers to be self-sealing.

1. Finish: Bearing surfaces machined to prevent rocking and rattling under traffic. Casting surfaces shotblast cleaned and coated with asphalt paint, non-tacky drying.
2. Identification: Cast the words SANITARY SEWER integrally on cover in two inch size raised letters.
3. Frame hold-down bolts: ASTM A307.
4. Anchor Bolts: J or L shape with standard coarse thread ends, ASTM A307.

F Watertight Manhole Frame and Cover: Gray iron castings conforming to previously specified requirements for Manhole Frame and Cover. The cover shall have a built in O-ring and a non-penetrating pickhole.

G. Preformed Plastic Sealing Compound: FS SS-S-210A, type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.

H PVC Waterstop for Cast-in-Place Base: Gasket Type waterstop composed of virgin polyvinyl chloride (PVC) such as manufactured by Femco Joint Sealer Co.; CMA Concrete Manhole Adapter.

I Manhole Inserts: HDPE construction as manufactured by Parson.

J Heat Shrinkable Wrap: Wrap to cover riser rings and joints in their entirety as equal to Wrapid seal as manufactured by CANUSA.

## 2.2 PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS

- A Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:
- 1 Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II or Type III cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
  - 2 Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C302.
  - 3 Manhole Steps: Factory installed in manhole components, prealigned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on drawings.
  - 4 Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a rubber compression gasket or preformed plastic sealing compound.
    - a. Rubber Compression Gasket: Composition conforming to ASTM C361 or ASTM C443.
    - b. Preformed Plastic Sealing Compound: As specified previously.
    - c. Heat Shrinkable Wrap: Wrap to cover all joints in their entirety as equal to Wrapid Seal as manufactured by CANUSA.
  - 5 Manhole Component Design: Base, tapered and straight riser section, and top section dimensions and diameters, not consistent with ASTM C478, are as indicated on drawings.
- B Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
- 1 Pipe Opening Seals: Resilient gasket type, cast integrally with manhole component conforming to requirements specified in ASTM C923 and of the following acceptable pipe seals:
    - a. A-LOK Products Corporation; A-LOK Manhole Pipe Seal.
    - b. Scales Manufacturing Corporation; RES-SEAL.
    - c. Thunderline Corporation; LOCK-SEAL Modular Wall and Casing Seal.
    - d. Dual Seal Gaskets, Inc.; DUAL SEAL II.

- C. Precast Top Sections: Of materials and construction as specified previously except additional and differing requirements as follows:
  - 1. Hold Down Bolt Inserts: Factory cast in top section no less than two 3/4 inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of three inches depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.
  - 2. Flat Slab Tops: Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.
  - 3. Eccentric Cone Tops: Manufacture to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.
- D. Precast Grade Rings: Leveling and adjusting units of three inches or four inches thickness of materials and constructions as specified previously. Factory cast grade rings with hold down bolt holes matching location of same in manhole frame. Design must provide for full bearing of manhole frame.
- E. Coatings:
  - 1. Prepare surfaces to be coated in accordance with the written instructions of the coating manufacturer, including cleaning, sandblasting or acid etching as necessary.
  - 2. Factory coat entire exterior of precast manhole components with two coats of Pennsbury 32-B-4 PENNOXY-TAR, or equal, to dry film thickness of 7 or 8 mils per coat, coating to be repaired in the field as warranted.

### PART 3 - EXECUTION

#### 31 LOCATING & INSPECTION

- A. All manholes will be field located and verified for depth and alignment by the Contractor and Authority. **No manholes shall be ordered until the actual location of such is determined in the field.**
- B. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C478 regarding repairable defects and defects subject to rejection by the Authority.
- C. 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 from the site.
- D. Unless noted on the drawings or otherwise directed by the Authority, all manholes shall be set such that to top of rim is flush with existing or final grade.

### 3.2 PREPARATION

- A. Keep pipe and manhole interiors cleared of debris as construction progresses.

### 33 MANHOLE CONSTRUCTION METHODS

#### A. Cast-In-Place Concrete Manhole Base (if required)

1. Form and pour concrete in accordance with requirements of Section 03300. Additional requirements as follows:
  - a. Vibrate poured concrete using mechanical vibrator of a type and design approved by Authority. Use vibrators of type capable of transmitting vibration to concrete in frequencies of not less than five thousand impulses per minute.
  - b. Form and pour joint monolithically in manhole base top to match joint of adjoining precast riser section. Use template as obtained from precast concrete manhole component manufacturer of manhole components used in the Project.
  - c. Do not place precast riser sections on cast-in-place bases for a minimum of 48 hours after pour.
2. Install sewer piping in cast-in-place manhole bases prior to pouring the concrete. Install PVC Waterstop on pipes entering and leaving manhole base prior to pouring concrete. Install PVC Waterstop in accordance with manufacturer's written instructions.
3. Use 4,500 psi concrete as specified in Section 03300.
4. Coat bases in accordance with the requirements for precast manhole components.

#### B. Precast Concrete Bases: Install bases on a six inch deep compacted layer of same material used for pipe bedding.

1. When using prefabricated pipe opening seals for connecting pipes into manhole, and such seals create an annular space on interior and exterior of manhole wall after pipe connection is made, fill such annular spaces with preformed plastic sealing compound.
  - a. Tightly caulk sealing compound into annual spaces, completely filling the spaces, and render the installation watertight.
  - b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.

#### C. Concrete Channel Fill: Field pour concrete channel fill for each manhole base or provide and install precast channels:

1. Form inverts directly in concrete channel fill.
2. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
3. Make changes in size and grade gradually.



4. Make changes in direction of entering sewer and branches to a true curve of as large a radius as manhole size will permit.
  5. Make slopes gradual outside the invert channels.
  6. Use 3,000 psi concrete as specified in Section 03300.
- D Manhole Wall Erection: Provide precast reinforced concrete straight riser, tapered riser and top sections necessary to construct complete manholes. Fit the different manhole components together to permit watertight jointing and true vertical alignment of manhole steps.
1. If rubber compression gaskets are used between sections, install gaskets and join sections in accordance with written instructions of manhole component manufacturer.
  2. Preformed plastic sealing compound must be used between all sections, installed in accordance with manufacturer's recommendations, and join sections also in accordance with written instructions of manhole component manufacturer.
    - a. Prime joint surfaces if required by preformed sealing compound manufacturer.
    - b. If sealing compound is installed in advance of section joining, leave exposed half of two piece protective wrapper in place until just prior to section joining.
    - c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.
    - d. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.
    - e. Make pipe connections into manhole walls as specified previously for pipes connecting into manhole bases.
- E Lifting Hole Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into holes in such a manner to render holes completely water and air tight.
- F. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using the following materials:
1. Precast Grade Rings:
    - a. Set precast grade rings in Water-Proof Mortar. Mortar thickness not to exceed 3/4 inch maximum and 3/8 inch minimum. Wet, but do not saturate precast grade rings immediately before laying.
    - b. Pre-set grade rings to proper plane and elevation using wedges or blocks of cementitious material not exceeding one square inch wide on all sides. No more than four wedges or blocks per grade ring permitted. Incorporate wedges or blocks in fresh mortar in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.

2. Concrete Masonry Leveling Units: Lay segmental concrete masonry units to line and in radial course with completely filled mortar joints. Flush cut exposed horizontal and vertical joints on manhole interior and exterior. Leave exterior surface ready for parging.
3. Use concrete masonry units upon written approval of Authority. Primary leveling unit shall be precast grade rings.
4. Parge the outside of finished concrete masonry leveling units with a minimum of 1/2 inch thick waterproof mortar.
5. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing 1/2 inch thick preformed plastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.
6. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inverts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after mortar has cured.

G. Plugging Pipe Openings: Plug pipe openings in manholes where such openings are required for future pipe connections.

1. Use masonry units and waterproofed mortar laid up to prevent deterioration.
2. Install such materials to meet exfiltration limits and to allow future removal without damage to manhole.

H Manhole Insert: The manhole frame rim shall be clean from all debris. Once insert is installed and manhole cover is re-installed, there shall be a flush surface from frame lip to cover.

- 1 Adjustments of inserts shall be the Contractor's responsibility.

I Heat Shrinkable Wrap: As per manufacturer's instructions.

### 3.4 TESTING MANHOLES

#### A General

- 1 Conduct tests in presence of and to complete satisfaction of the Authority.
- 2 Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.
- 3 Provide tools, materials (including water), equipment and instruments necessary to conduct manhole testing specified herein.
  - a Vacuum Testing Equipment:
    - 1) Use vacuum apparatus equipped with necessary piping, control valves and gauges to control air removal rate from manhole and to monitor vacuum.
    - 2) Provide an extra vacuum gauge of known accuracy to frequently checktest equipment and apparatus.

- 3) Vacuum testing equipment and associated testing apparatus subject to Authority's approval.
  - 4) Provide seal plate with vacuum piping connections for
4. Prior to testing clean manholes thoroughly and seal openings, both to the complete satisfaction of the Authority. Seal openings using properly sized plugs.
  5. Perform testing with frames installed. Include the joint between the manhole and manhole frame in the test.
  6. The Contractor may elect to make a test for his own purposes prior to backfilling. However, conduct tests of the manholes for acceptance, only after the backfilling has been completed.

B Vacuum Test Procedure:

1. Perform vacuum testing in accordance with the testing equipment manufacturer's written instructions.
2. Draw a vacuum of ten inches of mercury and close the valves.
3. Consider manhole acceptable when vacuum does not drop below nine inches of mercury for the following manhole sizes and times:
  - a. Four foot diameter - 60 seconds
  - b. Five foot diameter - 75 seconds
  - c. Six foot diameter - 90 seconds

C. Exfiltration Test Procedure:

1. Complete fill manhole to top of frame with water.
2. Allow water filled manhole to stand four hours prior to testing to allow absorbing in materials.
3. At commencement of test, fill manhole to top lip of manhole frame.
4. During a consecutive four hour period, keep an accurate record of the amount of water to be added because of exfiltration.
5. Consider manhole acceptable when exfiltration rate does not exceed a rate of 0.038 gallons a day per inch of manhole diameter per vertical foot of manhole.

D Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits.

1. Repair or replace defective materials and workmanship, as is the case, before conducting such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.
2. Materials and methods used to make manhole repairs must meet with Authority's approval prior to use.

END OF SECTION 02605

SECTION 02606 - PRE-CAST VAULTS

PART 1 - GENERAL

11 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections apply to this Section.

12 STIPULATIONS

- A. The Specifications Sections "General Conditions", "Special Requirements", and "General Requirements" form a part of this Section by this reference thereto and shall have the same force and effect as if printed herewith in full.

13 REFERENCES

- A. American Society for Testing and Materials:

- 1. ASTM A307 Carbon Steel Externally Threaded Standard Fasteners
- 2. ASTM A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- 3. ASTM C139 Concrete Masonry Units for Construction of Catch Basins and Manholes
- 4. ASTM C361 Reinforced Concrete Low Head Pressure Pipe
- 5. ASTM C478 Precast Reinforced Concrete Manhole Sections
- 6. ASTM C923 Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

- B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.

- C. Federal Specifications:

- 1. FS SS-S-210A Sealing compound, Preformed Plastic, for Expansion Joints and Pipe Joints (Type 1 Rope Form).

14 SUBMITTALS

- A. Submit detailed drawings modified to suite site conditions.

15 QUALITY ASSURANCE

A. Shop Inspection:

- 1 All materials 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. Field Inspection:

- 1 All materials shall be furnished and installed and tested for defects in material and/or workmanship in the manner specified and in the presence of and as approved by the Authority.

C. Source Quality Control:

- 1 Maintain uniform quality of products and component compatibility by using the products of one manufacturer in the case of precast reinforced concrete valve vaults.

16 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Transport and handle precast reinforced concrete vaults and other products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

1.7 SITE CONDITIONS

- A. Environmental Requirements: In no instance set or construct vaults on subgrade containing frost.

PART 2 - PRODUCTS

21 BASIC MATERIALS

- A. Cast-in-Place Concrete: Meet requirements of Section 03300.
- B. Waterproofed Mortar: Material composition meeting requirements of ASTM C270, Type M with waterproofing admixture included.
- C. Concrete Masonry Units for Manholes and Vaults: Commercially manufactured solid precast segmental concrete masonry units meeting requirements of ASTM C139.
- D. Preformed Plastic Sealing Compound: FS SS-S-210A, Type 1, Rope Form, of either bituminastic-base compound or butyl-rubber base compound (CS-102), and shipped protected in a removable two-piece wrapper. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.

## 2.2 PRECAST REINFORCED CONCRETE VAULT COMPONENTS

- A Materials and Construction: Conforming to requirements specified in ASTM C478 except as follows:
1. Concrete: Composition and compressive strength conforming to ASTM C478 except use Type II or Type III cement in vault components and increase compressive strength to 4,500 psi (at 28 days) in precast bases.
  2. Casting and Curing: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C302.
  3. Component Seals: Vault component joints factory formed for self-centering concrete to concrete bearing employing either a rubber compression gasket or preformed plastic sealing compound.
    - a. Rubber Compression Gasket: Composition conforming to ASTM C361 or ASTM C443.
    - b. Preformed Plastic Sealing Compound: As specified previously.
    - c. Heat Shrinkable Wrap: Wrap to cover all joints in their entirety as equal to Wrapid Seal as manufactured by CANUSA.
- B Pipe Openings: Custom preformed during manufacturing in each base and riser section requiring such, to accommodate type of pipe and pipe opening seal provided.
1. Pipe Opening Seals: Resilient gasket type, cast integrally with manhole component conforming to requirements specified in ASTM C923 and of the following acceptable pipe seals:
    - a. A-LOK Products Corporation; A-LOK Manhole Pipe Seal.
    - b. Scales Manufacturing Corporation; RES-SEAL.
    - c. Thunderline Corporation; LOCK-SEAL Modular Wall and Casing Seal.
    - d. Dual Seal Gaskets, Inc.; DUAL SEAL II.
- C Vault Coatings:
1. Prepare surfaces to be coated in accordance with the written instructions of the coating manufacturer, including cleaning, sandblasting or acid etching as necessary.
  2. Factory coat entire exterior locate below grade of precast manhole components with 2 coats of Pennsbury 32-B-4 PENNOXY-TAR, or equal, to dry-film thickness of 7- or 8-mils per coat, coating to be repaired in the field as warranted.
- D Aluminum Access Hatch: 300#/SF loading, 316 stainless steel hardware with spring assist locking hold open arm, 1.5-inch frame drain coupling, and slam lock. Holliday Series W1S.
- E OSHA Safety Grate: Aluminum "1" bar construction with fusion epoxy orange coating and stainless steel hardware. Haliday Series X
- F Aluminum Access Ladder: Aluminum construction with slip resistant ribbed rungs, flat wall mounting stand-offs. Haliday Series L1B.

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- G. Aluminum Ladder Extension: Aluminum and stainless steel construction with locking pins Haliday Series L1E.
- H. Precast vaults shown with watertight manhole covers shall also meet the frame and cover standards within the "Manholes" section.

### PART 3 - EXECUTION

#### 31 LOCATING AND INSPECTION

- A. All vaults will be field located by the Contractor and Authority. No vaults shall be ordered until the actual location of such is determined in the field.
- B. Inspect precast reinforced concrete vault components in accordance with requirements of ASTM C478 regarding repairable defects and defects subject to rejection by the Authority.
- C. 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 from the site.

#### 32 CONSTRUCTION METHODS

- A. Precast Concrete Bases: Install bases on a 6-inch-deep compacted layer of same material used for pipe bedding.
  - 1 Vault base shall be installed in a level position.
  - 2 When using prefabricated pipe opening seals for connecting pipes into vault, and such seals create an annular space on interior and exterior of vault wall after pipe connection is made, fill such annular spaces with:
    - a. Tightly caulk sealing compound into annual spaces, completely filling the spaces, and render the installation watertight.
    - b. Following sealing compound installation, trowel compound surface smooth and flush with interior face of manhole.
  - 3 Concrete Fill: Field pour concrete floor for each vault base as indicated.
    - a. Accurately shape invert to a semi-circular bottom conforming to inside of connecting pipes, and steel trowel finish to a smooth dense surface.
    - b. Make changes in direction of entering sewer and branches to a true curve of as large a radius as vault size will permit.
    - c. Make slopes gradual outside the invert channels.
    - d. Use 3,000 psi concrete as specified in Section 03300.

### PRECAST VAULTS

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- B. Lifting Hole Sealing: Seal with properly designed tapered rubber plugs. Drive plugs into holes in such a manner to render holes completely water and air tight. Sealing of lifting holes with grout not permitted.
  
- C. Riser Section: Pre-cast or cast-in-place riser sections shall be constructed and/or installed to match the existing grade. The riser section shall include the hatch, ladder or steps, and ladder-up extension device.

END OF SECTION 02606



## SECTION 02731 - GRAVITY WASTEWATER SEWER

### PART 1 - GENERAL

#### 11 SECTION INCLUDES

- A. Wastewater Gravity Sewer Pipelines.
- B. Service Connection Piping.
- C. Pipeline Testing.

#### 12 RELATED SECTIONS

- A. Trenching, Backfilling, and Compacting: Section 02221.
- B. Cast-in-Place Concrete: Section 03300.

#### 13 QUALITY ASSURANCE

##### A. Source Quality Control.

##### 1. Shop Tests and Inspection

- a All material furnished by the Contractor shall be certified by the Contractor for compliance with the pertinent specifications. Shop inspections and testing may be required. The cost of shop testing shall be borne by 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 Engineer. All defective materials furnished by the Contractor shall be promptly removed by him from the site at his own expense.

#### 14 REFERENCES

##### A. American Society for Testing and Materials.

- 1. ASTM D2321 - Underground Installation of Flexible Thermoplastic Sewer Pipe.
- 2. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- 3. ASTM D3212 - Joints for drain and sewer plastic pipes using flexible elastomeric seals.
- 4. ASTM F477 - Elastomeric seals (Gaskets) for joining plastic pipe.

## 1.5 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cuts 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.

## 1.6 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.

## 1.7 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 Engineer, for pipe laying work.

## PART 2 - PRODUCTS

### 21 SEWER PIPE AND FITTINGS

- A. For pipe joints, use rubber gaskets suitable for conveying domestic sewage.
- B. Polyvinyl Chloride Pipe (PVC)
  - 1. Pipe: Type PSM SDR-35, ASTM D3034 unless specified otherwise in the Drawings.
  - 2. Fittings: Conforming to same ASTM standard requirements for pipe.
  - 3. Joints: Push-on with elastomeric gasket, ASTM D3212; and ASTM F477 for gasket specifications.

C. Ductile Iron Pipe (DIP)

1. Pipe: ANSI A21.50 and ANSI A 21.51
2. Wall Thickness Class (Buried): Class 50.
3. Fittings: Gray iron or ductile iron ANSI A21.10.
4. Joints:
  - a Rubber Gasket Joints (Buried): ANSI A 21.11
    - 1) For buried pipe installation, provide push-on or mechanical joints except where other types of joints are indicated on the Drawings or required by the Specifications.
5. Cement Lining: Ductile Iron pipe and fittings shall be coated inside with double thickness cement mortar lining (1/8") and seal coated, all in conformance with ANSI A21.4 and AWWA C104.
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.

2.2 SERVICE CONNECTION PIPE AND FITTINGS

- A. Polyvinyl Chloride Pipe (PVC): As specified for sewer pipe and fittings; four-inch diameter minimum for single family residence; six-inch diameter minimum for commercial unit.
- B. Pipe Plugs: Designed for permanent installation and removable. Obtain plugs from the pipe manufacturer.

PART 3 - EXECUTION

31 PREPARATION

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

### 3.2 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 strict accordance with manufacturer's installation instructions.
- C. Laying Specified Types of Plastic Pipe: Installation and joint assembly according to ASTM D 2321.
- D. Construction Control
1. The use of laser equipment will be permitted. Cut sheets for all manhole runs as required.
  2. Regardless of control used, the Contractor shall provide alternative verification of grade as work progresses. Pipe not laid to proper line and grade will be removed and reconstructed at the Contractor's expense.
  3. Provide temporary bench marks for grade verification.
- E. Variations: The Engineer 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. No claims will be allowed for changes in location or grade except as such changes are made after trenching has been done. Payment for all variances shall be in accordance with the unit pricing as indicated in the bid and all excavation shall be unclassified.
- F. Sanitary Sewer near Water Mains. The Engineer may vary the location of sanitary sewers in close proximity to water mains. No variations on location will be permitted without approval of the Engineer.
1. Horizontal Separation - Sewers should be laid at least 10 feet horizontally from any existing or proposed water main. Should local conditions prevent a lateral separation of 10 feet, a sewer main may be laid closer to the 10 feet to a water main if (1) it is laid in a separate trench, or if (2) it is laid in the same trench with the water mains located at one side of the bench of undisturbed earth and if in either case the elevation of the crown of the sewer is at least 18 inches below the invert of the water main.

- 2 Vertical Separation - Whenever sewers must cross under water mains, the sewer shall be laid at such an elevation that the top of the sewer is at least 18 inches below the bottom of the water main. When the elevation of the sewer cannot be varied to meet the above requirement, the water main shall be relocated to provide this separation or reconstruct it with mechanical joint pipe for a distance of 10 feet on each side of the sewer. One full length of water main should be centered over the sewer so that joints will be as far from the sewer as possible.

When it is impossible to obtain proper horizontal and vertical separation as stipulated above, both the water main and sewer shall be constructed of mechanical joint cast iron pipe or ductile iron pipe and shall be pressure tested to assure water tightness; or, the sewer shall be concrete encased for a distance of 10 feet on either side of the water main in accordance with the details shown on the contract drawings or as ordered by the Engineer.

- G. Handling of Sewer Line Materials into Trench: Proper implements, tools and facilities satisfactory to the Engineer 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 six inches below and on each side of all pipe and fittings.
  1. The specified minimum clearances are the minimum clear distances 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. Culverts: Sanitary sewer shall be furnished and installed under culverts to the dimensions shown on the drawings.
- J. 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 Engineer, 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 Engineer shall have strict control of the rate of backfilling.

3 Concrete: 3000 psi per requirements of Section 03300.

### 3.3 SERVICE CONNECTIONS

- A. Fittings, (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 one foot behind the curblin, right-of-way line, or edge of paved surface, or to a location designated by the Engineer. 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. Service connections are to be installed at a grade of quarter inch per foot from the main line to the termination of the lateral.
- C. The Contractor shall submit to the Engineer, on a monthly basis, all as-built information which shall include: manhole run, station, length from centerline of sewer, invert elevation at the termination point of lateral and the address or property Authority's name for whom the lateral and the address or property Authority's name for whom the lateral is provided.
- D. 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.
- E. Plugs: Close free ends of branches and service connections with a carefully fitted plug. Type of plug used and method of installation shall meet Engineer's approval. Installed plugs shall successfully pass line acceptance tests.
- F. Install warning tape as described in Section 02221.

G. FIELD INSTALLED SERVICE LATERAL CONNECTION SPECIFICATIONS

G.01 General

- a. A separate and independent building sewer shall be provided for each building. The minimum size shall be four (4) inches for a single-family unit and six (6) inches for a commercial unit.
- b. The building sewer shall be connected into the public sewer at the curb or property line, if a service connection sewer is available at this location. Where no curb or property line located service connection is available; the owner of the building sewer shall extend the building sewer to the public sewer and connect to the nearest wye or tee available on the public sewer. If no wye or tee exists on the public sewer within the immediate vicinity of the frontage of the lot or tract of land that the building sewer is to serve, the owner of the building sewer shall have a wye or tee installed on the public sewer in accordance with requirements hereinafter set forth. The building sewer lateral shall be owned and maintained by the owner of the property served by such building sewer from the easement or right-of-way line to the building served.
- c. The depth shall be a minimum of four (4) feet and be sufficient to afford protection from frost. The sanitary building sewer shall be laid at uniform grade and in straight alignment. Changes in direction shall be made only with proper pipe fittings.

G.02 INSTALLING FACTORY WYE ON EXISTING MAINS

- a. Connections to existing public sewers where wyes or tees are not available shall be made by one of the following methods:
  - i. In the event that a standard wye or tee is to be installed in the field: The fitting shall be installed by cutting out a section of the sewer main, maintaining square ends, and inserting the standard wye or tee pipe section. The joints created as a result of the cuts shall be sealed using couplers or flanged adapters or approved equal. Each joint space between the existing pipe and the inserted section shall not exceed one (1) inch. All pipe and wye connections will require installation of two couplers (one at each end of the insertion).
  - ii. Whenever the sewer is deeper than nine (9) feet at the service lateral, a 45° riser pipe shall be installed up from the fitting unless full depth is required for service lateral grades.
  - iii. A GHJSA representative shall inspect each service lateral connection at the time of its installation. The GHJSA representative shall be present during the physical installation of the wye connection. Inspection must be performed prior to covering the service lateral connection. All materials for proper backfill must be on site at the time of inspection. If the inspector must return to the site to reinspect the sewer due to lack of proper materials being on site, a reinspection fee shall be assessed. Because the work will require a GHJSA representative to be present during the entire installation of the field tap, actual costs incurred will be paid by the party requesting this exception.
  - iv. Sanitary sewage shall be contained within the sanitary sewer system during the installation process.

### G.03 INSTALLING SADDLE TAP ON EXISTING MAINS

- a. The standards generally require all sewer lines to have factory installed wye or tee fittings for each building unit occupied. The standards allow for an exception to this general practice. The exception must be requested on a case by case basis. The request must be accompanied by a written request stating the reason for the exception. A specification sheet of the tapping saddle to be used must also be submitted with the written request.
- b. If GHJSA approves the Field Saddle Tap, the following procedures shall be followed:
  1. All recommendations from the manufacturer of the saddle shall be followed; including banding the saddle to the receiving pipe with stainless steel straps after the saddle is glued to the pipe.
  2. Only factory manufactured and molded saddle wye connectors shall be acceptable.
  3. The saddle shall properly match the sanitary sewer main pipe type, the primer and glue used must match the manufacturer's recommendation.
  4. Upon exposing the sewer main and prior to cutting the insertion hole in the main, a GHJSA Representative must be present at the site. The inspection of the tap should be scheduled with GHJSA at least 24 hours in advance.
  5. The cut on the existing pipe must be no larger than is necessary to install the saddle and, generally, must be made by following a properly applied template to assist the worker making the cut.
  6. Rough edges left by the saw cut should be smoothed with a file or sand paper. The saddle should then be dry-fit to assure proper alignment and fit of the hole to the saddle. Over cutting the hole or otherwise damaging the sewer main will be considered unacceptable and will warrant the replacement of the damaged main line segment and the installation of a factory wye per Section 12G.02.
  7. Proper preparation of the pipe exterior surface shall be required in accordance with the manufacturer's specifications. The exterior surface of the pipe shall be clean, dry and primer applied to the mating surfaces before the glue is applied and the saddle is installed and strapped down. The saddle must not be moved once it makes contact with the pipe. Under normal conditions (73 degrees F and 50% of humidity) the joint, when properly made, will reach 50% of its ultimate strength in 24 hours. The chemical bond between the PVC main and saddle must be allowed to set a minimum of one (1) hour prior to backfilling the trench.
  8. Backfill should be carefully selected and tamped around the pipe and saddle to provide firm and continuous support for both.



NOTE: The colder the weather, the greater the time required for the primer to etch the saddle. Saddle should be heated to 40 degrees F or higher by means of light bulbs, catalytic heater, etc. During cold weather it may be necessary to apply two or more coats to create sufficient etching. See that both mating surfaces are allowed sufficient time for the joint to set up before applying any load. P-70 primer and 717 glue have been used successfully at temperatures below zero; however, it is difficult to obtain good joints under these conditions and it is not recommended. The GHJSA representative shall inspect the connection to determine if the pipe and surfaces are etched and wet with primer before applying the cement. The chemical bond between the PVC main and saddle must be allowed to set a minimum of one (1) hour prior to backfilling.

### 3.4 PIPELINE TESTING PREPARATION

- A. Backfill trenches in accordance with detail on Drawings.
- B. Provide pressure pipeline with concrete reaction support blocking.
- C. Flush pipeline to remove debris. Collect and dispose of flushing water and debris.
- D. Clean pipelines by propelling a snug fitting rubber ball through the pipeline with water from the upstream manhole to the downstream manhole. Investigate and correct any stoppage of the cleaning ball. Collect and dispose of cleaning water and debris.
- E. Lamping:
  - 1. After flushing and cleaning, lamp gravity pipeline in the presence of the Engineer.
  - 2. Assist the Engineer in the lamping operation by shining a light at one end of each pipeline section between manholes. The Engineer will observe the light at the other end. Pipeline that has not been installed with uniform line and grade will be rejected. Remove and re-lay rejected pipeline sections. Reclean and lamp until pipeline section achieves a uniform line and grade to the satisfaction of the Engineer.
- F. Plug outlets, wye-branches and laterals. Brace plugs to offset thrust.
- G. All testing for pipes and manholes shall be conducted with an Authority representative on site.

### 3.5 TESTING GRAVITY SEWER PIPELINES

- A. Low Pressure Air Test:
  - 1. Test each newly installed section of gravity sewer line between manholes.
  - 2. Slowly introduce air pressure to approximately 5.0 psig.
  - 3. Allow pressure to stabilize for at least five minutes. Adjust pressure to 3.5 psig or the increased test pressure as determined below if groundwater is present. Start the test.

4. Test:

- a Determine the test duration for a sewer section with a single pipe size from the table below:

Nominal Pipe Size	T (Time) Min/100 Ft.	
4	.3	3 minutes minimum
6	.7	3 minutes minimum
8	1.2	4 minutes minimum
10	1.5	4 minutes minimum
12	1.8	4 minutes minimum

- b. Record the drop in pressure during the test period. If the air pressure has dropped more than 1.0 psig during the test period, the line is presumed to have failed. If the 1.0 psig air pressure drop has not occurred during the test period, the test shall be discontinued and the line will be accepted
- c. If the line fails, determine the source of the air leakage, make corrections and retest. The Contractor has the option to test the section in incremental stages until the leaks are isolated. After the leaks are repaired, retest the entire section between manholes.

B. Infiltration Test:

- 1. Use only when gravity pipeline is submerged in groundwater. Obtain prior approval of the Engineer.
- 2. Maximum Allowable Infiltration: 100-gallons per inch of pipe diameter per mile per day for any one section under test, including the allowances for leakage from manholes.

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 Engineer or the Authority, the Engineer and the Authority reserve the right to perform field investigations, prior to final written acceptance of each sewer run by the Authority and/or during the one-year correction period specified elsewhere in the Contract Documents, to establish the leakage of groundwater into the sewer and laterals constructed under this contract. The cost of these investigations shall be borne by the Authority.

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 Engineer or 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.

### 36 DEFLECTION TESTING OF PLASTIC SEWER PIPE

- A. At the direction of the Engineer, perform vertical ring deflection testing on suspect portions of PVC sewer piping, in the presence of the Engineer, after backfilling has been in place for at least 30 days but not longer than 12 months.
- B. The maximum allowable deflection for installed plastic sewer pipe shall be limited to 5% of the original vertical internal diameter.
- C. Perform deflection testing with a deflectometer, calibrated television, or a properly sized "Go, No-Go" mandrel. The mandrel(s) shall be constructed at the Contractor's expense and subject to the approval of the Engineer.
- D. Pipe exceeding the allowable deflection shall be located, excavated, replaced, and retested at the sole expense of the Contractor.

### 3.7 TEST REPORTS

- A. The Contractor shall submit a written, certified report which includes the detailed testing log with times and results for all pipe segments and manholes.

### 3.8 ACCEPTANCE

- A. Observation of successful testing of manholes, sewers or force mains by the Engineer does not constitute acceptance of the system or any portion thereof. Upon completion of any determined portion of a total system, and successful testing thereof, the Engineer may recommend final acceptance to the Authority. Only upon final inspection by the Authority or Engineer, and upon written acceptance for same will the system or portion thereof be considered substantially completed. Upon such acceptance, the one-year correction period as specified for the manholes, sewers or force main will commence.
  1. If, during this final inspection, any irregularities are observed, the condition shall be corrected at the Contractor's expense prior to acceptance.

END OF SECTION 02731

SECTION 02732 - FORCE MAINS

PART 1 - GENERAL

11 SECTION INCLUDES

- A. Force Main Pipe and Fittings.
- B. Site Conditions.
- C. Excavation, Bedding & Backfill.
- D. Anchorage.
- E. Tests.
- F. Submittals.
- G. Product Delivery, Storage and Handling.

12 RELATED SECTIONS

- A. Trenching, Backfilling, and Compacting, Section 02221.
- B. Cast-in-Place Concrete, Section 03300.

PART 2 - PRODUCTS

21 FORCE MAIN PIPE AND FITTINGS

All work shall be in accordance with UNI-B-3-92 "Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe.

- A. Polyvinyl Chloride Pipe (PVC)
  - 1. Polyvinyl Chloride (PVC) Pipe for force mains and pressure lines shall be of the bell and spigot type or the coupling type and shall be manufactured in accordance with ASTM D 2241.
  - 2. The pipe shall be made of PVC compounds having a cell classification of 12454-B (or type 1, grade 1 or type 1120) or 12454-C (or type 1, grade 11, or type 1220) as defined in ASTM D 1784.

3. The joint shall be a rubber ring gasket meeting the requirements of ASTM D 1869, C 361 and C 443, and shall provide an adequate compressive force against the bell and spigot or the coupling to affect a positive seal and to provide for expansion and contraction while preventing displacement. The rubber ring gasket shall be the only element depended upon to make the joint flexible and watertight. Solvent cement joints are not acceptable.
4. PVC pipe shall be furnished in standard lengths of 18-22 feet. All pipe shall be marked clearly at intervals of five feet or less with the manufacturer's name, cell classification, SDR rating, and ASTM Designation D 2241.
5. Pipe shall meet the dimensional requirements of SDR 21 or Schedule 40 with a pressure rating of not less than 200 psi or approved equivalent.
6. Fittings for PVC pipe shall be compatible PVC fittings as recommended by the pipe manufacturers, and of same class as the pipe.

**B Ductile Iron Pipe:**

1. ANSI A21.51, Ductile Iron Pipe, Thickness Class 51 for underground installation, Class 53 for Flanged piping.
2. Cement lining - double thickness cement mortar lining (1/8") with seal coat, in conformance with ANSI A21.4 and AWWA C104.
3. Exterior Coating:
  - a. bituminous coating, minimum 1.0 mil thickness for underground piping.
  - b. shop prime with primer compatible with finish coat for piping inside structures.
4. Joints:
  - a. Use rubber gasket joints for pipe and fittings installed underground.
    1. Mechanical Joint: ANSI A21.11
    2. Push-on Joint: ANSI A21.11
  - b. Use flanged joints for pipe and fittings installed inside of structures, unless indicated otherwise. Mechanical pipe couplings with self-centering gaskets designed to mechanically engage grooved or shouldered piping and lock in a positive watertight couple may be used in lieu of flanged joints, except where indicated otherwise.
    1. Flanged joint: ANSI A21.15
    2. Mechanical coupling: Victaulic Style 31 or equal.
    3. Gaskets: 1/16 inch thick, one piece cloth insertion rubber gaskets suitable for wastewater service.

C. Stainless Steel Pipe:

1. Type 304 stainless steel pipe

PART 3 - EXECUTION

31 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 Engineer, for pipe laying work.

3.2 EXCAVATION, BEDDING & BACKFILL

- A. Non-metallic force mains to be installed with magnetic underground warning tape.
- B. Where force main is benched into a sewer trench, the sewer backfill shall be installed to the elevation of the force main prior to the force main installation and backfill.

3.3 ANCHORAGE

A. Concrete Thrust Blocks: Provide concrete thrust blocks for all fittings, and at all locations where horizontal or vertical deflections are made in the joints of the piping.

1. Reaction Backing: Concrete of a mix not leaner than 1 cement: 2E sand: 5 stone and having a compressive strength of not less than 2,000 psi, at 28 days. Place backing between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be as indicated on the Drawings or directed by the Engineer. Unless otherwise indicated or directed, place backing so that the pipe and fitting joints will be accessible for repair.
2. Metal Harness: Where indicated, use metal harness of tie rods of adequate strength to prevent movement. Steel rods or clamps shall be galvanized and painted with two coats of asphalt type paint.

B Anchorage for Bends: Provide thrust restraint system for all bends deflected 11.25 degrees or more on mains six inches in diameter or greater.

- 1 Use only a thrust block system for PVC pipe.

2. Use metal rods only as indicated on the Drawings or directed by the Engineer.
3. Do not use split retainer flanges on PVC pipe to obtain a restrained joint.

### 3.4 TESTS

- A. Pressure/Leakage Test of Force Mains. Upon completion of the installation and backfilling of each portion of the force main, a formal pressure leakage test will be required of the force mains, valves and fittings in the system constructed (no services 2" in diameter or less). Where any section of a main is provided with concrete thrust blocks, the test shall not be made until at least five (5) days have elapsed after the concrete was installed. If high-early-strength cement is used in the concrete thrust blocks, the test shall not be made until at least two (2) days have elapsed. Prior to the formal test, the main to be tested shall be thoroughly flushed. The force main shall then be tested as per Unibell Standard Test #UNB-3. See standard for leakage requirements.
- B. The Engineer shall be furnished a written report of the results of the hydrostatic test that identifies the specified length of pipe testing, the pressures (minimum 1.5 times working pressure), the duration of the test, and the amount of leakage.
- C. If any test of pipe laid discloses leakage greater than specified in Unibell UNB-3, the Contractor shall at his own expense locate and repair the defective pipe or joints until the leakage is within the specified allowance.
- D. The Contractor shall furnish all labor, materials, tools and equipment necessary for or incidental to satisfactory testing, and shall be responsible for any damage to the pipe line or to adjoining property, due to this work.

### 3.5 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cuts 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.

3.6 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.

END OF SECTION 02732



SECTION 02733 – LOW PRESSURE SEWER PIPE (FORCE MAIN)

PART 1 - GENERAL

11 SECTION INCLUDES

- A. Low Pressure Sewer Pipe and Fittings.
- B. Site Conditions.
- C. Excavation, Bedding & Backfill.
- D. Anchorage.
- E. Tests.
- F. Submittals.
- G. Product Delivery, Storage and Handling.

12 RELATED SECTIONS

- A. Trenching, Backfilling, and Compacting, Section 02221.
- B. Manholes, Section 2605
- C. Cast-in-Place Concrete, Section 03300.

PART 2 - PRODUCTS

21 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

- A. The pipe and fittings shall be made of High Density, Extra High Molecular Weight (EHMW) polyethylene with a standard thermoplastic material designation code of PE3408 and having a cell classification of 345464E per ASTM D3350. The molecular weight category shall be extra high (250,000 to 1,500,000) as per the Gel Permeation Chromatography determination procedure with a typical value of 300,000 to 330,000. The pipe shall be manufactured in accordance with ASTM F714 and/or ASTM D3035.
- B. The manufacturer shall provide certification that the stress regression testing has been performed on the specific product in accordance with ASTM D2837 “Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials”. The certification shall also state the specific resin used and its source.

- C. HDPE pipe manufactured from materials meeting the specifications of this section shall have an Environmental Stress Crack Resistance of no failures in 10,000 hrs. (ESCR:  $F_o > 10,000$ ) when tested in accordance with ASTM F1248.
- D. The pipe and fittings shall have product traceability. The manufacturer shall include a printline on the pipe. This shall notate the manufacturer's name, date of manufacture, the lot and supplier of raw material, plant location, and production shift. The ASTM standard shall also appear as ASTM F714 with the material designation as PE3408.
- E. Both pipe and fittings shall carry the same pressure rating. All fittings shall be pressure rated to match the system piping to which they are joined. At the point of fusion, the outside diameter and minimum wall thickness of the fitting shall match the outside diameter and minimum wall thickness specifications of ASTM F714 for the same size pipe. Fittings shall be manufactured by the pipe manufacturers or be compatible fittings as recommended by the pipe manufacturers. Elbows, tees, and wyes shall be manufactured by mitered fabrication. All fittings shall be derated according to the manufacturer's written specifications, and clearly labeled on the fitting as such.
- F. Force main and lateral HDPE pipe shall meet the dimensional requirements of SDR 11 and SDR 11.5 with a pressure rating of not less than 160 psi.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation shall be in accordance with ANSI/ASTM F585, "Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers."
- B. The system shall be complete, including special equipment for transport and fusion joining of HDPE pipe. The Contractor shall be familiar with the procedures of installation and joining of pipe sections.
- C. Pipe shall be installed in such a way as to not create tension or compression forces in the pipe. Concrete encasement thrust blocking shall be placed at curvatures greater than forty-five degrees, or where pipe movement is likely to occur, at the direction of the Engineer.

### 3.2 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 Engineer, for pipe laying work.

### 3.3 EXCAVATION, BEDDING & BACKFILL

- A. Non-metallic force mains to be installed with magnetic underground warning tape.
- B. Where force main is benched into a sewer trench, the sewer backfill shall be installed to the elevation of the force main prior to the force main installation and backfill.

### 3.4 JOINING

- A. Heat Fusion Joining Systems: Pipe and fittings shall be thermal butt fusion, saddle fusion, or socket fusion according to manufacturer recommended procedures.
- B. The manufacturer shall provide fusion training. The Contactor (actual installers) and the onsite joint inspector shall be trained by the manufacturer or manufacturer's authorized representative.
- C. It will not be permitted to join unlike SDR's to one another. Transition from unlike SDR's shall be accomplished by mechanical couplings capable of identical pressure ratings or machined polyethylene nipples where a thicker wall polyethylene has been matched to the companion pipe wall.
- D. Mechanical Joining Systems: HDPE pipe and fittings shall be connected by means of a polyethylene flange adapter and backup ring. The polyethylene flange adapter will be of the same specifications as the LightView except will be made from black plate stock. This method is also approved to join to another piping system or valves. Mechanical compression couplings or full circle encasement clamps may be used depending on the test specification.
- E. Mechanical couplings shall be installed in accordance with the mechanical coupling manufacturer's recommended procedures.
- F. Equipment: The fusion equipment and operator shall be required to demonstrate successful field experience.

### 3.5 TESTS

- A. Pressure/Leakage Test of Force Mains. Upon completion of the installation and backfilling of each portion of the force main, a formal pressure leakage test will be required of the force mains, valves and fittings in the system constructed. Where any section of a main is provided with concrete thrust blocks, the test shall not be made until at least five (5) days have elapsed after the concrete was installed. If high-early-strength cement is used in the concrete thrust blocks, the test shall not be made until at least two (2) days have elapsed. Prior to the formal test, the main to be tested shall be thoroughly flushed. The force main shall then be tested as per Unibell Standard Test #UNB-3. See standard for leakage requirements.
- B. The Engineer shall be furnished a written report of the results of the hydrostatic test that identifies the specified length of pipe testing, the pressures (minimum 1.5 times working pressure), the duration of the test, and the amount of leakage.

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- C. If any test of pipe laid discloses leakage greater than specified in Unibell UNB-3, the Contractor shall at his own expense locate and repair the defective pipe or joints until the leakage is within the specified allowance.
- D. The Contractor shall furnish all labor, materials, tools and equipment necessary for or incidental to satisfactory testing, and shall be responsible for any damage to the pipe line or to adjoining property, due to this work.

36 WARRANTY

- A. The manufacturer shall provide evidence that their standard Terms and Conditions of Sales for warranty and guarantee have been one year from date of manufacture for a period of at least five years. It will not be permitted for a manufacturer to waive the date for the period of warranty and guarantee for this project to meet this specification. The one year date of manufacture shall be covered under the standard Terms and Conditions of Sale.

3.7 SUBMITTALS

- A. Shop Drawings and Product Data: Furnish completely dimensioned shop drawings, catalog cuts or other data as required, providing 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.

3.8 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.

END OF SECTION 02733