

SECTION 33 40 00
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies construction of outside, underground storm drainage system. The storm drainage system shall be complete and ready for operation, including: all drainage structures; piping; frames, grates and covers; connections to new building storm drainage system and existing storm drainage system; and all required incidentals.

1.2 RELATED WORK

- A. Maintenance of Existing Utilities: Section 01 00 00, GENERAL REQUIREMENTS.
- B. Concrete for Outlet Control Structure: Section 03 30 00, CAST-IN-PLACE CONCRETE.
- C. Excavation, Trenching, Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 00, EARTH MOVING.

1.3 QUALITY ASSURANCE

- A. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
- B. Manufacturers shall have manufacturing and quality control facilities capable of producing and assuring the quality of piping and structures specified.
- C. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to public storm drainage pipelines and the extension, and/or modifications to Public Utility systems.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit the following documentation to the COTR for review prior to commencement of the work of this Section:
 - 1. Manufacturers' documentation (including product data sheets) for products to be furnished, including: piping, drop inlets, and frames and grates.
- C. At project completion, submit record (as-built) drawings showing installed system as specified in this Section.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. During loading, transporting and unloading, exercise care to prevent damage to all products furnished.
- B. Pipe shall be marked with manufacturer's identification symbol, size, date of manufacture, class of pipe, and applicable product specification identification number.
- C. All materials shall be inspected upon delivery to the Site. Damaged or defective materials shall be rejected or repaired as determined by the COTR.
- D. Conform to manufacturers' recommendations for handling and storage of products. Exercise care to prevent damage to products. The interior of all pipe and structures shall be kept free from dirt and other foreign matter at all times.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the

basic designation only. Referenced standards shall be the current version as of the date of advertisement of the project.

- B. ASTM International (ASTM):
 - A48/A48M.....Standard Specification for Gray Iron Castings
 - A536.....Standard Specification for Ductile Iron Castings
 - A615/A615M.....Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
 - C76/C76M.....Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
 - C443/C443M.....Standard Specifications for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
 - C478/C478M.....Standard Specification for Precast Reinforced Concrete Manhole Sections
 - C655/C655M.....Standard Specification for Reinforced Concrete D-Load Culvert, Storm Drain and Sewer Pipe
 - C857.....Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
 - C923/C923M.....Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals
 - C990.....Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
 - D4101.....Standard Specification for Polypropylene Injection and Extrusion Materials
- C. American Association of State Highway and Transportation Officials (AASHTO):
 - M198.....Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- D. Texas Department of Transportation - TDOT Standard Specifications

PART 2 - PRODUCTS

2.1 PIPING

- A. Gravity Lines (Pipe and Appurtenances):
 - 1. Concrete:
 - a. Reinforced pipe, ASTM C76, Class III, or ASTM C655, 1350 lbs/lf per 1 foot inside dia. D-Load, 12 inches through 108 inches. Joints shall be watertight flexible joints made with rubber-type gaskets conforming to ASTM C443.

2.2 JOINTING MATERIAL

- A. Concrete Pipe: Rubber gasket ASTM C443.

2.3 MANHOLES, INLETS AND CATCH BASINS

- A. Manholes, inlets and catch basins shall be constructed of precast reinforced concrete or cast-in-place concrete. Manholes, inlets and catch basins shall be in accordance with the details shown on the Drawings and the following VA requirements (in case of variance, VA requirements supersede):
 - 1. Precast Reinforced Concrete Manhole and Junction Box Risers and Tops: Design, material and installation shall conform to requirements of ASTM C478. Top sections shall be eccentric. Steps on inside wall shall be in the same plane from bottom of structure to manhole cover.
 - 2. Flat top manhole tops shall be reinforced concrete as detailed on the Drawings.
 - 3. Precast Drop Inlets: Concrete for precast sections shall have a minimum compressive strength of 4,000 psi at 28 days, ASTM A615,

- Grade 60 reinforcing steel, rated for AASHTO HS20-44 loading with 30 percent impact, and conform to ASTM C857.
4. Mortar: Conform to Section 218 of the TDOT Standard Specifications.
 5. Flexible sealing compound shall be packaged in extruded preformed shape, sized to completely fill the joint between precast sections, and form permanently flexible watertight seal. The sealing compound shall be non-shrink and meet AASHTO M-198 (ASTM C990).
 6. Frames and covers shall be gray cast iron conforming to ASTM A48 and shall be fabricated to the dimensions indicated on the Drawings. The frame and cover shall be rated for HS20-44 loading. A studded pattern and the words "storm sewer" shall be provided on the top of the manhole cover. The studs and the lettering shall be raised 5/16 inch. The cover shall be a minimum of 24 inches in diameter and shall have four 3/4 inch vent holes and two lifting slots. The bearing surface of the frame and cover shall be machine finished. The cover shall fit firmly on the frame without movement when subject to traffic.
 7. Manhole steps shall be polypropylene plastic coated on a No. 4 deformed rebar conforming to ASTM C478, Polypropylene shall conform to ASTM D4101. Steps shall be a minimum of 10 inches wide and project a minimum of 5 inches away from the wall. The top surface of the step shall have a studded non-slip surface. Steps shall be placed at 12 inch centers.
- B. Frame and Cover for Drop Inlet Gratings: Frame and cover for gratings shall be cast gray iron conforming to ASTM A48; cast ductile iron conforming to ASTM A536 in accordance with the TDOT standard details included on the Drawings. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the drawings.

2.4 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS

- A. Resilient Connectors: Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C923.

2.5 WARNING TAPE

- A. Standard, 4-Mil polyethylene 3 inch wide tape, detectable type, purple with black letters, and imprinted with "CAUTION BURIED STORM SEWER BELOW".

PART 3 - EXECUTION

3.1 EXCAVATION FOR STORM DRAINS AND DRAINAGE STRUCTURES

- A. Excavation of trenches and backfilling for storm drains, manholes, inlets and catch basins shall be in accordance with the applicable portions of Section 31 20 00, EARTH MOVING.
- B. Excavate and prepare subgrade for underground detention vault as specified in Section 31 20 00, EARTH MOVING and as recommended by the vault manufacturer. Modules shall not be installed until the granular base has been placed and compacted as required (refer to subsection 3.2).

3.2 BEDDING FOR STORM DRAINS AND DRAINAGE STRUCTURES

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint.
- B. Place and compact granular base for underground detention vault to minimum depth of 7 inches as recommended by the vault manufacturer.

- C. Place and compact granular base under other drainage structures to depth indicated on the Drawings.
- D. The top surface of the granular base under drainage structures shall be uniformly graded to the required elevation.

3.3 GENERAL PIPING INSTALLATION

- A. Lay pipes true to line and grade. Gravity flow storm drainage piping shall be laid with bells facing upgrade.
- B. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
- C. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
- D. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
- E. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
- F. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
- G. Do not lay sewer pipe in same trench with another pipe or other utility.
- H. Do not walk on pipe in trenches until covered by initial trench backfill to a depth of 12 inches over the crown of the pipe.
- I. Install storm drainage piping in accordance with the provisions of these specifications and the following standards:
 - 1. Reinforced Concrete Pipe: Comply with manufacturer's recommendations for gasketed joints and in accordance with the TDOT standard details included on the Drawings.
- J. Warning tape shall be continuously placed 12 inches above storm drainage piping.

3.4 PIPE CONNECTIONS TO STRUCTURES

- A. Pipe connections to drainage structures (including connection of new storm pipe to existing manholes) shall be installed true to line and grade as shown on the Drawings. The pipe connections shall be made using resilient connectors conforming to ASTM C923 or other approved materials in accordance with the manufacturer's recommendations.
- B. Openings for connection of pipes to existing drainage structures shall be core drilled to ensure a smooth and uniform surface around the pipe opening. Chipping, hammering, and breaking into structure by any other means shall not be accepted.
- C. Connection of new storm drainage pipeline to underground detention vault shall be made using materials and methods recommended by the detention vault manufacturer and as shown on the Drawings.
- D. All connections shall be watertight.

3.5 MANHOLES, JUNCTION BOXES, AND DROP INLETS

- A. Precast reinforced concrete bases, risers and tops shall be installed true and plumb at the locations and elevations indicated on the Drawings. The joints between sections of the structures shall be sealed with a preformed flexible gasket material specifically manufactured for this type of application. Install required number and height of riser sections so that the eccentric conical top section will be at the required elevation for each structure. Cutting the conical top section is not acceptable.
- B. Set precast concrete structures on prepared subgrade at the required elevation, carefully leveled and aligned as indicated on the Drawings. Joints in structures shall be assembled with approved sealing materials and shall be constructed in accordance with the manufacturer's recommendations.

- C. Invert channels shall be smooth and semicircular in shape conforming to inside of adjacent connected piping. Make changes in direction of flow with a smooth curve of as large a radius as size of structure will permit. Make changes in size and grade of channels gradually and evenly. Construct invert channels by: forming directly in concrete base of structure; or building up with brick and mortar. Floor of structure outside the channels shall be smooth and slope toward channels not less than 1:12 (one inch per foot) nor more than 1:6 (2 inches per foot). Bottom slab and benches shall be concrete.
- D. The wall that supports access steps shall be 90 degrees vertical from the floor of structure to manhole cover. Install steps and ladders per the manufacturer's recommendations. Steps shall not move or flex when used. All loose steps shall be replaced by the Contractor.
- E. Install top sections and manhole frame and cover and drop inlet frame and grate in accordance with the details shown on the Drawings and the applicable requirements of the TDOT Standard Specifications. In unpaved areas, the rim elevation shall 2 inches above the adjacent finish grade.
- G. Place and compact backfill around installed concrete structures up to finish grade as specified in Section 31 20 00, EARTH MOVING.

3.6 TESTING OF STORM SEWERS

A. Gravity Sewers:

1. Exfiltration Test:

- a. Subject pipe to hydrostatic pressure produced by head of water at depth of 3 feet above invert of sewer at upper manhole under test. In areas where ground water exists, head of water shall be 3 feet above existing water table. Maintain head of water for one hour for full absorption by pipe body before testing. During 1 hour test period, measured maximum allowable rate of exfiltration for any section of sewer shall be 3.0 gallons per hour per 100 feet.
- b. If measurements indicate exfiltration is greater than maximum allowable leakage, take additional measurements until leaks are located. Repair and retest.

3.8 RECORD (AS-BUILT) DRAWINGS

- A. During the progress of the storm drainage system installation, record installed locations, elevations, and all changes and deviations from the original design by marking up the Drawings. Mark-ups shall show the following information: surveyed locations and invert elevations for pipes and structures; pipe diameter; structural dimensions; and material type. Show all deviations from the Drawing.

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