# Section 6 - Storm Drainage

## Overview

This section includes specifications regarding all material, equipment, and labor required to install storm drainage facilities as specified, as shown on the Plans, and as directed by the Engineer. The contractor shall furnish all material, equipment, and labor required to install storm drainage facilities as specified, as shown on the Plans, and as directed by the Engineer.

The Contractor shall construct the storm drainage pipelines true to line and grade including all manholes, drainage structures, and other appurtenances shown on the Plans and specified below. Clearing, grubbing, trench excavating, sheeting, shoring, backfilling, restoration, and related items shall be as specified in Section 2: Trench Excavation and Backfilling. All materials shall be furnished new and shall be as shown on the Plans and as specified below.

## Chapter 1 – Pipe Materials

The following pipe materials are approved for use within the City of North Augusta. All pipeline materials shall comply with SCDOT *Standard Specifications for Highway Construction* (latest edition). Specific exceptions are as follows*:*

- The minimum pipe diameter for storm drainage pipelines to be maintained by the City shall be eighteen inches (18”).

- No metal pipe *(*CMP, DIP, BCMP*,* aluminized or galvanized CMP) shall be installed or approved for use in construction.

- All storm drainage pipelines installed within road rights-of-way shall be reinforced concrete pipe (RCP).

Pipeline materials shall be as shown on the Plans and as directed by the Engineer.

1.00 Reinforced Concrete Pipe (RCP) shall conform to requirements of AASHTO M 170, *Standard Specification for Reinforced Concrete Culver, Storm Drain, and Sewer Pipe*. Circular, Class III RCP shall be used unless otherwise specified or shown on the Plans. Elliptical RCP may only be used on a case by case basis as approved by the Engineer.

1.01 Corrugated Plastic Pipe shall be allowed only outside of road rights-of-way. All corrugated plastic pipe shall be of the high-performance polypropylene type. Pipe shall be in conformance with AASHTO M330, *Standard Specification for Polypropylene Pipe, 300 to 1500 mm (12 to 60 in) Diameter*, and ASTM F2881 *Standard Specification for 12 to 60 in. [300 to 1500 mm] Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications*. Joints shall be either water tight (WT) or soil tight (ST) as specified. Joint gaskets shall be in conformance with ASTM F477, *Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe*, when applicable.

## Chapter 2 – Pipe Installation

All pipe shall be inspected and approved by the Engineer prior to installation. The pipe shall be free from functional defects (cracks, broken ends, spalls, etc.) as determined by visual inspection. The Contractor shall remove all defective pipe from the site.

The pipe trench shall be prepared as specified in Section 2: Trench Excavation and Backfilling and pipe installation shall proceed upgrade with the bell end upgrade. Pipe shall be carefully lowered into the trench using pipe slings or cable. Pipe shall not be rolled or dropped into the trench. Each pipe shall be laid true to the line and grade as shown on the Plans to form a close concentric joint to ensure a uniform flow line. A minimum grade of one (1%) percent is required for all storm drainage pipelines unless otherwise shown on the Plans or directed by the Engineer. Pipe shall be installed in a straight alignment to allow visual inspection by looking from both ends of the completed installation. Unless specifically approved by the Engineer, pipe shall not be laid on a curve.

Concrete pipe joints shall be made with flexible water-tight gaskets in conformance with AASHTO C 990, *Standard Specification for Joins for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants*. The pipe ends shall be thoroughly cleaned and dry prior to applying the gasket. In lieu of gasket joints, the Contractor may make concrete pipe joints with cement mortar fully packed in the annular space finished smooth and flush inside and an excess mortar bead outside the pipe joint.

Corrugated Plastic Pipe shall be installed in conformance with ASTM D2321, *Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications*. Bedding shall be in conformance with Detail 6.16 – Pipe Bedding.

## Chapter 3 – Structure Materials

All drainage boxes, wing traps, head walls, junction boxes, weir inlets, manholes, outlet structures, and energy dissipation structures shall be built as shown on the Plans and standard detail drawings. Structures shall be precast concrete or constructed in place with brick, block, or concrete as specified herein and as shown on the standard details. **No knockout boxes are allowed** unless specifically approved by the City Engineer.

3.00 All precast concrete manholes and drainage structures shall conform to ASTM C 478, *Standard Specification for Circular Precast Reinforced Concrete Manhole Sections*. Cast in place concrete shall be SCDOT Class A (3000 psi) unless otherwise specified. The concrete mix design must be approved by the Engineer.

3.01 Clay or shale brick used in the construction of manholes, catch basins and other drainage structures shall conform to the requirements of ASTM C32, *Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)*, Grade MM. Concrete brick shall conform to ASTM C55, *Standard Specification for Concrete Building Brick,* Grade S-II. Concrete block shall be Grade A, Hollow Load Bearing Concrete Masonry Units in conformance with ASTM C90, *Standard Specification for Loadbearing Concrete Masonry Units*. Mortar materials shall meet SCDOT requirements.

3.02 Trap weir inlet frame must be U.S. Foundry USF 1258, cover type "BD". Manhole frame and must be U.S. Foundry USF 668, cover type KL.

3.03 Rip-rap stones shall be hard quarry or field stone and shall be of such quality that they will not disintegrate on exposure to water or weathering. Stone for hand placing to thickness of twelve inches (12”) shall vary in size with no pieces weighing more than one hundred and fifty (150 lbs). At least twenty percent (20%) of the stone pieces, excluding spalls, shall weigh more than sixty pounds (60 lbs), and no more than twenty percent (20%) of the stone pieces, excluding spalls shall weigh less than twenty-five pounds (25 lbs). Stone for hand placing to a thickness of six inches (6”) must be no less than three inches (3”) in one dimension and six inches (6”) in another dimension.

## Chapter 4 – Structure Installation

Drainage structures shall be installed where shown on the Plans and as directed by the Engineer. Excavation shall proceed as specified in Section 2: Trench Excavation and Backfilling to prepare a firm foundation on native material capable of supporting the weight of the structure. Water shall not be present in the foundation area. If native materials are not capable of providing a firm foundation, the foundation area shall be excavated and suitable material placed and compacted to provide the necessary bearing strength.

4.00 All masonry structures shall be installed on reinforced concrete footings or foundations as shown on the Plans and Standard Details. Brick and block shall be laid to line in courses in full and close joints of mortar which shall be not less than one quarter inch (1/4”) and not more than one half inch (1/2”) in thickness, and the thickness shall be uniform throughout. Adjoining courses shall break joints one half a brick (block) as nearly as practicable. Courses shall be level except where otherwise necessary. All joints shall be finished properly as the work progresses and, on exposed faces, they shall be neatly struck. Broken or chipped brick (block) will not be allowed in the faces of the structure. In making closures, no piece of the brick (block) less than the width of a whole shall be used and wherever practicable in making such closures, whole brick (block) shall be laid with the long side at right angles to the face of the structure. The exposed surface of the masonry structure shall be thoroughly cleaned of mortar stains, and pointed satisfactorily. When Reinforced Masonry is specified, care shall be taken to ensure the proper placement of the reinforcing steel as specified in the plans.

4.01 All precast concrete structures shall be set plumb and to the elevations shown on the plans. Pipe connections shall be made by stubbing the pipe end inside the structure and rebuilding the structure wall around the pipe with brick and mortar. In lieu of brick and mortar, concrete collars may be poured around the pipe on the outside structure wall, overlapping the structure wall a minimum of six inches (6”) in all directions.

4.02 All cast-in-place concrete structures shall be constructed in accordance with the design requirements and details shown on the Plans and as specified elsewhere herein. Concrete shall be placed and compacted to form a structure of maximum density and impermeability and of uniform texture exhibiting a smooth surface when the forms are removed. Concrete shall not be placed until the foundation, steel placement, and formwork has been approved by the Engineer. Defective concrete, as determined by the Engineer, shall be removed and/or repaired by the contractor.

4.03 The Contractor shall place rip-rap as shown on the plans, or a minimum of ten square yards (10 sy) at all discharge points of ditches and pipe outlets/inlets. Rip-rap shall be placed by machine and/or by hand to the designated slope, thickness, length, and depth, taking care to avoid damage to pipes and structures. The Contractor shall grout loose rip-rap as indicated on the Plans and as directed by the Engineer.

## Chapter 5 – Inspection and Testing

Upon completion of pipe installation, the pipeline shall be cleaned to remove all construction debris, dirt, mud, mortar, etc. Existing downstream piping shall be inspected by the Engineer and cleaned by the Contractor if necessary. All new storm drainage piping and appurtenances will be subject to final inspection by the Engineer. All deficiencies noted shall be corrected to the satisfaction of the Engineer prior to acceptance. All required testing such as concrete strength, soil compaction, etc., as specified in Section 2: Trench Excavation and Backfilling and as directed by the Engineer shall be conducted by an approved independent laboratory hired by the Contractor. Test results shall be submitted directly to the Engineer.

## Chapter 6 – As-Built Drawings

As the work progresses, a record shall be made on all changes to and deviations from the Plans. As-Built drawings shall be furnished to the City before acceptance of all storm drainage systems.