

SECTION 02400  
STORM DRAINAGE SYSTEM

1. SCOPE:

Under this heading shall be included all operations in connection with the installation of the storm drainage system.

2. EXCAVATION AND BACKFILL:

Excavation and backfilling shall be as specified in Section 02221, Excavation, Trenching and Backfilling for Utility Systems.

3. DELIVERY, STORAGE, AND HANDLING OF MATERIALS:

a) Delivery and Storage.

Materials delivered to site shall be inspected for damage, unloaded, and stored with the minimum of handling. Do not store materials directly on the ground. Inside of pipes and fittings shall be kept free of dirt and debris.

b) Handling.

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried to the trench, not dragged. Gasket materials and plastic materials that are not to be installed immediately shall not be stored in the direct sunlight.

4. PIPE FOR CULVERTS AND STORM DRAINS:

Pipe for culverts and storm drains shall be as indicated and shall conform to requirements for the following types.

a) Concrete Pipe.

Pipe shall be reinforced concrete pipe conforming to ASTM C76, Class III. The minimum pipe diameter shall be 15".

1) Joints.

Joints shall be made by use of a continuous rubber gasket conforming to the requirements of ASTM C443. Type II or III rubber gaskets shall be used on the pipe. Joints which do not fit tightly and uniformly shall be grouted after that segment of the line has been installed. All pipe joints shall be wrapped with a two foot wide strip of non-woven filter fabric lapped two feet.

The assembly of the gasketed joint shall be performed as recommended by the pipe manufacturer. The elastomeric gaskets may be supplied separately in cartons or pre-positioned in the bell joint or coupling at the factory. In all cases, clean the gasket, the bell or coupling interior, especially the groove spigot area to

remove any dirt or foreign material before assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and seating surfaces for damage or deformation. When gaskets are separate, use only gaskets which are designed for and supplied with the pipe. Insert them as recommended by the manufacturer.

Lubricant should be applied as specified by the pipe manufacturer. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly.

5. DRAINAGE STRUCTURES:

Drainage structures shall be of the following types, constructed of the materials specified for each type and in accordance with the indicated details.

a) Manholes and Inlets.

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete or precast concrete segmental blocks, complete with frames and covers or gratings. Precast concrete manholes and inlets shall be designed for the required depth and to sustain the required wheel loads and/or surface pressures. When manholes and inlets are to be constructed of prefabricated materials, shop drawings shall be submitted for approval before ordering the material.

b) Connection to Existing Inlets and/or Manholes.

Pipe connections to existing inlets and/or manholes shall be in such a manner that the finished work will conform as nearly as practicable to the applicable requirements specified for new inlets and/or manholes, including all necessary concrete work, cutting and shaping.

6. MATERIALS FOR DRAINAGE STRUCTURES:

a) Mortar.

Mortar for connections to other drainage structures, and brick or block construction shall conform to ASTM C270, Type M, except the maximum placement time shall be one half hour.

Hydrated lime may be added to the mixture of sand and cement in a quantity equal to 25 percent of the volume of cement used. Hydrated lime shall conform to F.S. SS-L-351, Type M, or ASTM C141, Type A.

The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 5 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalis, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water.

b) Precast Reinforced Concrete Manholes.

Manholes shall conform to ASTM C478 or AASHTO M199. Joints between precast concrete risers and tops shall be flexible plastic gasket and shall provide a flexible watertight joint. Flexible plastic gasket shall be RAM-NEK, or equal.

c) Precast Concrete Segmental Blocks.

Blocks shall conform to ASTM C139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

d) Bricks.

Bricks shall conform to ASTM C62, Grade SW; ASTM C55, Grade S-I or S-II; or ASTM C32, Grade MS. Mortar for jointing and plastering shall consist of one part Portland cement and two parts fine sand. Lime may be added to the mortar in a quantity not more than 25 percent of the volume of cement. The joints shall be filled completely and shall be smooth and free from surplus mortar on the inside of the structure. Brick structures shall be plastered with 3/4 inch of mortar over the entire outside surface of the walls. For square or rectangular structures, brick shall be laid in stretcher courses with a header course every sixth course. For round structures, brick shall be laid radially with every sixth course a stretcher course.

e) Frame and Cover or Gratings.

Fabrication shall be from one or more of the material options presented in F.S. RR-F-621, except the malleable cast iron option shall conform to ASTM A220, Grade 40010. Weight, shape, size and waterway openings for grates and curb inlets shall be as indicated on the Drawings. Frames and covers for curb inlets and for areas not subject to vehicular traffic or storage may be malleable iron if so indicated. Malleable iron frames and covers shall conform to ASTM A220 and shall be of the weight, shape and size indicated.

7. BEDDING:

See Section 02221 "Excavation, Trenching and Backfill for Utility Systems," for additional requirements.

8. PLACING PIPE:

Each pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used. Pipe lines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Pipe shall be moved horizontally into place by use of a winch or other suitable means. A backhoe bucket or other means which could damage the pipe shall not be used. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. All pipe in place shall be inspected before backfilling, and those damaged during placement shall be removed and replaced at no additional cost to the Owner. No additional

compensation will be given to the Contractor for the required diversion of drainage and/or de-watering of trenches.

9. BACKFILLING:

Backfilling shall be done in accordance with Section 02221, "Excavation, Trenching and Backfill for Utility Systems."

10. RIPRAP:

a) Materials.

Bag riprap shall consist of sand and Portland cement mixed at the ratio of 4:1 by weight. The amount of water used shall be sufficient to make up the optimum moisture content of the aggregate and cement, as determined by AASHTO T134.

b) Placement.

The bags shall be uniformly filled to the maximum capacity which will permit satisfactory tying. The bagged rip-rap shall be placed by hand with the tied ends facing the same direction, with close, broken joints. After placing, the bags shall be rammed or placed against one another to produce the required thickness and form a consolidated mass. The top of each bag shall not vary more than 3 inches above the required plan.

11. STONE RIPRAP:

a) Materials.

The stone used for stone slope protection shall be sound, rough, dense and resistant to the action of air and water and satisfactory to the Engineer. The stone shall have a density of not less than 150 pounds per cubic foot. Neither the breadth nor the thickness of any piece of stone shall be less than one-third of its length. The stone will be subject to inspection on delivery and if found to be improper gradation or quality, it will be rejected. The stone shall consist of quarry run sizes, graded as specified below:

STONE SLOPE PROTECTION

<u>SIZE OF</u> <u>STONE</u>	<u>PERCENT OF TOTAL WEIGHT</u> <u>SMALLER THAN THE GIVEN SIZE</u>
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Class I	
100 lb.	100
60 lb.	80
25 lb	50
2 lb.	Not to Exceed 10

b) Placement.

The slope protection shall be placed in such a manner as to produce a reasonable well-graded mass of material with the minimum practicable percentage of voids, and

shall be constructed within the limits and to the lines, grades, and sections shown on the Drawings. A tolerance of plus 6 inches or minus 3 inches from the limits shown on the Drawings will be allowed in the finished surface on the slope protection except that the extreme of this tolerance shall not be continuous over an area greater than 100 square feet. Materials shall be placed in horizontal layers starting on the riverward edge of the section and worked up the slope. Dumping down the slope will not be permitted. Materials shall not be dropped from a height greater than 3 feet. Any damage to the slope due to the fault of the Contractor shall be repaired at no expense to the Owner. Stone shall be placed on geotextile fabric.

12. GEOTEXTILE FABRIC:

Geotextile fabric shall have excellent puncture and tear resistance properties and act as a separation barrier between fine grain soils and load distributing aggregate fill material. Geotextile fabric shall be a woven fabric meeting the following requirements:

Fabric Property	Unit	Test Method	Typical Values
Grab Tensile Strength	lb	ASTM D-1682	200
Grab Tensile Elongation	%	ASTM D-1682	30 (MAX)
Burst Strength	psi	ASTM D-3786	400
Trapezoid Tear Strength	lb	ASTM D-1117	115
Puncture Resistance	lb	ASTM D-3787	85

Fabric shall be Mirafi 500X, or equal.

13. SUBGRADE DRAINS:

Subgrade drains will be provided from storm drain inlets where required because of the groundwater table. The subgrade drain will consist of a trench containing a 6 inch perforated pipe embedded in granular material as shown in the detail on the Drawings. The drain will extend 10 feet in two directions from the inlet and will be extended beyond that point when instructed by the Owner or his representative. The drains will be constructed on a uniform slope toward the inlet.

14. SHOP DRAWINGS:

Shop drawings shall be submitted on each manufactured item supplied under this Section along with other information as specified.

END OF SECTION 02400