

SECTION 11.0 DRAINAGE STRUCTURES

11.01 Scope of Work

This item shall consist of installation and construction of storm drainage pipes, culverts, basins, headwalls, manholes, junction boxes, head ditches, tail ditches and berm ditches. All drainage construction shall conform to the requirements and dimensions as shown on the project plans, City Standard drawings, or as stated in these specifications.

11.02 Masonry

This item covers the following types of masonry which shall be constructed in accordance with these specifications and as shown on the plans or as directed by the City Engineer.

(a) Concrete Masonry

This type of masonry shall consist of roughly squared or dressed stones laid in cement mortar.

(b) Brick Masonry

This type of masonry shall consist of brick laid in full beds of cement mortar.

(c) Block Masonry

This type of masonry shall consist of cement blocks laid in full beds of cement mortar.

(G) Payment for any and all masonry construction shall be included in the cost per structure, complete in place.

11.03 Materials for Masonry Construction

Materials for masonry construction shall meet the requirements as set forth in the following test designations and specifications.

- (a) All materials and masonry construction including cement, sand, aggregate, water, brick and mortar shall comply with Section 1040 of the NCDOT Standard Specifications.

- (b) Reinforcing Steel

Reinforcing steel shall be new billet stock of grade 40 and shall conform to ASTM 615 latest revision. The contractor shall furnish the City Engineer with a certificate from the manufacturer stating that the product is open hearth steel and giving those chemical and physical properties of the heat required by ASTM 615. Bars shall be deformed to conform to ASTM 615. Bars when placed in the work shall be free from loose rust, loose mill scale, oil, structural defects and other foreign material and shall be kept protected at all times on the job.

All reinforcing steel within the limits of a days pour shall be in place and firmly wired before concrete pouring is started. Wire supports, laps splices, and construction shall comply with the "Manual of Standard Practice" published by the Concrete Reinforcing Steel Institute.

On exterior exposed work, no ties or spacers shall be permitted to remain within three eighths (3/8") of an inch of the finished surfaces.

- (c) Precast Concrete Blocks

Blocks of proper radius used in circular manholes shall conform to ASTM C-139 specifications or latest addendum. See Section 13.08 for further requirements.

- (d) Frames, Grates, and Hoods

Frames, grates, and hoods for catch basins shall conform to City of Gastonia standard drawings 71C-1, 71C-2, and 71C-3 and shall be equal to those used presently by the City. All castings shall conform to ASTM A-48-74 Class 30 or latest addendum. All castings shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes, and other defects affecting their strength. Bearing surfaces between cast frames, covers, and grates shall be machined, fitted, and match-marked to prevent rocking. Steps shall be those as shown on Standard Detail 71B-2 or approved equal. All gray iron castings may be supplied with "no paint".

11.04 Concrete Pipe Culverts

All reinforced pipe supplied under this item shall be Modified Bell and Spigot or Tongue and Groove. For Modified Bell and Spigot pipe supplied under this item, the nominal Bell diameter shall not exceed the nominal diameter of the pipe by more than two inches (2"). Unless installation depth or loading requires otherwise, all such pipe shall be Class III "Wall B" as determined by ASTM Test Designation C-76. The pipe class, type of wall, and date of manufacturer shall be clearly marked on each section of pipe. Test data for reinforced concrete pipe supplied to the City shall be made available to the City within 7 days of such request.

Lift holes shall be constructed in all reinforced pipe 60 inches or larger in diameter. The maximum allowable lengths per joint for reinforced pipe shall be:

<u>SIZE RCP</u>	<u>LENGTHS PER JOINT</u>
30" and smaller	8 feet

All reinforced concrete pipe shall be delivered to the City's stockpile or to the job site as may be designated by the City Engineer. Any pipe damaged during shipping or handling by supplier or hauler's personnel or equipment shall not be accepted and shall be removed from the City at the expense of the supplier or hauler.

Under materials only contracts, any and all cost for delivery of this material shall be included in the unit price of the pipe. The City will try to request delivery of the materials specified in the proposal in truck or mixed-truck loads; however, the materials may, from time to time, be requested in smaller quantities. The contractor shall be required to deliver these materials as requested by the City to a minimum load size of forty (40) linear feet of pipe.

Under construction contracts, this item shall consist of reinforced concrete pipe Class III-Wall B of the sizes and dimensions called for on the plans, including flared end sections, furnished and installed at such locations as designated on the plans or as designated by the City Engineer.

(G) This item shall include all material and equipment needed to install pipe and unit price shall be per linear foot of pipe installed complete in place including backfilling, tamping, and fine grading.

All RCP joints shall be sealed using a Butyl Rubber Sealant; refer to City of Gastonia specifications, Section 13.09

Materials and construction methods shall conform to the specifications as set forth in Section 310 and Section 412 of the NCDOT "Standard Specifications for Roads and Structures" latest revision, and all materials shall be approved by the City Engineer before installation. Before any pipe may be covered with backfill, the City Construction Inspector shall approve such lines as to grades, alignment, and joints. Any line disapproved by the City Construction Inspection shall be removed and new pipe relayed and inspected.

11.05 Corrugated Steel Structural Plate Pipe Arch

This item shall include all corrugated metal pipe installations. All such installations shall conform to those requirements as set forth in Section 11.04 for concrete pipe and Section 326 and Section 328 of the NCDOT "Standard Specifications for Roads and Structures" latest revision. Corrugated metal pipe or multi-plate pipe arches shall not be allowed on City of Gastonia maintained systems except as specifically approved by the City Engineer and then only where the diameter of pipe exceeds 96 inches.

11.06 Corrugated Steel Structural Plate Pipe-Arch Culverts Assembly and Installation

This item shall include all labor, tools, equipment, etc. necessary for the assembly and installation of the corrugated metal multi-plate pipe arch culverts supplied by the City of Gastonia. It shall include the excavation and backfilling required to bring the road section to the grades and dimensions as shown on the plans, standard drawings, or as specified by the City Engineer.

Extra care shall be taken to keep from chipping, peeling, or otherwise defacing the asphaltic coating supplied on the corrugated metal multi-plate pipe arch culvert. If in any instance, the asphaltic coating is defaced as above, the coating shall be replaced by the contractor and no additional payment will be rendered. Corrugated steel structural plate pipe shall not be allowed on City of Gastonia maintained systems except as specifically approved by the City Engineer and then only where the equivalent (by flow) size circular pipe would be 96 inches or larger.

11.07 Corrugated Steel Structural Plate Pipe Arch Culverts - Relocation of Existing Structure

This item shall include all labor, tools, equipment, etc. necessary to relocate the existing corrugated metal multi-plate pipe arch culvert to the line and grade as shown on the plans or as directed by the City Engineer. It shall include the

excavation and backfilling required to bring the road section to the grades and dimensions as shown on the plans, standard drawings, or as specified by the City Engineer.

This item shall include all materials, labor, tools, equipment, etc. necessary to fully bituminous coat the existing corrugated metal multi-plate pipe arch culvert. Corrugated steel structural plate pipe shall not be allowed on City of Gastonia maintained systems except as specifically approved by the City Engineer and then only where the equivalent (by flow) size circular pipe would be 96 inches or larger.

11.08 Catch Basins

This item shall include all catch basin construction, complete in place. It shall include the excavation, materials, labor and backfilling required so as to bring catch basins to the grades and dimensions as shown on the plans, "Standard Details" Section No. 71C or as specified by the City Engineer.

Bricks used in construction of all catch basins shall be either kiln dried red clay or standard concrete catch basin brick. Also, see Sections 11.02 and 11.03 of these specifications.

All cast iron frames, grates, and hoods shall be equal to those currently used by the City in size, dimension, strength and equality. See Standard Details 71C-1, 71C-2 and 71C-3. All castings shall be manufactured and tested in the U.S.A.

Precast Catch Basins are allowed with approval from the City Engineer, drawings and details for pre-cast basins shall be sealed by a professional engineer. No "knock-out" panel designs will be approved. The contractor is solely responsible for the depth/height finally incorporated in the work, no additional payment will be allowed due to changes in depth during construction.

(G) There shall be no extra payment for excavation for these structures except for solid rock excavation or unsuitable material as defined in Section 10.02.

(G) Payment for this item shall be on the unit cost per structure, complete in place.

11.09 Headwalls

This item shall include installation of materials and construction of all headwalls, complete in place (dimensions shall be as shown in the plans and standard drawings No. 71C-9 thru 71C-24).

On reinforced concrete pipe of thirty six inches (36") or less in diameter, standard flared end sections may be used in place of headwalls provided that written permission is granted by the City Engineer for each installation and construction is made in accordance to City Standard No. 71C-8.

Where flared end sections are used, concrete footings and splash pads shall be used.

(G) A unit price for installation of flared end sections, complete in place shall be negotiated between the City and contractor prior to installations.

Standard headwalls shall be either plain concrete, reinforced concrete, concrete block (Stalite or concrete block, as supplied by S.C.S. of Belmont, North Carolina or approved equal) with durwall construction, or kiln dry red clay brick and shall be constructed to the dimensions and limits shown on the plans and standard drawings No. 71C-9 thru 71C-24.

11.10 HDPE Pipe-Provisional Specification only. City Engineer approval required on a project by project basis.

All HDPE pipe shall be double wall, corrugated exterior and smooth interior wall pipe, meeting AASHTO M294 Type S, ranging in diameter from 15" to 36". HDPE pipe with nominal diameter 42" and 48" will be approved by the City Engineer on a per project basis, and conform to AASHTO Provisional MP6-95. All pipes shall conform to ASTM D3350 Cell Classification of 345420C, or ASTM 1248 Type III, Class C, Category 5, Grade P34. The pipe joints shall be gasketed bell and spigot, meeting ASTM F-477. All pipe shall be clearly marked in the factory showing the AASHTO designation, date of manufacture, and name/trademark of the manufacturer.

Any pipe damaged during delivery to or unloading at the job site will not be accepted and shall be removed at the suppliers or haulers expense. Pipe shall not be stockpiled in a manner that will expose it to direct sunlight for more then a total accumulation of six months.

Pipe shall be installed straight and true to line and grade, bell end facing upgrade. The pipe is to be handled, belled up, and placed in the trench in accordance with manufacturers recommendations and established engineering practices as described in the various publications referenced in this document.

Trench widths for HDPE pipe shall be the outside diameter of the pipe plus two (2) feet, with the pipe being placed in the center of the trench. The pipe is to be bedded and backfilled to the spring line with evenly graded Class Ib or II material and in a manner consistent with ASTM D2321. In cases where fines from the trench walls and subsequent backfill on top of the trench could migrate into the voids in the Class Ib or II initial backfill, a filter fabric will be placed surrounding the Class Ib or II backfill, in a manner to prevent such migration. The initial backfill of Class Ib or II material to the springline of the pipe is to be placed such that the pipe does not shift in the trench and remains true to line and grade. No backfill is to be placed over the pipe until the Engineer has visually inspected the bedding, haunching and pipe installation. If for any reason backfill is placed over the pipe prior to the inspection, the contractor will be required to remove the backfill to allow for this visual inspection. All costs for this removal and replacement of backfill, as well as correction of any defects found, shall be at the contractor's expense.

A deflection test will be performed not less than 30 days following completion of backfill operations. The contractor shall supply all labor, equipment, and materials necessary to pull a mandrel sized for a maximum of 5% deflection of the actual pipe inside diameter. The mandrel shall be pulled through each section of pipe, from structure to structure, and must slide freely through the pipe with only nominal hand force applied. No mechanical force shall be used in pulling the mandrel. Any pipe that refuses the mandrel shall be removed and replaced according to standard specifications, and retested. All costs for removal, replacement and retest shall be at the contractor's expense.

Where requested by the Field Engineer, the contractor shall provide CCTV video taping of placed pipe within 30 days of completion of backfill operations. Video taping will be done in accordance with Section 2.63 of the Standard Specifications. Any areas found to be deficient by the Field Engineer will be removed and replaced at the contractor's expense, and could be cause for videoing of all pipe on the project.

HDPE pipe is to only be used where 18" minimum cover to the grassed surface or bottom of the pavement structure can be attained.