

SECTION II - MATERIALS

PART 1 - EARTHWORK AND SITEWORK

1.01 Clean Backfill

Clean backfill (first 2' of backfill) material shall contain no man-made or organic material or clay pockets and shall be free of rocks, clods, or other materials larger than 2 inches in nominal diameter. Materials from on-site excavations may be used for clean backfill provided they meet the specified requirements and contain optimum moisture content for proper compaction. Water saturated material shall not be used as clean material. If sufficient on-site clean backfill material is not available, acceptable material from an off-site borrow area shall be secured.

1.02 Backfill

Backfill shall be free of all organic materials and shall not contain any rocks larger than 4 inches in diameter, asphalt, concrete, trash, or be in a water saturated condition. All trash (plastic bottles, cardboard packaging, plastic wrappers, etc.) left by the contractor, shall be removed from the trench prior to backfilling.

1.03 Crushed Stone or Screened Gravel

Crushed stone or screened gravel shall meet the requirements of the North Carolina Department of Transportation Standard Specifications - latest revision.

Crushed stone or screened gravel shall conform to standard size No. 5. Any rock, run-of-bank sand or gravel excavated on site which meets this gradation may be used. Specifically the stone shall meet the following gradation:

<u>Sieve Size</u>	<u>Percentage Dry Weight Passing Designated Sieve Size</u>
1-1/2 inch	100
1 inch	90-100
3/4 inch	20-55
1/2 inch	0-10
3/8 inch	0-5
No. 200	0-0.6

1.04 Pipe Bedding

All material used for pipe bedding shall be size #67 washed stone in accordance with current NCDOT Standard Specifications.

1.05 Riprap

The stone for riprap shall consist of field stone or rough unhewn quarry stone. The stone shall be sound, tough, dense, and resistant to the action of air and water. The riprap shall be of the size required for proper erosion control and shall meet the standards for NCDOT Class 1 riprap, Class 2 riprap, Class A erosion stone or Class B erosion stone. Class 1 stone shall vary in weight from 5 to 200 pounds. At least 30 percent of the total weight of the riprap shall be in individual pieces weighing a minimum of 60 pounds each. Not more than 10 percent of the total weight of the riprap may be in individual pieces weighing less than 15 pounds each. Class 2 stone shall vary in weight from 25 to 250 pounds with at least 60% of the total weight of the riprap and shall be individual pieces weighing a minimum of 100 pounds. Not more than 5% of the total weight of the riprap may be individual pieces weighing less than 50 pounds each. Class A erosion stone shall range in size from 2"-6". Class B stone shall range from 5"-15".

During placing, the stone shall be graded so that the smaller stones are uniformly distributed through the mass. The stone may be placed by mechanical methods, augmented by hand placing where necessary. The placed riprap shall form a properly graded, dense, neat layer of stone. The channel shall be undercut to allow for the following depths of riprap.

Class I -	2'
Class II -	2.5'
Class A -	1'
Class B -	2'

1.06 Portland Cement Concrete

Portland Cement

Portland cement shall meet the requirements of AASHTO M85 for Portland cement Types I, II and III, except the maximum fineness requirements of AASHTO M85 do not apply to cement used in precast concrete products.

Air-entraining portland cement shall not be used.

Different types of cement shall not be mixed nor used alternately.

Cement shall be protected from contamination or damage during handling and storage. Cement which is damaged, partially set, lumped or caked shall not be used.

Fine Aggregate

Fine aggregate shall consist of natural or manufactured sand having clean, durable, hard, uncoated particles, free from dirt, wood, paper, fiber and all other foreign material.

Natural sand shall meet the gradation requirements for No. 25 fine aggregate. Manufactured sand shall meet requirements for standard size 2MS.

<u>Sieve Size</u>	<u>% Total Weight Passing</u>	
	<u>2S</u>	<u>2MS</u>
3/8"	100	100
#4	95-100	95-100
#8	80-100	84-100
#16	45-95	45-95
#30	25-75	25-75
#50	8-30	8-35
#100	0.5-10	0.5-20
#200	0-3	0-8

Coarse Aggregate

Coarse aggregate shall consist of crushed stone, crushed or uncrushed gravel or other inert materials of similar characteristics, washed to remove clay, loam and dust. The aggregate shall be free from dirt, wood, paper, fiber and all other foreign materials.

Coarse aggregate shall meet requirements of standard size no. 67 or no. 57. Standard size no. 78M shall be used in concrete for machine placed curb, gutter and paved ditch.

For aggregate gradations, see specification Section II, Item 5.0, "Stone and Aggregate".

Water

Water used for mixing concrete shall be clear, potable, and free of deleterious substances.

Concrete Mix Design

REQUIREMENTS FOR CONCRETE

Class of Conc.	Minimum Compressive Strength at 28 days, Lbs. Per Sq. Inch	*Maximum Water-Cement Ratio				*Consistency, Max. Slump Inches		Maximum Cement Content Pounds Per Cu. Yd.	
		Air-entrained Concrete		Non-Air-entrained Concrete		Vibrated	Non- Vibrated	Vibrated	Non- Vibrated
		Rounded Aggregate	Angular Aggregate	Rounded Aggregate	Angular Aggregate				
AA	4500	.381	.426	-	-	3	-	639	-
A	3000	.488	.532	.550	.594	3	4	564	602
B	2500	.488	.567	.559	.630	2.5	4	508	545
CMB	3500	.427	.470	-	-	3	-	639	-

Depositing

Concrete shall not be used if it cannot be placed within ninety (90) minutes of the dispatch time. Concrete shall be deposited in such a manner so as to prevent contamination by foreign material and segregation due to rehandling or flowing. Segregated concrete and/or concrete consisting of foreign material shall not be used. Depositing shall not be done when temperature has not exceeded 35 degrees Fahrenheit and rising by 10:00 A.M. Concreting shall cease when the descending air temperature in the shade falls below 40 degrees Fahrenheit. It shall not resume until the ascending air temperature rises to 35 degrees Fahrenheit. All concrete shall be kept from freezing. Frozen concrete shall be replaced. Free fall shall not exceed 3 feet in any case.

Forms

Forms may be made of wood, plywood, metal, or any other suitable material. Forms shall be mortar tight, of material strong enough to resist noticeable deflection or bulging between supports, and the interior dimensions of the forms shall be such that the finished concrete shall be of the proper form and dimensions. The design of the forms shall take into account the effect of vibration of concrete as it is placed and also the rate of speed at which the forms will be filled.

Mechanical vibrators, of an approved type, and continuous spading and/or rodding of concrete shall be used to produce proper contact of concrete with forms and reinforcing steel in piers and with forms and pipe in monolithic inverts insuring a compact, dense and impervious artificial stone of uniform texture.

Curing

All concrete shall be cured by one of the following methods:

- (a) Forms left in place for a period of seven (7) days. Exposed concrete shall be moist cured.
- (b) Moist curing performed when forms are removed before seven (7) days. All construction joints shall be moist cured.
- (c) Curing compound used immediately after forms are removed and all surface water has disappeared.

Finishing

The structure shall have a uniform and textured surface. All form marks exposed to view shall be rubbed off with a stone.

Testing

Concrete shall be tested in accordance with Section IV of this manual.

Acceptance of Concrete

The City Engineer and/or SRU Management may require as many additional tests as deemed necessary to insure the concrete acceptability. The cost of the tests shall be at no expense to the City.

SECTION II - MATERIALS

PART 2 - WATER

2.01 Ductile Iron Pipe (DIP)

All ductile iron pipe shall be Pressure Class 350 (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

DIP pipe must be manufactured in the USA.

DIP pipe must be new pipe (no used pipe allowed).

No damaged pipe will be allowed.

All water pipe shall have a potable water logo (PW) on all joints.

DIP is required for the following applications:

- Under all roadways, except local residential streets or as approved by SRU Management
- For creek crossings (Creek crossings require an encasement pipe)
- Under railroads
- Where there is less than 3' of cover
- Where there is 15' or more of cover
- Where pipe is located in fill material (above undisturbed soil)
- For pipe used as carrier pipe in bores/road bores
- For fire hydrant installations (on hydrant legs/branches)
- Where minimum clearances with other utilities cannot be met
- In poor soil, in rock, and/or where PVC pipe is not allowed by the City Standards, NCDEQ, or NCDOT

DIP pipe for water lines shall have blue copper tracer wire (14-gauge) for its entire length and shall be looped up at valves, fire hydrants, and water services/meter boxes for connection to pipe locating equipment.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C-151/ANSI A21.51, AWWA C-111/ANSI A21.11, AWWA C-150/ANSI A21.50. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

The ductile iron pipe shall be cement-mortar lined with a sealcoat in accordance with AWWA C-104, and bituminous coated on the exterior in accordance with AWWA C-151.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with AWWA Standard C-111, or flanged joints in accordance with AWWA Standard C-115.

Each joint of ductile iron pipe shall be hydrostatically tested to 500 psi at the point of manufacture before the outside coating and inside lining are applied. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material, are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Restrained joints shall be TR Flex or Lok Tyte as manufactured by U.S. Pipe, Lok-Fast or Lok-Ring as manufactured by American Pipe or approved equal. Restrained joints shall be used when the pipe location excludes the use of thrust blocks for proper support.

2.02 Ductile Iron Fittings

Ductile Iron Fittings must be USA made (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A") All fittings shall be short, compact ductile iron type, pressure class 350 in accordance with ANSI/AWWA C153/A21.53, AWWA C-111/ANSI A21.11, AWWA C-104/ANSI A21.4. The fittings shall be tested, and the manufacturer shall provide certified test results when requested by the City. This testing shall include hydrostatic proof testing of the fittings.

All fittings shall be all-bell and of the mechanical joint type. Mechanical joints shall be manufactured in accordance with AWWA Standard C-111/A21.11.

All fittings shall be ductile iron and shall have a minimum working pressure rating of 350 psi and a minimum iron strength of 25,000 psi.

All fitting interiors shall be cement-mortar lined and sealed in accordance with AWWA Standard C-104/A21.4, and the outside shall be bituminous coated.

Ductile iron cross type fittings are not allowed without prior approval of SRU Management.

2.03 Polyvinyl Chloride Pipe (PVC) and Fittings

All PVC water pipe is to be in accordance with AWWA C-900. Pipe shall have push-on joints with integral bell and locked-in gasket and shall conform to ASTM D-1784, ASTM D-3139. The bell shall consist of an integral wall section with a locked-in, solid cross-section elastomeric ring. Pipe will also be the type approved by the National Sanitation Foundation, and shall bear the NSF logo. All water pipe shall have a potable water logo (PW) on all joints. (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

All pipe for 6-inch and larger mains shall conform to AWWA Standard C900, DR 14, Class 200, rated with a working pressure 200 psi. All fittings shall be mechanical joint ductile iron as specified in Item 2.02 of this section.

PVC pipe will be used only in areas where the highest working pressure is 125 psi or less. Maximum line size for PVC pipe is 12-inches. Minimum cover is 3-feet. Ductile iron pipe will be required in all locations where the working pressure exceeds 125 psi as measured or calculated, where cover is less than 3-feet or where pipe size exceeds 12-inches.

PVC pipe shall not be allowed in the following applications:

- Under roadways, except local residential streets or as approved by SRU Management
- For creek crossings
- Under railroads
- Where there is less than 3' of cover
- Where there is 15' or more of cover
- Where pipe is located in fill material (above undisturbed soil)

- For pipe used as carrier pipe in bores/road bores
- Where minimum clearances with other utilities cannot be achieved
- Where ductile iron pipe is required by the City, NCDEQ, or NCDOT

PVC pipe that has been yard stored for an extended time and/or exposed to outside weather elements for an extended amount of time (to the point that it has changed color and/or has become brittle) shall not be allowed.

All pipes and materials are to be tested according to the requirements of AWWA Standard C-900. Certified test results are to be provided to the City when requested. These tests shall be performed by an independent testing laboratory at the expense of the pipe manufacturer.

PVC water pipe (C-900) shall be installed with stone bedding as shown in the Standard Details as Type II bedding, unless rock, poor soil or saturated conditions exist, in which case, Type III bedding shall be used.

All PVC pipe for water lines shall have blue colored copper tracer wire (14-gauge) for its entire length and shall be looped up at valve boxes for connection to pipe locating equipment.

2.04 2” Public Water Mains

Where 2” public water mains are allowed per the Water System Design Criteria (Section V, Item 2.01), allowable pipe materials are as follows:

- SDR-13.5 with Type II bedding (not for use under roads/pavement unless approved by SRU Management)
- Type “K” copper
- Muncipex® (Pex “A”) – in accordance with Item 2.05 of this section.

All 2” pipe for water lines shall have blue colored copper tracer wire (14-gauge) for its entire length and shall be looped up at valve boxes for connection to pipe locating equipment.

2.05 Muncipex® (Pex “A”)

Muncipex® (Pex “A”) is an approved pipe material for ¾”, 1”, and 2” water services from tap to meter setter as described herein. SRU Management must approve the use of 2” Muncipex® (Pex “A”) pipe or approved equal for water main construction. Muncipex® (Pex “A”) pipe is not allowed in planting strips containing street trees, where minimum separations are not obtainable, or where ferrous pipe materials are otherwise required.

Due to the unique testing requirements, Muncipex® Pex “A” is only approved for use under the following conditions:

- For construction of new 2” water mains (where ferrous pipe is not required by City or State standards) and must be approved in advance by SRU Management.
- For service lines when installed on a newly installed or existing 2” Pex “A” water mains.
- For water service lines on existing water mains.

Municipex® (Pex “A”) is not allowed for use on projects that contain other water main sizes and/or materials (except when the 2” Pex “A” pipe can be completely valved off from the other water lines and independently pressured tested).

2” Municipal® (Pex “A”) water mains must be independently tested as outlined in Section IV.

Pex “A” pipe for water lines shall have blue copper tracer wire (14-gauge) for its entire length and shall be looped up at valve boxes and meter boxes for connection to pipe locating equipment.

2.06 Steel Pipe for Cased Crossings

Cased crossings of roads and railroads shall meet standards of Item 3.04, Part 3, of this section and the applicable controlling agency (i.e. NCDOT, RR).

2.07 Gate Valves and Tapping Valves

Gate valves and tapping valves:

(see current City of Salisbury water & sewer approved product manufacturer’s sheet for approved types located in Appendix “A”)

Gate valves twelve (12) inches in diameter and smaller, shall be all bell with mechanical type joints. They shall be "O" ring, open-left valves of the nonrising stem type. Valves shall be AWWA type. Resilient seated valves may be used on all new construction. On existing water lines, valves shall be wedge (bronze) seated. Valves shall be designed for a minimum of 200 psi working pressure and 300 psi hydrostatic test pressure with a two (2) inch operating nut. Valves shall be cast iron or ductile iron. All interior and exterior parts shall be epoxy coated.

Valves shall be M.J. type, with slotted holes allowed only at the 11 o'clock and 1 o'clock positions. Shoulder bolts (not tee bolts) shall be used in the slotted holes.

Flange valves can not be substituted for tapping valves.

2.08 Automatic Air Release Valves

Air release valves shall be Crispin Pressure Air Valves, Model P 20, with a vacuum check unit, Val-Matic, Model VM-45, with a vacuum check unit or equal as approved by SRU Management. These valves shall be suitable for 150 psi working pressure and designed to allow air to escape automatically while the main is in service and under pressure. The valve shall be housed in an approved eccentric manhole and shall be installed in accordance with the manufacturer's recommendations. Air release valve locations shall be approved by SRU Management, and shown on the plans.

Air release valves are to be used at the option of the design engineer, and are to be located in new construction only.

2.09 Tapping Sleeves and Tapping Saddles

All sleeves shall have a minimum of 200 psi working pressure and shall be pressure tested in-place before the tap is made. The tapping shall be tested at 200 psi for a period of 30 minutes to 2 hours. If the test pressure has dropped less than 5 psi and there is no further pressure loss, the SRU inspector may allow the 30 minute test time. If there is any continuing pressure loss, the tapping sleeve test time may be increased to the full test time of 2 hours (as required by the SRU inspector). The pressure may not drop more than 5 psi during the test. All visible leaks must be repaired. All sleeves shall be ductile iron, cast iron or stainless steel (requires prior approval from SRU Management). All taps shall be machine drilled, no burned taps will be allowed. (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

2.10 Valve Boxes

Adjustable valve boxes shall be gray cast iron of the dimensions specified in the Standard Details of these specifications. Boxes and extensions shall be of the "slip-on" type. Screwed connections shall not be accepted. The word "water" shall be cast into the lid (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

2.11 Fire Hydrants

Nozzles shall have NST threads and shall consist of the following: 2-two and one-half inch nozzles, and 1-four and one-half inch nozzle. All nozzles shall be provided with cap and cap retaining chain. The hydrant valve opening shall be four and one-half inches. Bronze to bronze threads shall be provided between the hydrant seat or seat ring and the seat attaching assembly. All hydrants must include cast or ductile iron epoxy lined shoe and protective valve stop device. All hydrants shall be grease lubricated, no oil filled assemblies shall be allowed. Fire Hydrant color shall be silver or color required by the local fire authority having jurisdiction. (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

Hydrants shall be open-left type and shall have a six-inch hub-end or mechanical joint elbow. The hydrant barrel shall be of sufficient length to provide a minimum of three feet bury and be of the break-away impact type.

Hydrant tees with screwed end valve assemblies, as manufactured by Griffin or equal are acceptable, or restraint may be accomplished using Mega-Lugs as shown in the standard details.

Fire hydrants installed within the Town of China Grove zoning jurisdiction shall be fitted with a 5" Storz connection on the pumper nozzle facing the street (See Detail W-3A).

2.12 Taps

For taps 2" diameter or less, saddles and corporation cocks shall be used. (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

Corporation cocks shall have AWWA standard tapered threads. (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

Taps larger than 2" shall be made using the appropriate size tapping sleeve and valve. On a "dry line", the connection shall be made with a tee and valve or by tapping.

2.13 Service Lines

Service lines shall be a minimum of 3/4". Lines 3/4" through 2" shall be type "K" soft copper or Muncipex® (Pex "A") as allowed in Item 2.05 of this section. Female iron thread, male iron thread, flared, pack joint or other approved fittings may be utilized. Service lines greater than 2" may be ductile iron pipe with ductile iron fittings.

2.14 Meter Setters and Boxes

Residential meter boxes and meter setters may be purchased from the City (advance ordering required). Meter setters shall be of 3/4" copper tubing. The inlet shall have a copper tube pack joint and the outlet shall have male iron pipe threads. Meter setters shall be installed with locking wing on the City's side of the meter (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A"). If meter boxes and meter setters are not purchased from the City, it will be the responsibility of the contractor to make sure all items are to the City of Salisbury's Uniform Construction Standards and Specifications.

All boxes shall have cast iron "meter reading lids".

Commercial and industrial meters shall be of a size and configuration approved by the City. All meters over 1" shall have a bypass as shown in the Standard Details. Meter bypass lines for fire protection shall have a detector check, or if the bypass line is to be used for purposes other than emergency fire protection, a meter shall be installed.

The City shall provide and install all meters at owner's expense.

All meter connections shall have an approved backflow prevention device.

2.15 Multiple Meter Assemblies

When allowed, meter assemblies shall be as shown in the Standard Details. Meters shall be purchased from and set by the City. A master meter is required at the property line and shall be of a size and configuration as approved by the City. A backflow prevention device with valved bypass shall be located in the master meter vault. Individual meters shall be City standard. Piping between the master meter and the individual meters shall be the responsibility of the Owner, except that private permitted systems must meet the requirements of the City of Salisbury's Uniform Construction Standards for materials, bedding, and testing. The City shall not be responsible for repair or maintenance of these lines.

Manifold assemblies are not allowed, unless otherwise approved by SRU Management.

2.16 Backflow Prevention Devices

All new or renewed connections require backflow prevention. Backflow prevention shall be installed on the customer's side of the meter.

3/4", 1", and 2" services shall have a dual check valve installed on meter setter (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A"). Some of these services may be required to have backflow prevention devices installed above ground in the appropriate enclosure on the owner's property. Services larger than 2-inches shall have backflow prevention devices installed in a separate vault on the Owner's property. High risk connections shall have backflow prevention devices (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A" and backflow standard detail drawings in Appendix "D" for installation details). Risk category determination is by SRU Management.

All backflow prevention devices shall meet approval of the Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California.

All lines, including fire lines and irrigation lines, shall have approved backflow prevention.

Backflow guidance documents can be found in Appendix "D".

2.17 Federal Lead Free Drinking Water Act, Jan. 2010 (Reduction of Lead in Drinking Water Act)

All fire hydrants, curb stops, corporation stops, copper meter setters, and misc. brass fittings shall be compliant with the Federal Lead Free Drinking Water Act, January 2010 (Reduction of Lead In Drinking Water Act) and shall be "no lead" or "lead free".

SECTION II - MATERIALS

PART 3 - SANITARY SEWER

3.01 Ductile Iron Pipe (DIP) and Fittings

All ductile iron pipe shall be Pressure Class 350 (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A")

DIP pipe must be manufactured in the USA.

DIP pipe must be new pipe (no used pipe allowed).

No damaged pipe will be allowed.

DIP is required for the following applications:

- Under all roadways, except local residential streets or as approved by SRU Management
- For creek crossings (creek crossings require encasement pipe)
- Under railroads
- Where there is less than 3' of cover
- Where there is 15' or more of cover
- Where pipe is located in fill material (above undisturbed soil)
- For pipe used as carrier pipe in bores/road bores
- Where minimum clearances with other utilities cannot be met
- In poor soil, in rock, and/or where PVC pipe is not allowed by City Standards, NCDEQ, or NCDOT

DIP pipe for sewer lines shall have green copper tracer wire (14-gauge) for its entire length and shall be looped up at cleanouts and manholes for connection to pipe locating equipment.

The ductile iron pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C-151/ANSI A21.51, AWWA C-111/ANSI A21.11, AWWA C-150/ANSI A21.50. The ductile iron pipe shall be supplied in nominal lengths of 18 or 20 feet.

The ductile iron pipe shall be cement-mortar lined with a sealcoat in accordance with AWWA C-104, and bituminous coated on the exterior in accordance with AWWA C-151. SRU Management may require Protecto 401 ceramic epoxy lining for certain applications or locations of sewer line installation in place of the cement-mortar lining.

Pipe joints shall be mechanical or "push-on" manufactured in accordance with AWWA Standard C-111, or flanged joints in accordance with AWWA Standard C-115.

Each joint of ductile iron pipe shall be hydrostatically tested to 500 psi at the point of manufacture before the outside coating and inside lining are applied. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any rupture or leakage of the pipe wall.

All materials used in the production of the pipe are to be tested in accordance with AWWA Standard C-151 for their adequacy within the design of the pipe, and certified test results are to be provided to the City upon request. All certified tests, hydrostatic and material, are to be performed by an independent testing laboratory at the expense of the pipe manufacturer.

Ductile Iron Fittings must be USA made (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A") All fittings shall be short, compact ductile iron type, pressure class 350 in accordance with ANSI/AWWA C153/A21.53, AWWA C-111/ANSI A21.11, AWWA C-104/ANSI A21.4. The fittings shall be tested, and the manufacturer shall provide certified test results when requested by the City. This testing shall include hydrostatic proof testing of the fittings.

All fittings shall be all-bell and of the mechanical joint type. Mechanical joints shall be manufactured in accordance with AWWA Standard C-111/A21.11.

All fittings shall be ductile iron and shall have a minimum working pressure rating of 350 psi and a minimum iron strength of 25,000 psi.

All fitting interiors shall be cement-mortar lined and sealed in accordance with AWWA Standard C-104/A21.4, and the outside shall be bituminous coated. SRU Management may require Protecto 401 ceramic epoxy lined fittings for certain applications or locations of sewer line installation in place of the cement-mortar lining.

3.02 Polyvinyl Chloride Pipe (PVC)

PVC gravity sanitary sewer pipe shall be SDR-35 or SDR-26 and conform to the provisions contained in this section. See current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A".

PVC pipe shall not be allowed in the following applications:

- Under parking lots and other non-street paved areas, unless SDR-26 is specified
- Under roadways, except that SDR-26 is allowed under local residential streets or as approved by SRU Management
- For creek crossings
- Under railroads
- Where there is less than 3' of cover
- Where there is 15' or more of cover
- Where pipe is located in fill material (above undisturbed soil)
- For pipe used as carrier pipe in bores/road bores
- Where minimum clearances with other utilities cannot be achieved
- Where ductile iron pipe is required by City Standards, NCDEQ, or NCDOT

PVC gravity sanitary sewer pipe (SDR-35) and related fittings shall be manufactured in accordance with all the requirements of ASTM C3034, SDR 35, Type PSM polyvinyl chloride sewer pipe and fittings (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A"). PVC gravity sewer pipe may be used for 8, 10 or 12-inch mains and shall be supplied in 12-foot to 14-foot lengths with bell-and-spigot joints. All fittings shall use rubber gaskets which conform to the requirements of ASTM F477. PVC gravity pipe larger than 15" shall conform to ASTM F679SDR 35 and be used only as approved by SRU Management.

PVC gravity sewer pipe (SDR-26) and related fittings require approval by SRU Management and shall be manufactured in accordance with all the requirements of ASTM D-3034, F-477. PVC gravity sewer pipe may be used for 8, 10 or 12-inch mains and shall be supplied in 12-foot to 14-foot lengths with bell-and-spigot joints. All fittings shall use rubber gaskets which conform to the

requirements of ASTM F477.

All PVC sewer pipe shall have stone bedding as shown in the Standard Details as Type III bedding. SRU Inspector may require additional depth of stone bedding if poor soil conditions exist, rock is present, and when other conditions exist that would require additional stone bedding to protect the PVC pipe.

PVC pipe that has been yard stored for an extended time and/or exposed to outside weather elements for an extended amount of time, and pipe that has changed color and/or has become brittle shall not be allowed.

When ductile iron pipe is required on a section of sewer line, the entire section (line between the two manholes) must be DIP. No material transitions are allowed between manholes.

Sanitary sewer laterals must be DIP, except that Schedule 40 PVC laterals are allowed on 4" and 6" laterals when the pipe can be bedded in Type III bedding and meet all minimum clearance requirements. Sewer laterals shall be all PVC or all DIP, no combination of the two materials shall be allowed. Sewer laterals originating under pavement must match the material of the sewer main.

Sewer laterals are required to be DIP for the following applications:

- when minimum clearances/separations cannot be achieved
- when the lateral crosses a creek or stream
- when the lateral cannot be bedded in type III bedding
- when the lateral depth is 15' or greater

All PVC pipe for sewer lines shall have green copper tracer wire (14-gauge) for its entire length and shall be looped up at cleanouts and manholes for connection to pipe locating equipment.

3.03 Steel Pipe

Steel pipe for aerial creek crossings or boring installations (without encasement and carrier pipe) shall be domestic manufactured high strength steel, spiral welded or smooth-wall seamless manufactured in accordance with ASTM A139 and A283 and consisting of grade "B" steel with a minimum yield strength of 35,000 psi. On 8 and 10-inch pipe, the minimum wall thickness shall be 0.375 inches.

The outside of the pipe shall have one coat of zinc chromate primer conforming to Federal Specification TT-86a and afterwards painted with a compatible black paint.

Pipe ends shall be right-angled and shall be compatible to receive a "dresser style 62" - type I or approved equal mechanical transition coupler.

Steel encasement pipe shall be spiral welded or smooth-wall seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and manufactured in accordance with ASTM A139 and A283.

The pipe thickness shall be as required by the encroachment agreement obtained from the controlling agency, but in no case be less than 0.250 inches and the ends shall be beveled and prepared for field welding at the circumferential joints. Thicker encasement pipe may be required by the North Carolina Department of Transportation, Railroads or other agencies.

The pipe shall be coated inside and outside, in accordance with AWWA C203 or the NC Department of Transportation or the American Railway Engineering Association's specifications. All encasement pipe must be approved by the appropriate controlling agency (i.e. NCDOT, RR, etc.) prior to ordering the material.

All carrier piping shall be slip-joint ductile iron and the minimum inside diameter casing shall be 8-inches greater than the inside dimension of the carrier pipe as follows:

<u>Carrier Pipe Inside Diameter</u>	<u>Steel Casing Pipe Minimum Inside Diameter</u>
4-inch	12-inch
6-inch	14-inch
8-inch	16-inch
12-inch	20-inch
16-inch	24-inch

3.04 Manholes

Precast Manholes

Manholes shall be manufactured in accordance with ASTM C478-03a except as modified herein and shall be precast with monolithic base and eccentric cone. All manholes will be 4'0" inside diameter with 5-inch walls or 5'0" with 6-inch thick walls and have a 6-inch minimum base.

Manholes with any large chipped or broken areas, large cracks, exposed reinforcement, improper fitting joints, or any structural defects shall not be allowed. New manhole bases shall not be re-cored if sewer line alignment changes – a new manhole base section shall be used for the new alignment. All manhole joints are to be wrapped on the outside of the manhole with a wide (minimum 8”) butyl mastic wrap/tape.

All manholes over 10'0" deep (top rim to lowest point) shall be 5'0" diameter. All manholes with 21-inch or larger pipes will be 5'0". All manholes with inside drops shall be 5'0" diameter. The standard joint shall be sealed with an all-weather butyl rubber sealant for manhole joints and must conform to ASTM C990. "O" ring joints shall conform to the requirements of ASTM C443. A rubber water stop/rubber boot shall be supplied with the manholes to tie the pipe to the barrel section. These gaskets and clamps shall meet the requirements of ASTM C923.

Manhole transition slabs (example: a 5’ to 4’ transition slab or adapter) shall not be allowed.

Manholes deeper than 3'0" shall have steps. Manhole steps will be press set plastic, or approved equal. Steps will not be used on the outside of raised manholes.

Brick or Block Manholes

Brick or block manholes are not allowed.

Monitoring Manholes

Those commercial and industrial dischargers that require monitoring manholes in accordance with City Ordinance Section 25-186 (13) shall provide a monitoring manhole easily accessible in the public right-of-way. All discharge from the property must pass through a monitoring manhole before entering the public sewer system.

3.05 Manhole Rings and Covers

Manhole rings and covers shall be USA made (see current City of Salisbury water & sewer approved product manufacturer's sheet for approved types located in Appendix "A"). All covers will be marked "SEWER" unless otherwise required by SRU Management or these specifications. Manholes located in off-street locations in non-residential areas shall be extended one-foot above finished grade. Manholes may be flush with the finished grade in residential or landscaped areas. Manholes on outfalls and/or located within unmaintained areas should be raised with a rim elevation min. 2' above grade. Manholes in flood plains shall extend 2-feet above the 100-year flood elevation or be provided with sealed covers, bolted down with "City of Salisbury" pattern locking bolts, and vented. Sealed manholes shall be vented the greater of 1000 LF, every other manhole, and/or as required by SRU Management. Manholes being raised above flood elevation to avoid sealing/venting requirements may not exceed 4' above grade without prior approval from SRU Management. Manholes shall not be located in ditches, or where excessive runoff may occur.

Manholes which are not to be sealed shall have 2 holes as shown on Standard Detail SS-6.

3.06 Sewer Lift Stations

Lift stations will be considered for approval only when no gravity sewer options are available and are subject to approval by SRU Management.

Sewer lift stations shall be designed and sized to serve the drainage area in which they are to be located.

Sewer Lift Stations: (see sewer lift station specifications located in Appendix "C")

SECTION II - MATERIALS

PART 4 - DRAINAGE

4.01 Catch Basins

Catch basins shall be of precast segmented block conforming to ASTM C-139 or brick conforming to ASTM C-32, grade MA or be precast concrete conforming to ASTM C-478.

Catch basins deeper than 3'-6" shall be provided with steps. Steps shall be press set plastic as shown in Standard Detail SS-7, or approved equal.

Catch basins shall be installed on a minimum of 8-inches of compacted stone bedding.

Catch basin bottoms shall be poured in place 6" thick Class A concrete with block or brick catch basins. Generally, inverts will be poured in place to prevent ponding in the bottom of the basin. However, precast bottoms may be used with precast barrel sections.

4.02 Frames and Covers

All frames, grates, hoods and covers shall be heavy duty type of Class 30 gray cast iron conforming to ASTM A48-60. Dewey Brothers Model CH-BN-1, or approved equal, shall be used. Substitute grates shall have an open area equal to or greater than the Dewey model, and be interchangeable with the Dewey grates

Solid covers shall have "Storm Sewer" cast in the top and be equal to sanitary sewer manhole covers as described in Section II, Part 3, Item 3.05 and Standard Detail SS-6.

4.03 Reinforced Concrete Pipe

Reinforced concrete pipe shall conform to ASTM C-76 - latest revision. The pipe class shall be selected for expected conditions. Pipe shall be of sufficient strength to support a minimum of H-20 loading in the street right-of-way and a minimum H-10 loading outside of the street right-of-way.

Minimum Class III.

Minimum laying length is 4'.

Portland cement shall conform to ASTM C-150, Type II.

Pipes shall have bell-and-spigot ends with mastic joint material. Pipe shall be installed in accordance with all manufacturers' recommendations.

All pipe shall be aged at the manufacturing plant for a minimum of 14 days before delivery.

All storm drainage pipe in public rights-of-way shall be 15" to 36" diameter reinforced concrete pipe. Larger sizes may be corrugated metal pipe.

Minimum size for these pipes is 15-inches.

4.04 Steel Corrugated Metal Pipe

Corrugated metal pipe shall meet AASHO Designation M36 - latest revision. All CMP shall be fully asphalt coated inside-outside and CMP 60" and smaller shall have an asphalt-paved invert. CMP larger than 60" or arch-type pipe with a vertical height of 55" or more shall have a Portland cement concrete-paved invert, reinforced with welded wire mesh. The pipe shall be completely backfilled before the invert is paved with concrete.

Pipe in street right-of-way should be designed for H-20 loading. Minimum thickness for CMP is 14-gauge.

Coupling bands shall be used at all joints and shall be of a size as specified by the pipe manufacturer. Bands shall be fully asphalt coated on both sides and shall conform to AASHO M36.

Steel corrugated metal pipe may be used for pipes greater than 36" in public rights-of-way, or for pipes 15" or greater in drainage easements.

4.05 Aluminum Corrugated Metal Pipe

Aluminum corrugated metal pipe shall meet AASHTO M-196, M-197 and M-219, latest revision, as applicable to the application, as well as Federal Specification WW-P-402, latest revision. Type IA pipe will not be permitted.

Aluminum pipe shall be a minimum of 0.075-inches decimal thickness (14-gauge equivalent). Pipe shall be designed for H-20 loading in the street right-of-way.

Installation conditions, as recommended by the manufacturer, shall be met so as to minimize corrosion.

Pipes shall be joined with coupling bands as recommended by the manufacturer. Couplings shall provide a positive union of adjacent pipe sections while effectively preventing displacement of pipe along its axis and lateral displacement at the joint.

Inverts of pipes larger than 60" or arch-type pipe with vertical height of 55" or more shall have a concrete-paved invert as described in Item 4.04 of this section.

Aluminum corrugated pipe may be used for pipes greater than 36" in public rights-of-way, or for pipes 15" or greater in drainage easements.

SECTION II - MATERIALS

PART 5 - ROADS

5.01 General

All materials used in road construction will meet NCDOT standard specifications for Roads and Structures - latest revision. All materials shall be new and appropriate to the application. Any material found to be defective, substandard, or damaged shall be removed from the site immediately.

5.02 Pavement

General

Except where otherwise indicated, North Carolina State Department of Transportation (NCDOT) Standard Specifications, latest revision, shall apply.

Materials

Fill - The portion beneath the paving foundation including the shoulders shall be carefully selected from surplus excavation on site or obtained from an outside source. Fill between the road shoulders and the limits of excavation shall be earth free from large stones, roots and rubbish. All fill material placed under the roadway shall meet the requirements of well-graded backfill specified in Section II, Part 1, Item 1.02.

Crushed Stone or Gravel shall be NCDOT Item 910-1.

Asphalt Concrete Intermediate Course shall be NCDOT Item 640, Type H. This material shall be placed in one lift.

Asphalt Concrete Surface Course shall be NCDOT Item 645, Type I-1 or I-2.

Concrete Paving and Walkways shall be Class A concrete as specified in Section I, Part 1, Item 1.06.

Tack Coat - The tack coat shall be Type AC-20, Rapid Curing Liquid Asphalt, Section 605 of NCDOT Specifications.

5.03 Stone and Aggregate

General

Aggregate shall meet requirements of NCDOT Standards Specifications. Aggregates must be obtained from sources approved by the NCDOT. It shall be stored and handled in a manner as to minimize segregation.

Aggregate Gradation

All aggregates described in these specifications shall meet the following gradation and other requirements of this table excerpted from NCDOT standards.

TABLE 905-1
AGGREGATE GRADATION
COARSE AGGREGATE

STD. SIZE	PERCENTAGE OF TOTAL BY WEIGHT PASSING																REMARKS
	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#8	#10	#16	#30	#40	#50	#80	#100	#200	
467	100	95-100		35-70		10-30	0-5									0- 0.6	Bit. Conc. Base Course
5		100	90-100	20-55	0-10	0-5										0- 0.6	AST Mat Coat
57		100	95-100		25-60		0-10	0-5								0- 0.6	Str. Conc.
57M		100	95-100		25-45		0-10	0-5								0- 0.6	P.C. Conc. Pavement
6			100	90-100	20-55	0-15	0-5									*	BST. Bit. Retreatment
67			100	90-100		20-55	0-10	0-5								0- 0.6	Str. Conc. Bit. Plant Mix Pavement
78M				100	95-100	75-100	20-45	0-15								0- 0.6	Bit. Plant Mix Pmnt. BST, Weep hole drains
14						100	50-75	5-20		0-5						*	Bit. Retreatment
15				100	95-100		30-60		10-35							0-4	Bit. Plant Mix
16						100	88-99	35-50	25-35	15-25	0-10		0-5			0-10	Cold Mix Resurfacing
17	100	75-90	60-80		40-60		20-40		0-25							0-10	Maintenance Stabilization
SA	100	95-100	60-100		36-84		21-61		10-50			0-34				0-13	Stabilizer Aggregate
ABC		100	75-97		55-79		35-55		25-45			14-30				4-12**	Aggregate Base Course Bit. Plant Mix
ABC(M)		100	75-100		45-79		20-40		0-25							0-12	Maintenance Stabilization

*When these sizes of aggregate are used for portland cement concrete, bituminous surface treatment and retreatment, and bituminous plant mix, the requirements pertaining to material passing the No. 200 sieve shall be as follows:

- A. FOR COARSE AGGREGATE USED IN PORTLAND CEMENT CONCRETE, AND BITUMINOUS SURFACE TREATMENT AND RETREATMENT:
- When tested during production, the amount of material passing the No. 200 Sieve shall be not greater than 0.6% by weight.
 - When tested at the job site prior to use, the amount of material passing the No. 200 Sieve shall be not greater than 1.5% by weight and shall consist essentially of rock dust produced through normal handling of the aggregate.
 - For portland cement concrete only, if a stockpile at the job site is found to contain in excess of 1.5% passing the No. 200 Sieve prior to use, The Engineer may approve its use provided the total percentage by weight passing the No. 200 sieve in the combined coarse and fine aggregate in the mix does not exceed 2.0%, and provided no increase in water-cement ratio is required by the use of this coarse aggregate.
- B. FOR COARSE AGGREGATE USED IN BITUMINOUS PLANT MIX OTHER THAN SIZE ABC:
- When tested during production, the amount of material passing the No. 200 Sieve shall be not greater than 0.6% by weight.
 - When tested at the job site prior to use, the amount of material passing the No. 200 Sieve shall be not greater than 2.0% by weight and shall consist essentially of rock dust produced through normal handling of the aggregate.
 - If a stockpile at the job site is found to contain in excess of 2.0% passing the No. 200 Sieve prior to use, the Engineer may approve its use provided the total percentage by weight of minus. 200 material in the plant mix being produced, as determined by the extraction test, can be maintained within the limits allowed by the job mix formula.
- C. FOR SIZE ABC COARSE AGGREGATE USED IN BITUMINOUS PLANT:
- When tested during production or at the job site prior to use, the amount of material passing the No. 200 Sieve shall be from 0.0% to 12.0% by weight. The gradation requirements for material passing the No. 10 sieve (soil mortar) which are shown in Section 910 for aggregate base course shall not apply.

**For ABC Coarse Aggregate:

- A. The gradation requirements for material passing the No. 10 sieve (soil mortar) are 40-84% passing the No. 40 sieve and 11-35% passing the No. 200 sieve
- B. In addition to the gradation requirements the material passing the No. 40 sieve shall not have a liquid limit in excess of 30 nor a plasticity index in excess of 6.

5.04 Concrete

Concrete shall be as described in Section II, Part 1, Item 1.06 and NCDOT specifications, latest revision.

5.05 Joint Fillers and Sealers

Expansion joints shall be filled with cork, neoprene or rubber meeting AASHTO M153 or bituminous fiber meeting AASHTO M213. If more than 1" thickness is required, 2 layers may be used. Filler shall be installed per NCDOT Standard 420.

Filled joints shall be sealed with hot-poured rubber asphalt joint sealer per NCDOT Sec. 928-2 or 1 part low modules silicone sealant per NCDOT Standard 928-4.